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SOUTH EAST ASIA
CBRN
POLICY REFERENCE TOOL

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SOUTH EAST ASIA CBRN POLICY REFERENCE TOOL


RADIOACTIVE
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Introduction and Glossary

CHAPTER 1
INTRODUCTION AND GLOSSARY

A technical background library for the EU CBRN Risk Mitigation Centres of Excellence-South East Asia Region

A · BACKGROUND AND OBJECTIVES

The European Union (EU) Chemical Biological Radiological and Nuclear Risk Mitigation Centres of Excellence Initiative (or EU-CBRN CoE) was launched in 2010 under the Instrument for Stability (IfS) as a means to strengthen the institutional capacity of countries outside the European Union to mitigate CBRN risks, by increasing local ownership, local expertise and long-term sustainability. It is led, financed and implemented by the European Commission, in close coordination with the European External Action Service (EEAS) and with the support of the UNICRI (The United Nations Interregional Crime and Justice Research Institute) and other International Organisations and national experts. Continuing since March 2014 under the EU's Instrument contributing to Stability & Peace (IcSP),[1] the CoE initiative currently comprises 61 partner countries that work together through eight regions, with centres in different parts of Asia, Eastern and Southern Europe, the Middle East, and Africa each headed by a regional secretariat.[2]

The EU CBRN Action Plan,[3] adopted in 2009, requires the Commission and the Member States to develop **information tools** for CBRN security. One of the first steps was the publication of a **CBRNE Glossary**[4] in 2013, which was then extended and updated in cooperation with EUROPOL,[5] with more than 800 entries to include terms related to explosives. It is accompanied by an application (app) for smartphones and tablets which could be useful for first-responders and also as an awareness raising tool.[6,7] The 2015 edition of the Glossary was available for this toolkit. Other glossaries that will be known to bioscience professionals appear in the WHO laboratory biosecurity guidance.[8] In the WHO Communicable disease Alert and Response for Mass Gatherings - Key Considerations.[9] These glossaries are also highly relevant to the EU-CBRN CoE projects. Although the precise wording of definitions in the CBRNE Glossary and these other sources differ, in our context there are no major

1 EU Service for Foreign Policy Instruments (FPI). The EU's Instrument contributing to Stability and Peace (IcSP). https://ec.europa.eu/fpi/news/eu%E2%80%99s-instrument-contributing-stability-and-peace-icsp_en.

2 CBRN Centres of Excellence. http://www.cbrn-coe.eu/.

3 Council conclusions on strengthening chemical, biological, radiological and nuclear (CBRN) security in the European Union an EU CBRN Action Plan - Adoption.

4 Under revision in 2019.

5 European Union Agency for Law Enforcement Cooperation.

6 EU. Joint Research Centre. European CBRNE glossary. http://opencbrne.jrc.ec.europa.eu/about.

7 EU. Joint Research Centre. European CBRNE glossary. http://opencbrne.jrc.ec.europa.eu/main.

8 WHO Laboratory Biosecurity Guidance: https://www.who.int/ipcs/methods/harmonization/areas/ipcsterminologyparts1and2.pdf.

9 WHO. Communicable disease alert and response for mass gatherings Key considerations. June 2008. https://www.who.int/csr/Mass_gatherings2.pdf?ua=1.

conflicts. For the most part we have not therefore felt the need to cite definitions in the other sources, except when additional context is needed for better understanding.

This body of work is intended as a further step towards information tools that can help to promote a uniformity of approach essential for the multidisciplinary interactions within each cooperative CoE project. The product designed for the **EU-CBRN CoE-South East Asia Region** is a purpose-built library that describes:

1 · CBRN History
2 · Related International Conventions and Organisations
3 · Legislation and Guidance Documents
4 · EU-CBRN Centres of Excellence Initiative

This is not a road map to the entirety of EU-CBRN CoE cooperation strategies and project areas; it is not a framework for a National Action Plan (NAP). Nevertheless, experience shows that national and regional actors need to be aware of this global history and current counter-measure scene when they consider their own CBRN risk areas and mitigation gaps in order to plan the scope and sequence of actions to address these.

We cover risks of the use of nuclear materials only in the context of the activities of the International Atomic Energy Agency (IAEA) in promoting the peaceful uses of nuclear energy while working to stop the spread of nuclear weapons and the agreements by members of the Nuclear Suppliers Group over the enforcement of the Nuclear Non-Proliferation Treaty. The objectives to strengthen global CBRN risk mitigation capacities and the progress being made in that overlap with several of the development goals of the UN Agenda for Sustainable Development, most directly as we will describe in respect of activities to reduce the risks from hazardous chemicals and wastes and activities to promote human and animal health.

This tool is expected to be able to assist in providing the consistency and focus of technical discussions and objective-setting in all CoE stages: i.e. from refinement of an implementer approach through the local policy and senior administrator levels and into the working level structures in the partner country and region. It could also help to inform senior policy makers and budget holders who have to take difficult decisions about priorities, and accordingly each Chapter starts with a short initial overview followed by a synopsis, so as to serve a less technical specialist audience. The tool could be accessed as a whole; or for example one or more Chapters could be recommended beforehand to participants in a dialogue, particularly to people new to the subject, by way of background preparation. This tool aims to provide a basic background knowledge in CBRN and help contextualise the technical terms specific to the field, so that policy makers will have a better understanding and perspective when presented with the task of reviewing/discussing policies relevant to CBRN Risk Mitigation. It will be a handy, quick-reference guide available to them as needed.

B · STRUCTURE OF THE TOOL

The tool is structured as a series of crosslinked chapters on specific topics, as follows:

CHAPTER 1 · Introduction and Glossary
CHAPTER 2 · Headline history of past CBRN weapons concepts and uses
CHAPTER 3 · Scenarios for terrorist and criminal acts
CHAPTER 4 · Past accidental and natural events involving CBRN agents
CHAPTER 5 · The evolution of the international arms control regimes
CHAPTER 6 · Responsibilities, advice, training and assistance under the Conventions
CHAPTER 7 · Health responses to disease outbreaks
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CHAPTER 13 · Health responses to CBRN attacks at mass gatherings
CHAPTER 14 · UN Sustainable Development Goals (SDGs)

C · THE DIFFICULTY IN DEFINING TERRORISM

There is no universally agreed definition of terrorism despite much debate in the international community fora such as the United Nations and its various bodies. (No definition is attempted in the 2015 CBRNE Glossary). Part of the difficulty arises from diverging opinions as to whether suicide bombers,[10] for example, are best treated in law as terrorists, common criminals, religious or ideological martyrs or freedom fighters, and how this should fit with peoples' right to self-determination as enshrined in the UN Charter.[11] As a result, a Comprehensive Convention on International Terrorism eludes agreement in the UN after more than two decades, although three separate UN protocols have been agreed upon, focusing on terrorist bombings, financing of terrorism, and nuclear terrorism.[12]

The general reaction to this dilemma has been to define not terrorism itself, but, *acts of terrorism*. This practice goes back to 1977 where one of the two Protocols added to the 1949 Geneva Convention states: "*The civilian population as such, as well as individual civilians, shall not be the object of attack. Acts or threats of violence the primary purpose of which is to spread terror among the civilian population are prohibited*".[13] Each SEA country may have made its own decision as to how to include the concept of

10 A suicide bomber is a terrorist who carries out a bomb attack, knowing that he or she will be killed in the explosion. COBUILD Advanced English Dictionary. https://www.collinsdictionary.com/dictionary/english/suicide-bomber.

11 European Parliament. At a glance November 2015. Understanding definitions of terrorism. http://www.europarl.europa.eu/RegData/etudes/ATAG/2015/571320/EPRS_ATA(2015)571320_EN.pdf.

12 International Convention for the Suppression of Terrorist Bombings, adopted on 15 December 1997; International Convention for the Suppression of the Financing of Terrorism, adopted on 9 December 1999; and International Convention for the Suppression of Acts of Nuclear Terrorism, adopted on 13 April 2005.

13 Protocol Additional 1) to The Geneva Conventions of 12 August 1949, 2) and relating to the Protection of Victims of Non-International Armed Conflicts (Protocol II). Part IV. Civilian Population. Para 2. https://treaties.un.org/doc/Publication/UNTS/Volume%201125/volume-1125-I-17513-English.pdf.

terror offences in its legal instruments. An example of how this has been achieved is European law. The first Council Framework Decision on combating terrorism was enacted in 2002 and has been regularly updated, for instance to include radiological harm.[14] It requires EU countries to align their legislation and introduce minimum penalties for terrorist offences. In Article 3, Terrorist Offences, 10 categories of intentional acts are defined as terrorist offences where committed with one of three aims. In the 2017 version, one such act is:

> *(f) manufacture, possession, acquisition, transport, supply or use of explosives or weapons, including chemical, biological, radiological or nuclear weapons, as well as research into, and development of, chemical, biological, radiological or nuclear weapons;*

The three aims are:

1 · seriously intimidating a population;
2 · unduly compelling a government or an international organisation to perform or abstain from performing any act;
3 · seriously destabilising or destroying the fundamental political, constitutional, economic or social structures of a country or an international organisation.

As the stated acts include *threatening* to commit any of them, this may be inferred to include hoaxes of the deployment of simulated or supposed CBRN material which then result in disruption - acts which historically have been more numerous than real attacks with harmful material.

Non-state actor. This is a term which is used in a variety of applications to describe individuals or groups that are influential but are wholly or partly independent of state governments. For instance, it includes Inter-governmental Organisations (IGOs) such as the United Nations or the World Health Organisation WHO, and Non-governmental Organisations (NGOs) many of which make important contributions to international development. On the other hand, the label can be used for groups which threaten or use violence to achieve their goals – groups which might better be distinguished as 'violent non-state actors'. In the United States particularly there has been a tendency to use 'non-state actor' as an informal shorthand for terrorist. The context of the use of the term is therefore critical, and should be clearly indicated.

The ASEAN Context of Terrorism. Many of the countries of the SEA region are no stranger to "acts of terrorism" in the form of suicide bombers and attacks on civilian population. Most of these incidents have been attributed to identified separatist groups and/or rebel armies and non-state-actors operating in the individual countries and in the region, some with ties to known international terrorist groups like the ISIS. The ASEAN Declaration on Transnational Crime (adopted 20 December 1997),[15] in which the organisation resolved to expand the "scope of Member Countries' efforts against transnational crime such as terrorism" called for cooperation

14 DIRECTIVE (EU) 2017/541 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 March 2017 on combating terrorism and replacing Council Framework Decision 2002/475/JHA and amending Council Decision 2005/671/JHA. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32017L0541.

15 ASEAN Declaration on Transnational Crime: https://asean.org/?static_post=asean-declaration-on-transnational-crime-manila-20-december-1997.

in the context of counter-terrorism. This was followed by several key ASEAN counter-terrorism instruments from 2001 after the 9/11 attacks through to 2017 with The Manila Declaration to Counter the Rise of Radicalisation and Violent Extremism and ASEAN Comprehensive Plan of Action on Counter Terrorism (adopted by the 11th ASEAN Ministerial Meeting on Transnational Crime on 20 September 2017).[16] The Southeast Asian Regional Centre for Counter-Terrorism was established in Malaysia in 2002, with the overarching purpose to strengthen regional and international cooperation and strengthen capacity in counter-terrorism.

Since 2014, ASEAN has sought to respond to regional threats posed by foreign fighters drawn from within its membership, joining conflicts in Iraq and Syria who then return to the region. This resulted to the crafting of additional key instruments within the ASEAN to address the rise of violence and brutality committed by terrorists/extremists organisations and combating the rise of radicalisation and violent extremism, forming an important aspect of regional and international counter-terrorism measures in line with the UN Global Counter-Terrorism Strategy goals.

ASEAN key counter-terrorism instruments included the following objectives:

- Strengthen regional counter-terrorism efforts and cooperation such as through sharing best practices and information/intelligence
- Augment regional counter-terrorism capacity
- Integrate international anti-terrorism conventions within ASEAN mechanisms to combat international terrorism
- Provide operational guidelines for regional cooperation in counter-terrorism
- Counter radicalisation and violent extremism, in particular those which lead to terrorism in all forms and manifestations
- Progressing the implementation of programmes and activities to enhance legal cooperation in ASEAN, in particular, the discussion to elevate the Mutual Legal Assistance Treaty (MLAT) and finalise the Model ASEAN Extradition Treaty (MAET)

The **ASEAN Convention on Counter-Terrorism** was adopted on 13 January 2007 and entered into force 27 May 2011. This is the principal binding instrument for strengthening regional counter-terrorism efforts for the SEA region. One key feature of this Convention is it does not include a regional definition of terrorism or terrorist offences; instead it relies on the definition of "offence" as defined within the universal instruments. This could be brought about by the fact that many ASEAN Member States regard terrorism essentially as a domestic matter, thus the emphasis on national legal frameworks. In addition there are differences in terms of national counter-terrorism doctrine, with some Member States favouring a more militaristic approach to counter-terrorism, whilst others generally adopt a criminal justice paradigm. The weaknesses of the ASEAN Counter-Terrorism efforts are discussed comprehensively in one reference.[17]

16 ASEAN Key Counter-Terrorism Instruments: https://www.unodc.org/e4j/en/terrorism/module-5/key-issues/asian-region.html.

17 ASEAN Counter-Terrorism Weaknesses: https://www.jstor.org/stable/26351552.

D · A COMMON UNDERSTANDING OF THE TERMINOLOGY.

When participants from several different professions are brought together in forums to address the principles and practices of CBRN risk mitigation, it is common for individuals from different occupations to come with different understandings of some important terms that will underpin the debate. These different usages of terms can be found in the disciplines of health, security, Weapons of Mass Destruction (WMD) non-proliferation, arms control, etc. At the early stages of a new multi-disciplinary process, a realisation that other participants are using terms differently causes misunderstandings that tend to delay the collegiate spirit. This is particularly the case for terms that are additionally widely used in everyday language, like 'risk' or 'hazard', which can be further exacerbated during translation into different languages. A good example is the long standing confusion over the terms biosafety and biosecurity, both at the working interfaces between the security and biosciences communities and also when discussion in English is translated into other languages, e.g. German, which prompted the WHO to publish a clear distinction.[18] Having a glossary of terms as the starting point for a new interactive process on a highly-specialised topic is thus imperative.

Each chapter of the library following this introductory Chapter covers a particular topic and explains the important terms used. However, as a starting point, several of the fundamental concepts are explained below, with corresponding definitions in the JRC CBRNE Glossary and some OPCW definitions being shown in **Annex 1**.

Core definitions in the CBRN context.

ABC: abbreviation for Atomic, Biological and Chemical
CBRN: abbreviation for Chemical, Biological, Radiological and Nuclear
CBRNE: abbreviation for Chemical, Biological, Radiological , Nuclear and Explosive
NBC: abbreviation for Nuclear, Biological and Chemical
WMD: abbreviation for Weapons of Mass Destruction**.**

18 WHO. Biorisk management • Laboratory biosecurity guidance • September 2006. https://www.who.int/csr/resources/publications/biosafety/WHO_CDS_EPR_2006_6.pdf.

HAZARD

THREAT

VULNERABILITY

RISK

EXPOSURE LIMIT

HYBRID THREAT

RISK ASSESSMENT

CBRN RESILIENCE

RESILIENCE

HAZARD

An accidental or naturally occurring phenomenon with the potential to cause harm (physical or psychological) to humans including loss of life, damage or losses of property, and/or disruption of the environment or to structures (economic, social, political) upon which a community's way of life depends.

THREAT within the context of HAZARD (expanded definition): A danger or source of danger; the potential to cause harm. In the CBRN context this could be harm to life through physical impact or disease, harm to the environment, physical structures and the socio-political norm caused by intentional man-made behaviour.

THREAT

The likelihood of occurrence of a hazard or event with a harmful effect. In contrast to risk, a threat is not related to the impact it may cause. In the context of public health, a threat is defined as a substance, condition or event, which by its presence has the potential to rapidly harm an exposed population, sufficiently lead to a major crisis.

VULNERABILITY

Susceptibility of individuals or community, services or infrastructure to damage or harm arising from an emergency or other incident. (JRC CBRNE Glossary of Terms.)

Susceptibility is the attribute (feature, characteristic) of an object (person, environment, device, infrastructure, services, community) that allows damage or harm arising from a hazard. Vulnerability does not result in any negative consequences if the hazard or threat are not present.

RISK

The probability of adverse effects caused by a hazardous phenomenon or substance in an organism, a population, or an ecological system. Risk could be expressed as the following equation format:

RISK= PROBABILITY (LIKELIHOOD) X CONSEQUENCE (IMPACT)

In the safety context, probability of occurrence of unwanted event in the risk is influenced by risk mitigation measures. In the security context, probability of occurrence of unwanted event is influenced by vulnerability and adversary attributes (threat).

NOTE: Several factors will influence the acquiring and progress of particular disease, like SARS-CoV-2 virus. Not wearing a mask properly or going to crowded places during pandemic or staying closely with a patient with SARS-CoV-2 will increase the risk of acquiring infection. Comorbidities (existing illness like respiratory disease, hypertension, cardiovascular diseases, diabetes, etc.) and / or obesity, suppressed immune system due to drugs or other diseases could increase the risk of disease progress.

EXPOSURE LIMIT

In general terms, this gives a measure/concentration of how much agent can be taken in by the individual and the value is usually the maximum limit before irreversible poisoning and death occurs. The values given are determined by factors like length of time exposed, mode of exposure including inhalation, through the skin or mouth, etc. and with or without PPE.

It has a different meaning for different types of agents and under various conditions.

HYBRID THREATS

This type of threat combines conventional, irregular and asymmetric activities in time and space. Hybrid threats are methods and activities that are targeted towards vulnerabilities of the opponent. Vulnerabilities can be created by many things, including historical memory, legislation, old practices, geostrategic factors, strong polarization of society, technological disadvantages, or ideological differences.*

It normally consists of two stages: priming and operational.

Hybrid threats combine conventional and unconventional, military and non-military actions that can be used in a coordinated manner by state or non-state actors to achieve specific political objectives.

HYBRID THREAT = INTENTION + CAPABILITY + VULNERABILITY

Taken in the context of intentionally doing harm, such as in terrorist or lone-wolf attacks.

Intention = refers to the main goals of the event, whether to cause widespread death, terror, economic sabotage, damage to life, properties and means of livelihood or to incapacitate target population and governments/ responders, etc.; More severe and more widespread consequences, higher threat level.

Capability = usually refers to the financial, technical, socio-political support and opportunistic capacities to carryout the event; Higher capability, higher threat level.

Vulnerability = refers to the susceptibility of the target population and/or properties/communities; Also see above sources of vulnerabilities.

RISK ASSESSMENT

The overall process of hazard identification (identification of a risk source capable of causing adverse effects to humans or the environment) and hazard characterization (quantitative evaluation of the nature of the adverse health effects associated with the hazard), exposure assessment (evaluation of the likely exposure of man and/ or the environment to risk sources) and risk characterisation (estimation, including attendant uncertainties, of the probability of occurrence and severity of known or potential adverse health effects in a given population). (JRC CBRNE Glossary of Terms.)

CBRN RESILIENCE

The ability to reduce the risk from CBRN attacks (UK definition) or the capacity to anticipate risks and to limit their impact in order to return to the previous state (US definition). (JRC CBRNE Glossary of Terms)

RESILIENCE

The capacity of a system to absorb disturbance and reoganise so as to retain essentially the same function, structure, and feedbacks; the ability to cope with shocks and keep functioning in a similar manner as before.

* Hybrid CoE: The European Centre of Excellence for Countering Hybrid Threats.

HAZARD, THREAT, RISK: DIFFERENCES

EXAMPLE OF THREAT: Release of a dangerous nerve agent, VX, from the bottle.
The following reasons could cause this:

A malicious intent: a terrorist steals the VX in the bottle and breaks the container;

B a natural disaster of any kind: an earthquake results in the bursting of the primary and secondary secure containers where the VX is stored;

C through an accident caused by negligence: a lab worker leaves the bottle of VX on the lab bench/ cupboard instead of locking it up; or

D an accident: A nearby buliding explodes, causing a strong vibration which topples the bottle of VX.

VULNERABILITY

RISK: BASED ON 3 FACTORS

CONSEQUENCE

The worst case scenario is death by nerve gas poisoning, due to the nature of the chemical VX: the amount that can be inhaled before its Immediately Dangerous to Life/ Health (IDLH) value for VX as a vapour is very low.

LIKELIHOOD

The probability of developing an adverse effect (consequence). What is the likelihood of death due to inhalation of nerve gas release from a broken bottle of.

VULNERABILITY

If we have two people in the room near the bottle, one with an FM2 mask on sling position (not covering the face), and without a mask of any kind, the one without a mask is more vulnerable to the potential and actual risks.

STEPS TO REDUCE RISK · To lessen likelihood, consequences and vulnerability:

1. Store the VX in a proper container and locked away for safety and security
2. Check for weather conditions and potentially dangerous activities in the vicinity before taking out the nerve agent if needed
3. Use very small amounts (these are actually stored in very small vials if for laboratory use)
4. Ensure people within the vicinity have the proper PPE ready on-hand to be used when needed
5. Train personnel to effectively don PPE and apply proper first-aide measures in an emergency (use combo-pen for nerve agent poisoning) and use of prophylaxis agents as needed
6. In earthquake or hurricane prone areas, Ensure secure placement of chemical cabinet

EXPOSURE LIMIT: ACUTE EXPOSURE GUIDELINE LEVELS

Acute Exposure Guideline Levels (AEGL) values represent toxicologically substantiated ceiling exposure levels for different relevant exposure periods (10 minutes, 30 minutes, 1 hour, 4 hours, 8 hours), for three different degrees of severity of toxic effects:

AEGL-1: threshold for notable discomfort;

AEGL-2: threshold for serious, long-lasting effects or an impaired ability to escape;

AEGL-3: threshold for lethal effects.

AEGL values take into account the general population, including susceptible individuals. (JRC CBRNE Glossary of Terms.)

Annual Limit of Intake is defined as the derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. The values for intake by ingestion and inhalation of selected radionuclides are given by the national competent authority based on the recommendations of international organizations such as the International Commission for the Radiological Protection (ICPR) or the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). (JRC CBRNE Glossary of Terms.)

HYBRID THREAT: CHARACTERISTICS AND EXAMPLES

Characteristics of a Hybrid Threat:

- Coordinated and synchronized action that deliberately target democratic states' and institutions' systemic vulnerabilities through a wide range of means
- The activities exploit the threshold of detection and attribution as well as the different interfaces (war-peace, internal-external, local-state, national-international, friend-enemy)
- The aim of the activity is to influence different forms of decision-making at the local (regional), state or institutional level to favour and/or gain the agent's strategic goals while undermining and/or hurting the target

Reference: Hybrid CoE: The European Centre of Excellence for Countering Hybrid Threats.
https://www.hybridcoe.fi/hybrid-threats/

- **TERRORISM**
- **CYBER ATTACKS**
- **ORGANISED CRIME**
- **MARITIME DISPUTES**
- **SPACE**
- **RESOURCE SCARCITY**
- **COVERT OPERATIONS**

RISK ASSESSMENT: ELEMENTS

RESILIENCE: CHARACTERISTICS

The ability to reduce the risk from CBRN attacks (UK definition) or the capacity to anticipate risks and to limit their impact in order to return to the previous state (US definition) is CBRN Resilience.

NATECH

Technological accidents triggered by a natural hazard or disaster which result in consequences involving hazardous substances (e.g. fire, explosion, toxic release) are commonly referred to as Natech accidents.
(JRC eNatech Database definition)

EXAMPLE A: FUKUSHIMA

The Fukushima Daiichi Nuclear Power Plant Disaster in March 2011 was started by the Tohoku earthquake and tsunami on March 11, culminating in three nuclear meltdowns, three hydrogen explosions and the release of radioactive contamination in three reactor units between March 12 to 15, 2011. More than 160 000 people were forced to evacuate. The Level 7 nuclear event (classification in the International Nuclear Event Scale) is the second of its kind since the 1986 Chernobyl Nuclear Power Plant disaster.

1. Earthquake
2. Tsunami over the plant
3. Reactor buildings with sea water, knocking out the emergency generators
4. Large amounts of contaminated water were released into the Pacific Ocean during and after the disaster

EXAMPLE B: THE QUANG NINH COAL MINE INCIDENT IN VIETNAM

The July-August 2015 coal mining and coal ash disaster in Vietnam occurred in late July after heavy rains resulted in the major flooding in Quang Ninh province. Major coal mines were flooded, a coal mine tailings dam burst, major roads in mines and connecting the mines to ports were damaged as were some coal port facilities. The Quang Ninh area supports about 95% of coal production of Vietnam. The breach of 'Dam 790' resulted in coal mine tailings flooding through Cam Pha City with residents being evacuated. At least 17 people died. The coal mines and power stations are in close proximity of the Ha Long World Heritage site, with water pollution from the mines affecting the area.

1. Heavy Rains
2. Coal Mines Flooded
3. Breach of Dam
4. Release of coal mine tailings which flooded the city, roads, ports, including some areas of the Ha Long Bay World Heritage Site

Safety. The protection of people, animals, the environment or physical structures against accidental exposure to CBRN materials or their effects.

Security. Measures to deliberate acquisition or uses of CBRN materials in contravention of international norms and Conventions or national laws and regulations.

Dual use: products and technologies normally used for civilian purposes but which may also have military applications. In politics and diplomacy, it is usually interpreted as goods and technology that can be used for either peaceful or military including WMD objectives.

Misuse: the inappropriate or illegitimate use of CBRN materials, despite existing norms, agreements, national laws and regulations, international treaties and conventions.

Critical infrastructure (CI): critical infrastructure means an asset, system or part thereof which is essential for the maintenance of vital societal functions, health, safety, security, economic or social well-being of people, and the disruption or destruction of which would have a significant impact in a state as a result of the failure to maintain those functions. CI is frequently designated by the national authority by specific procedure. List of national CI and specific criteria of designation should be treated as classified information. Business continuity management of CI should be ensured by the highest possible level.

Technical definitions based on World Health Organisation definitions[19]

These following terms are not defined in the 2015 CBRNE Glossary:

- **Accountability:** ensures that specified CBRN materials are controlled and traced, by individuals who provide oversight and are held responsible for them.
- **Laboratory biosecurity**: the protection of microbiological assets from theft, loss or diversion, which could lead to the inappropriate use of these agents to cause public health harm.[20]

19 WHO. Biorisk management • Laboratory biosecurity guidance • September 2006. https://www.who.int/csr/resources/publications/biosafety/WHO_CDS_EPR_2006_6.pdf.

20 WHO 2004 definition; expanded in 2006 to include Valuable Biological Materials. Please see Chapter 9 for more details.

ANNEX 1

SOME DEFINITIONS FROM THE JRC CBRNE GLOSSARY AND THE OPCW

A · JRC CBRNE GLOSSARY EXAMPLES, 2015 EDITION

From: European Commission. Joint Research Centre. European CBRNE Glossary.[21]

Biological weapon. A device – in the worst case a weapon of mass destruction – that releases a biological agent or pathogen such as bacteria or viruses that are harmful to living beings (humans or animals) and/or vegetation (plants). A biological weapon consists therefore of the biological agent and the dissemination mechanism.

Biorisk. The combination of the probability of occurrence of a particular harmful event and the severity of the harm when the source of harm is a biological agent. The source of the biological agent may be a natural, unintentional exposure, accidental release or loss, theft, misuse, diversion, unauthorised access or intentional unauthorised release.

Biosafety. The development and implementation of administrative policies, work practices, facility design and safety equipment to prevent the transmission of biological agents to laboratory personnel, other persons and the environment.

Biosecurity. The protection of high-consequence microbial agents, technologies, materials and toxins as well as critical relevant information against theft or diversion by those who intend to misuse them intentionally.

Bioterrorism. The threat of or an intentional release or dissemination of biological agents to cause fear, illness or death in humans, animals or plants and/or disrupt social, economic or political stability.

Chemical weapon. A weapon specifically designed to cause death or other harm through the toxic properties of chemicals. It consists of a substance or agent (Chemical warfare agent) and of some form of container e.g. ammunition.

Hazard. An accidental or naturally occurring phenomenon with the potential to cause physical or psychological harm to humans including loss of life, damage or losses of property, and/or disruption to the environment or to structures (economic social, political) upon which a community's way of life depends.

Risk. Measure of the significance of a potential event in terms of its assessed likelihood and its hazard.

Safety. Protection of e.g. workers against accidental events. Not be confused with security. See: Biosafety, International chemical safety cards, Safety data sheet, Tremcards.

Security. Protection against intentional damages. Not be confused with safety. See: Biosecurity, Nuclear security, Security of explosives, Security scanners

Threat. Intent or capacity to cause loss of life or create adverse consequences to human welfare, property and the supply of essential services and commodities, the environment or security.

21 The glossary can be accessed at: https://ec.europa.eu/home-affairs/sites/homeaffairs/files/what-we-do/policies/crisis-and-terrorism/securing-dangerous-material/docs/cbrn_glossary_en.pdf.

Vulnerability. Susceptibility of individuals or community, services or infrastructure to damage or harm arising from an emergency or other incident.

B · DEFINITIONS FROM THE ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS (OPCW).

From: OPCW. Capacity Building. Chemical Safety and Security Management Programme.[22]

"Chemical safety" refers to measures to prevent non-deliberate releases of toxic chemicals into the environment and to mitigate the impact if such events occur. Chemical safety comprises disciplines such as occupational safety, public safety, process safety, environment safety, consumer safety and transport safety. Many of these are also dealt with by other international conventions and by several other international bodies and lead agencies.

"Chemical security" refers to measures to prevent deliberate releases of toxic chemicals and to mitigate the impact if such events occur. In a wider context, it also includes policies to prevent attempts to acquire toxic chemicals or chemical weapons precursors.

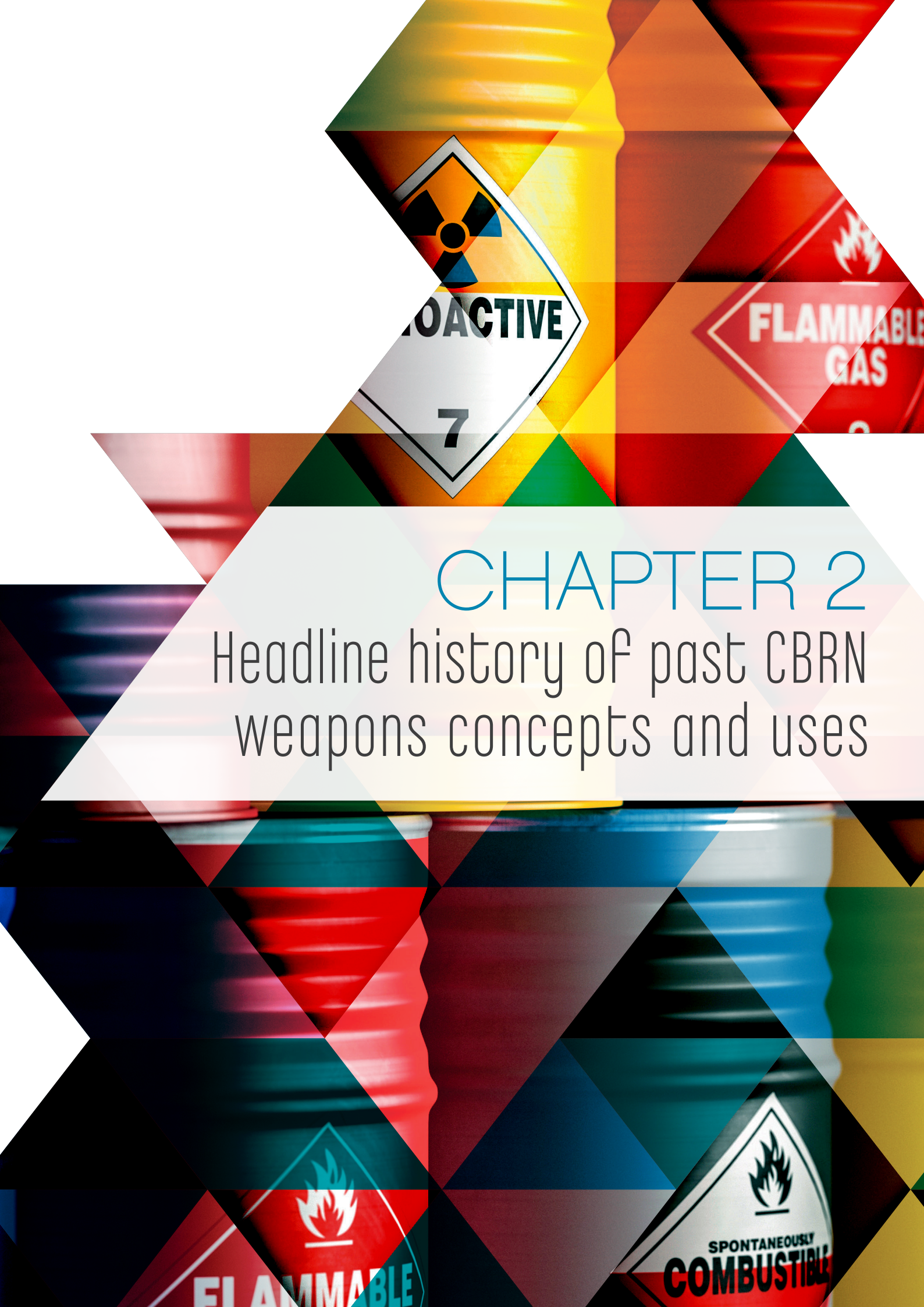
From: The Convention itself. Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction. OPCW.[23]

"Chemical Weapons"

- In: Article II. Definitions and Criteria For the purposes of this Convention:
- "Chemical Weapons" means the following, together or separately:
  - Toxic chemicals and their precursors, except where intended for purposes not prohibited under this Convention, as long as the types and quantities are consistent with such purposes;
  - Munitions and devices, specifically designed to cause death or other harm through the toxic properties of those toxic chemicals specified in subparagraph (a), which would be released as a result of the employment of such munitions and devices;
  - Any equipment specifically designed for use directly in connection with the employment.

22 This document can be accessed at: https://www.opcw.org/resources/capacity-building/international-cooperation-programmes/chemical-safety-and-security.

23 This document can be accessed at: https://www.opcw.org/sites/default/files/documents/CWC/CWC_en.pdf.



CHAPTER 2

Headline history of past CBRN weapons concepts and uses

CHAPTER 2

HEADLINE HISTORY OF PAST CBRN WEAPONS CONCEPTS AND USES

This chapter describes the historical development of CBRN weapons, excepting nuclear weapons. The concept of using chemicals for criminal or political acts of 'poisoning' goes back to the earliest historical records. Advances in chemical industry of the early twentieth century allowed troops to be attacked with chemicals *en masse* in World War 1 (WW1). The chemicals used in that conflict are bound to be very effective against unprotected civilian populations, and in spite of the general opprobrium against chemical warfare there is continuing evidence of attacks against civilians. From the middle of the twentieth century the large scale CW arsenals designed for use against troops centred round the newly discovered nerve agents, toxic in very small doses.

Records of the use of disease to attack enemy troops or civilians also pre-dates the first millennium. There was limited use of biological agents for sabotage in WW1, but from the middle of the century several countries built up large arsenals of biological weapons variously capable of attacking man, livestock or crops on strategic scales comparable with nuclear attacks. The US, UK, Soviet Union, Japan and South Africa all had offensive programmes. The only known use was by Japan in its war with China in about 1942.

There are no known examples of radiological weapons having been developed for military use for large scale area contamination and terrain denial, but use of radioisotopes for state sponsored assassination is a new spectre.

SYNOPSIS

There have been many published assessments of the comparative effects of the various types of CBRN weapon or Weapons of Mass Destruction (WMD), including from government sources. For example, an official United States (US) publication in 1993 assessed the relative effects of attacks on a city: 1 tonne of sarin nerve agent could produce up to 8,000 dead, 100 kg of anthrax bacteria up to 3 million dead, and 1 megaton Hydrogen bomb up to 1.9 million dead.[1]

After World War 1 (WW1, also known as The Great War), the main emphasis was on offensive and defensive preparations for CBW attacks on armed forces, but actual uses are also on record: anti-personnel chemical and biological attacks on Manchurian civilian populations by Japan;[2] and defoliant

1 United States Congress, Office of Technology Assessment, Proliferation of Weapons of Mass destruction: Assessing the Risks, OTA-ISC-559, S/N 052-003-01335-5, 5 August 1993.

2 Croddy, Eric, editor. Weapons of Mass Destruction. An Encyclopedia of Worldwide Policy, Technology, and History. 2005. ABC-CLIO.pp169-170.

and anti-crop attacks by the US in Vietnam.[3], [4] The Soviet Union particularly put a huge effort into civil protection against nuclear attack.[5] Events in recent decades in Iraq and Syria show that some classical WW1 Chemical Weapon (CW) agents that are relatively easy to manufacture and thus widely used in the processes of chemical and pharmaceutical industries, are still being used as weapons with great effect against unsuspecting civilian populations lacking Personal Protective Equipment (PPE).

However, from the middle of the twentieth century a new class of warfare agent dominated in weapons designed to be able to overcome the physical protection available to troops - the **nerve agents.** These worked rapidly and at very small dosages, attacking through the lungs or the skin. The US and Russia built up CW arsenals each in excess of 20,000 metric tons, until the Chemical Weapons Convention (CWC) entered into force in 1997 and demilitarisation started.[6] Other countries, such as the United Kingdom (UK),[7] had abandoned an offensive policy, but they carried out R&D to develop and test their defensive strategies and equipment such as individual and collective protection measures, detectors and antidotes. The picture was slightly different for Biological Weapons (BW). The UK had a purely defensive BW policy after the 1950s; the US had a large BW programme with weapons for large area attacks which it unilaterally dismantled in 1969; Russia had a large programme which it admitted to in 1992. Japan had a BW programme from the early 1930s to 1945, which did involve **the actual use of biological weapons**, in Japan's war with China. The most recent known offensive BW programme was that of South Africa in the 1980s. Many countries made defensive preparations: in NATO countries, where programmes varied in scope because of resource differences, Standardisation Agreements (STANAGS) were applied to protective equipment, training and organisation etc.[8]

An important factor in designing CW is that they do not require complicated delivery systems. Weapons such as grenade throwers, artillery, aircraft bombs, rocket launchers and missiles can easily be adapted for chemical fills, and ongoing attacks in Syria demonstrate the effectiveness of crude delivery means such as the type of Improvised Explosive Device IED known as barrel bombs.[9] For non-volatile chemicals, including the poisonous substances produced by living cells or organisms with the ability to cause disease, known as toxins (see **Annex I** below), weapons technologies were developed to disseminate dry particles or liquid droplets. Suspensions of live biological agents could be delivered efficiently by spray devices upwind of the target or from sub-munitions released over the target. (For a well referenced review, see Wikipedia[10]). The main classes of CW agents are described in Annex 1 below. The work of the Ad Hoc Group in the 1990s that attempted to strengthen the Biological and Toxin Weapons Convention (BWC or BTWC)

3 NCBI. Veterans and Agent Orange. Health Effects of Herbicides Used in Vietnam. https://www.ncbi.nlm.nih.gov/books/NBK236351/.

4 Federation of American Scientists. Biological Weapons Program. https://fas.org/nuke/guide/japan/bw/.

5 Director of Central Intelligence. Soviet Civil Defense. NI 78-10003. July 1978. https://www.cia.gov/library/readingroom/docs/DOC_0000420176.pdf.

6 Chemical and Biological Weapons Status at a Glance. Arms Control Association, posted June 2018. https://www.armscontrol.org/factsheets/cbwprolif.

7 In full the United Kingdom of Great Britain and Northern Ireland.

8 NATO and Weapons of Mass Destruction. Regional alliance, global threats. E. Terzuolo. 2006. Routledge. Page 4.

9 The term 'barrel bomb' is often used to describe a large container packed with gasoline, nails or chunks of steel and enough explosive to make it explode on impact, typically thrown out of a helicopter. These improvised explosive devices IEDs represent an inexpensive munition for aerial warfare but their rudimentary and unguided design means that instead of militarily justifiable targets they can kill civilians through their inaccuracy.

10 Wikipedia. Biological warfare. https://en.wikipedia.org/wiki/Biological_warfare.

included a long list of candidate BW agents – 39 viable bioagents and 11 isolated toxins - for declarations of legitimate work in each State Party.[11] (See **Chapter 5**)

There are no known examples of radiological weapons for military use for large scale area contamination and terrain denial being developed during the Cold War period.[12] There is however evidence that chemicals and radioisotopes have been developed for state sponsored assassination, recent cases being in the UK when the Russian government was blamed for two episodes: poisoning by radioactive polonium-210 in 2006, and poisoning with a 'Novichok'[13] chemical agent in 2018.

It is important to note that nuclear incidents involve blast, detonation, explosion of a nuclear device, whereas radiological incidents produce radiation without detonation of a nuclear device. The latter involves the use of Radiological Dispersal Devices (RDDs) like dirty combs or Radiological Exposure Device (RED).

PPE and collective protective measures for armed forces and civilians are briefly discussed.

KEY TERMS

- **CAS Number or CAS Registry Number:** A unique numerical identifier assigned by the Chemical Abstract Service (CAS) to every chemical substance described in the open scientific literature. Useful in searching molecule databases for a particular chemical substance. The CAS Registry identifies organic, inorganic, proteins and DNA sequences and is regularly updated.
- **Cold war:** the period of geopolitical tension between the Soviet Union or USSR and the US and its allies, between about 1946 and the 1991 collapse of the Soviet Union.
- **IED:** Improvised Explosive Device. Each can be unique since it may be built from whatever is available.
- **PPE:** Personal protective equipment, that is equipment worn to minimize exposure to serious injuries and illnesses.
- **Radiological weapon:** a term used particularly during the cold war period for the concept of military weapons using deliberate radiation poisoning or contamination of an area with radiological sources.
- **RDD and Dirty Bombs:** Radiological Dispersal Devices also commonly called 'dirty bombs'
- **RED:** Radiological Exposure Device
- **Toxin:** a poisonous substance produced by living cells or organisms with the ability to cause a disease by contact with or uptake by the body. (see **Annex 1** below)
- For a description of the main classes of CW agents, see **Annex I**.

11 Ad Hoc Group of the States Parties [to the BWC]. Rolling text of a Protocol.... 1 March 2001. BWC/AD HOC GROUP/55-1. Annex A, p 196-200. http://www.opbw.org/ahg/docs/rolling%20text%20and%20annexes.pdf.

12 The period of geopolitical tension between the Soviet Union or USSR and the US and its allies, between about 1946 and the 1991 collapse of the Soviet Union.

13 Novichoks are a series of nerve agents believed to be developed in the Soivet Union after 1970, some of them several times more toxic than existing nerve agents soman and VX.

A · CHEMICAL WEAPONS

Chemicals as assassination weapons.

The concept of using chemicals for criminal or political acts of 'poisoning' is very ancient, and for example is well documented in Greek and Roman writings in the BCE.[14] Almost always the chemicals were administered orally, without the knowledge of the victim, in food or drink. A solid or liquid preparation could simply be hidden in a solid or liquid food chosen to disguise any taste of the chemical. Many of the poisons were alkaloids in plant extracts, such as belladonna from berries of the 'deadly nightshade' plant, extracts of the hemlock plant, strychnine from seeds of the plant *Strychnos nux* vomica found in Asia and Australia. Arsenic was another classic murder weapon; it is a natural element, like strychnine often widely available for household use as a pesticide.

Chemical weapons

Using a chemical to attack troops *en masse* did not happen until World War 1. The toxic chemicals chosen had physical properties allowing them to be dispersed and reach the intended target as fine droplets or a gas that could act through the lungs, eyes or skin.

By the beginning of the war, Germany had the most advanced chemical industry in the world, leaders in the world's dye and chemical production. Because of its chemical reactivity, chlorine was a major building block in many processes, and it became the first battlefield weapon in the war. Germany's decision to do this was presumably a means to break the deadlock of trench warfare. The first known major **chlorine gas** attack took place in April 1915 at the Second Battle of Ypres in Belgium.[15] [16] Taking advice about the prevailing wind patterns, a special army unit opened the valves of more than 6,000 steel cylinders of pressurised liquid chlorine. Within 10 minutes, 160 tons of chlorine gas drifted downwind over the French trenches, a total surprise, and troops who were not suffocated quickly fled from their lines. The slow moving cloud killed more than 1,000 French and Algerian soldiers and wounded 4,000.[17] The British retaliated with attacks from chlorine cylinders, but uncertain meteorology sometimes resulted in casualties to friendly troops. French chemists synthesised a new chemical, **phosgene**, more toxic than chlorine and being colourless more difficult to detect, often used in mixtures with chlorine that helped to spread it. The most widely reported chemical weapon, and probably the most effective as a harassing agent, was sulphur mustard (CAS Number 505-60-2), known as **mustard gas or yperite**.[18] Delivered in artillery shells, mustard gas settled to the ground as an oily liquid and could remain there active even for months. Fatally injured victims sometimes took four or five weeks to die of mustard gas exposure, in great pain.[19, 20]

Over the various theatres in the conflict, gas was employed primarily on the Western Front—the static, confined trenches being ideal for achieving an effective concentration. By the time of the armistice, chemical weapons had caused more than 1.3 million casualties and approximately 90,000 deaths.[21]

14 in the Before Common Era (BCE). The same as Before Christ (BC).

15 Wikipedia. Chemical weapons in World War I. https://en.wikipedia.org/wiki/Chemical_weapons_in_World_War_I.

16 UK Public Record Office (PRO). An account of German gas cloud attacks on the British Front in France. WO 32/5183.

17 Fitzgerald G.J. Chemical Warfare and Medical Response during World War I. 2008. Am J Public Health 98(4), 611-625.

18 Named after Ypres (Belgium) where the German army used CW.

19 The burning effects of mustard gas were not normally apparent for some hours after exposure, but they led to blindness, blistering and lung damage.

20 Wikipedia. Western Front (World War I). https://en.wikipedia.org/wiki/Western_Front_(World_War_I)#Gas_warfare.

21 UK Public Record Office (PRO). An account of German gas cloud attacks on the British Front in France. WO 32/5183.

Revulsion about the suffering and slow death caused by the massive use of 'poison gas' warfare in WW1 led to chemical (and biological) weapons being banned in the Geneva Protocol of 1925.[22] Some countries signed but failed to ratify the Protocol; many others explicitly reserved the right to retaliate in kind if attacked. From the middle of the century a new class of warfare agent dominated in weapons designed to be able to overcome the physical protection available to troops - the **nerve agents.** These worked rapidly and at very small dosages, and could attack through the lungs or the skin. Not surprisingly, many countries carried on with defensive and offensive preparations. The CWC, which banned the development and acquisition of chemical weapons as well as their use and required the destruction of weapon stocks, entered into force in 1997.

The Geneva Protocol notwithstanding, sporadic episodes of interstate chemical warfare occurred during the many subsequent wars of the Twentieth Century. Devices range from fragile containers dropped from the air that fracture on impact, through fused containers such as shells, mortar rounds and bombs, to aircraft or missile spray systems. Another dissemination method uses heat provided by a pyrotechnic composition.[23] During the Cold War, the arms race between the US and Soviet Union included huge stockpiles of chemical weapons, still at the tens of thousands of tons level by the time these countries ratified the CWC with the commitment to disarm. Widely quoted in explaining this CW escalation was a statement by Soviet Minister of Defence Marshal G.K. Zhukov in 1956 predicting that any future war would involve CBN weapons - '**weapons of mass destruction'**.[24] The classes of chemical agents, in chronological order from their first appearance in WW1, are described in **Annex I** to this Chapter.

Japan used CW against Taiwan in 1930 during the Wushe massacre[25], Italy used mustard gas against Abyssinia in 1935[26] and Japan used CW against China between 1938 and 1941. The British in Malaya,[27] the French in North Africa and then the Americans from 1961 onwards in Vietnam,[28], [29] used chemicals against plants as means to attain a variety of military objectives, including crop-destruction to reduce enemy food supply and defoliation in order to reduce ambushes. By 1967, these US actions in Vietnam had increased to 965,000 acres of land, about half of it cropland.[30] In the Yemeni civil war, on 16-17 May 1967, an International Red Cross mission treated villagers after bombing raids, symptoms indicating use of asphyxiating gases.[31] In the Iran/Iraq war of the 1980s, United Nations (UN) experts

22 The full title of this international treaty is the Protocol on the Prohibition of the use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare.

23 In a pyrotechnic weapon heat is used to evaporate the fill which then condenses in the air as a suspension of inhalable particles, creating a hazard through the lungs or the eyes. But this use of heat is feasible only for heat-resistant and non-combustible agents.

24 'Marshal Zhukov, at the Soviet Party Congress in February 1956: 'Future war if they [that is the West] unleash it, will be characterised by the massive use of atomic, thermonuclear, chemical and bacteriological weapons'.

25 Croddy E. China's role in the Chemical and Biological Disarmament Regimes. Page 17. https://www.nonproliferation.org/wp-content/uploads/npr/91crod.pdf.

26 SIPRI Arms Control and Non-proliferation Programme, October 2009. The use of chemical weapons in the 1935–36 Italo-Ethiopian War. Grip L. and Hart J. https://www.sipri.org/sites/default/files/Italo-Ethiopian-war.pdf.

27 Whitby S.M. Biological Warfare against crops. 2002. Palgrave. page 132.

28 CBW Chemical and Biological Warfare: The London Conference on CBW, ed Steven Rose. Harap & co Ltd, London, 1968. pp 62 -66.

29 NCBI. Veterans and Agent Orange. Health Effects of Herbicides Used in Vietnam. https://www.ncbi.nlm.nih.gov/books/NBK236351/.

30 CBW Chemical and Biological Warfare: The London Conference on CBW, ed Steven Rose. Harap & co Ltd, London, 1968. pp62-66.

31 Stanford Edu, US. Yemeni Civil War: UAR Gas Use Charged. 30 August, 1967. https://web.stanford.edu/group/tomzgroup/pmwiki/uploads/1109-1967-08-30-FoF-a-JZW.pdf.

concluded that there had been repeated use of CW against Iranian forces, employing aerial bombs and probably rockets to deliver mustard gas, a pulmonary irritant probably phosgene, and probably on some occasions the nerve gas tabun.[32]

From 1985, the Iraqi regime under Saddam Hussein tried to eradicate pockets of peshmerda Kurdish resistance in the north including by the use of CW. Though there were probably earlier attacks, the attack on Halabja came to international attention and was investigated by the UN. The UN medical team concluded that mustard gas had been used, as well as unidentified nerve agents.[33]

On 20 March 1995, the Japanese religious cult Aum Shinrikyo released sarin nerve gas inside trains on three subway lines in Tokyo. A large number of passengers and station personnel suffered toxic effects; many victims needed immediate medical treatment, others fled from the trains and went to local hospitals where panic ensued. Twelve passengers and station staff died, and some 5,000 people were injured. In the year before, the cult had manufactured chemicals and tested them on sheep on a farm in Australia. The cult had also synthesised VX nerve gas. In a trial run in 1994, they killed 8 people by releasing sarin from a truck in Matsumoto.[34] According to testimony of cult members at the subsequent trial, they had also planned to release nerve gas in the United States. Cult scientists testified that they made the sarin hurriedly; outside experts considered that deaths could have run into the thousands had the sarin been pure.[35]

In July 2012, Syria publicly acknowledged that it possesses chemical weapons. In September 2013, the Assad regime agreed to join the CWC and dismantle its CW arsenal, declaring its stockpile of weapons to the OPCW.[36] There were seven Category 1 warfare agents and chemicals for use in binary weapons. i.e. weapons in which the toxic chemical is absent until two separated precursor chemicals are mixed. The declared stockpile totalled over 1000 tonnes, with 27 Production Facilities and 12 Storage Facilities. In October 2013, a joint team of OPCW and UN officials arrived in Syria to begin destruction of the stockpiles and facilities. Further OPCW missions were mounted during the next five years to investigate fresh allegations of chemical attack, finding evidence for chlorine and sarin delivered by aircraft. Though chlorine is much used as a legitimate industrial chemical, the CWC bans the use of any chemical as a weapon. It is unclear which side in the conflict was dropping barrel bombs filled with chlorine.[37], [38] However, there is a widespread view that the use of CW by the Assad regime has made a considerable contribution to their military successes.[39]

32 United Nations Security Council, Report of the mission dispatched by the Secretary-General to investigate allegations of the use of chemical weapons in the conflict between the Islamic Republic of Iran and Iraq, S/18852, 8 May 1987.

33 Hiltermann, Joost R. A Poisonous Affair: America, Iraq, and the Gassing of Halabja. Cambridge University Press (2007) ISBN 978-0521876865. https://assets.cambridge.org/97805218/76865/frontmatter/9780521876865_frontmatter.pdf.

34 The Sarin Gas Attack in Japan and the Related Forensic Investigation. OPCW News. 1 June 2001. https://www.opcw.org/media-centre/news/2001/06/sarin-gas-attack-japan-and-related-forensic-investigation.

35 Japanese Cult Said to Have Planned Nerve-Gas Attacks in U.S. Kristof ND. 23 March, 1997. The New York Times. https://www.nytimes.com/1997/03/23/world/japanese-cult-said-to-have-planned-nerve-gas-attacks-in-us.html.

36 The Organisation for the Prohibition of Chemical Weapons – the implementing body for the CWC.

37 Timeline of Syrian Chemical Weapons Activity, 2012-2018. Arms Control Association. https://www.armscontrol.org/factsheets/Timeline-of-Syrian-Chemical-Weapons-Activity.

38 Walker PF. More Chemical Weapons Use in Syria: The Need for Accountability. 2016. Arms Control Association. https://www.nytimes.com/reuters/2016/08/10/world/middleeast/10reuters-mideast-crisis-syria-gas.html?smid=tw-share.

39 BBC News. How chemical weapons have helped bring Assad close to victory. al-Maghafi N. BBC Panorama.15 October 2018. https://www.bbc.co.uk/news/world-middle-east-45586903.

Chemicals for state assassinations

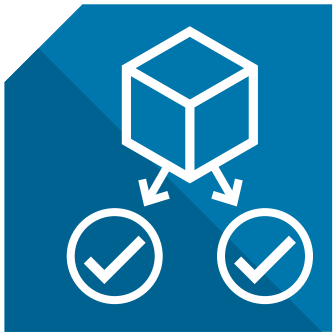
The technology advances in the various state weapons programmes seem to have spilled over into methods developed for state sponsored assassination. Three examples have been well reported in the press. In 1978 the Bulgarian dissident Georgi Markov, recently defected to London, was assassinated in the street, by a pellet containing ricin that was fired into his leg from a modified umbrella. There were suspicions that the Bulgarian Secret Service was responsible.[40] Then in February 2017, Kim Jong-nam , the older brother of the North Korean President, was murdered in Kuala Lumpur airport in February 2017 by assailants who smeared nerve agent VX onto his face. The two women captured on CCTV have pleaded not guilty to conspiring with the North Korean state.[41] In 2018 in Salisbury, UK, on 4 March, the former Russian spy Sergei Skripal and his daughter Yulia were taken seriously ill, and laboratory tests showed that they had been poisoned by the nerve agent Novichok. The UK government claimed that the attack had been carried out Russia,[42] which the latter denied.[43]

40 The Telegraph. Poison-tip umbrella assassination of Georgi Markov reinvestigated. Edwards R. 19 June 2008. https://www.telegraph.co.uk/news/2158765/Poison-tip-umbrella-assassination-of-Georgi-Markov-reinvestigated.html.

41 The Guardian. How North Korea got away with the assassination of Kim Jong-nam. 1 April 2019. https://www.theguardian.com/world/2019/apr/01/how-north-korea-got-away-with-the-assassination-of-kim-jong-nam.

42 GOV UK. G7 foreign ministers' statement on the Salisbury attack. 17 April 2018. https://www.gov.uk/government/news/g7-foreign-ministers-statement-on-the-salisbury-attack.

43 BBC News. Russian leaflets denigrate 'novichok' scientist Vladimir Uglev.15 February 2019. https://www.bbc.co.uk/news/world-europe-47251132.



DUAL USE GOODS

Items, including software and technology, which can be used both for civil and military purposes. It includes all items which can be used in the manufacture of weapons. A list of controlled dual-use items is set out in Annex I to the EU Council Regulation 428/2009 (JRC ENATECH DATABASE DEFINITION)

EXAMPLE: Thiodiglycol (CAS Number 111-48-8)

MILITARY USE

A Chemical Weapons Convention schedule 2 chemical which can be used in mustard gas.

CIVILIAN USE

Used as:

- a dye carrier
- ink solvent
- lubricant
- an antistatic agent and in cosmetics
- anti-arthritic drugs
- plastics
- stabilizers
- antioxidants
- epoxides
- coatings
- metal plating
- photography
- and copying.

B · BIOLOGICAL WEAPONS

The use of disease to attack the troops or civilians of an enemy goes back to the earliest historical records, and long before the nature of infection was understood it was common to pollute water sources of an enemy with animal or human corpses.[44] During the medieval period diseased bodies were catapulted into besieged cities, and even as late as the 1760s British commanders ordered blankets from smallpox victims to be given to North American Indians in order to cause widespread fatalities in the highly susceptible population.[45]

The use of chemicals on the battlefields of WW1 is well documented, but what is less well known is the use of biological agents during sabotage campaigns. For example, German agents used anthrax and glanders bacteria to infect horses and livestock being shipped to Europe, and grain shipments were attacked with a fungus.[46, 47] After WW1, the suspicion that enemy side had been investigating the use of biological agents spurred research into offensive potentials, in some cases extending to the development of considerable arsenals – all considered to be consistent with the retaliatory reservations tabled with the 1925 Geneva Protocol.

In WW2 (1939-45), because of fears – as it turned out, unfounded - that Germany might be developing biological weapons – Britain produced an anti-livestock weapon in the form of cattle cakes containing anthrax, to be dropped over Germany from aircraft; but this was never used. As an anti-human weapon, the UK concentrated on the development of an explosive munition which could disseminate anthrax bacteria as spores because in this robust form it could withstand the explosive forces. Field trials were carried out on Gruinard Island in Scotland, using imported sheep as test animals. Because of the stability of the spores, residual contamination of the terrain was an issue. However, most other live microorganisms that were considered as potential warfare agents were too fragile to be disseminated by the explosive munitions that had been developed for chemicals.[48]

R&D on potentials for biological weapons continued after the war, in some cases progressing to actual weapons designs.[49] With a new objective of downwind travel to cover large areas, entirely new dissemination methods were needed for liquid aerosol droplets or powder formulations small enough to be inhaled, and field trials were carried out to assess survival and efficacy downwind.

Although the possibilities of using naturally or deliberately infected corpses and tissues for sabotage remained, the new weapons R&D largely reflected the advances that allowed the artificial growth and storage of microbes on large scales, and techniques for the extraction of certain microbial toxins.[50]

44 Science Alert. Biological Weapons-agents for Life and Environmental Destruction. Onyenekenwa Cyprian Eneh. Research Journal of Environmental Toxicology, Volume 6 (3): pp 65-87, 2012. https://scialert.net/fulltextmobile/?doi=rjet.2012.65.87.

45 Colonial Williamsburg. Colonial Germ Warfare. Gil H.B.Jnr. Spring 2004. https://www.history.org/foundation/journal/spring04/warfare.cfm.

46 Office of the Surgeon General (US). Medical Aspects of Chemical and Biological warfare. 1997. Page 16. http://www.bvsde.ops-oms.org/tutorial1/fulltex/armas/textos/chebio/chebio.pdf.

47 Whitby S.M. Biological Warfare against crops. 2002. Palgrave. pp 3-4.

48 HMSO. Chemical and Biological Defence at Porton Down 1916-2000. Carter G.B. pp62-66.

49 Examples of agents infective for man: Bacillus anthracis (causing anthrax), Francisella tularensis (tularemia), Yersinia pestis (plague), Coxiella burnetii (Q-fever) and the virus causing Venezuelan Equine Encephalomyelitis.

50 Toxins with weapon potential were botulinum toxin and staphylococcal enterotoxin.

Realisation of the way that a particular disease is able to infect through the respiratory tract,[51] even if this is not its natural route of infection, undoubtedly led to major medical advances. In the weapons field it led to the design of agent formulations and delivery equipment that would release the weapon 'fill' as liquid droplets or dried particles small enough to remain suspended in the air, that is as 'aerosols'. For anti-crop BW, rather larger particles would be created so as to deposit on the plant surface. Some devices were large enough to generate sufficient aerosol to cause infection over areas of many square km, virtually simultaneously. Thus, biological weapons became recognised as 'weapons of mass destruction' (WMD).

Japan. This is not to say that the state programmes did not include development of weapons for smaller scale use, for sabotage or assassination. A known example is the Japanese BW programme that existed from the early 1930s to 1945, and which did involve **the actual use of biological weapons**, in Japan's war with China. The test programme at Unit 731 included infecting thousands of prisoners of war (POWs) often under horrifying conditions, and 'field trials' were carried out against the populations of a dozen Chinese cities.[52] The programme evaluated how the severe intestinal diseases such as typhoid, dysentery and cholera could be used in contaminating water supplies. Another technique was to inject plague bacteria into flea-ridden rats, which were then released into densely populated areas. There is evidence, unconfirmed, that Japanese troops retreating from the Chinese province of Chekiang in 1942 deliberately infected reservoirs, wells and rivers, and houses in the expectation that advancing Chinese troops would be infected, but that some 10,000 Japanese casualties occurred when their troops mistakenly overran the infected area.[53] Other Japanese weaponised mechanisms that were tested on humans included: the use of shrapnel to allow entry of bacteria through the wounds;[54] and combinations of agent, for example the bacteria causing anthrax and glanders because skin lesions caused by the anthrax provided a portal of entry for the glanders.[55]

United States. In the US, the first limited BW retaliatory capability was achieved in 1951 when an anti-crop bomb was developed, tested and placed in production. In March 1956, the President approved a revised policy that the US would be prepared to use BW and CW in a general war were it necessary to enhance the effectiveness of its military forces. Between 1954 and 1967, the Pine Bluff facility produced the bacteria causing brucellosis, tularemia, Q fever, and anthrax;[56] and Venezuelan Equine Encephalomyelitis virus and the toxins botulinum toxin and staphylococcal enterotoxin. Antipersonnel munitions were filled with these various agents and toxins were produced and stored as a deterrent capability. The staphylococcal toxin weapon reflected a new interest in short term incapacitating weapons at the time that active US military participation was increasing in the Korean war after 1964. Three anti-crop biological agents were also produced: stem rust of wheat and rye, produced by infecting crops; and rice blast produced in a submerged culture process. Defensive developments emphasized rapid detection systems,

51 Lower respiratory infections, such as pneumonia, tend to be far more serious conditions than upper respiratory infections, such as the common cold.

52 Harris, Sheldon. Factories of death: Japanese Biological Warfare, 1932-45, and the American Cover-up. 2002. Routledge.

53 See, for example, Peter Williams and David Wallace, Unit 731: The Japanese Army's Secret of Secrets, London: Hodder and Stoughton (1989), at pp 28 and 69.

54 Stockholm International Peace Research Institute, The Problem of Chemical and Biological Warfare. Volume I: The Rise of CB Weapons, Stockholm & New York (1971) at p 116.

55 Li Xiaofang (editor), Qixie Kongsu: Blood-Weeping Accusations: Records of Anthrax Victims, Beijing: Zhongyang Wenxian Chubanshe, 2005, ISBN 7-5073-1862-1.

56 Respectively Brucella suis, Pasteurella tularensis, Q fever rickettsia, Bacillus anthracis.

vaccine development and improved therapy and prophylaxis. Dispersion tests in the open air and in June 1966 in subway systems were carried out using various safe simulants. The US offensive programme was unilaterally terminated by Presidential order in 1979.[57]

The UK. Information about the much smaller UK programme including field trials was also published after the BWC and CWC had both entered into force. As well as downwind releases of safe simulants, there were releases at sea of live bacteria causing tularemia and brucellosis, and the virus Venezuelan equine encephalomyelitis.[58] The offensive objective ended in the 1950s.

The Soviet Union. Although no detail was ever published about the third known major BW development programme, that of the former Soviet Union, it is widely believed that offensive possibilities were being actively explored from the 1930s onwards. A number of defectors in the late 1980s brought news of a very large programme that continued after the prohibitions of the 1972 BWC had entered into force, information presumably reflected in the repeated public accusations by Western intelligence agencies. Accumulating information about the organisation of the illicit programme revealed how since 1973 it had been hidden in a massive biotechnology initiative named Biopreparat, that employed many thousands of scientists in several apparently legitimate military medical R&D and vaccine production facilities. One line of research was the development of a genetically engineered strain of plague bacteria with enhanced resistance to cold, heat, and several antibiotics.[59] The first high level political admission from Russia was made by Russian President Yeltsin when in January 1992 he referred to 'a lag in implementing' the BWC. In a meeting with US President Bush on 1 February, Yelstin described prototypes of aerial bombs and rocket warheads capable of carrying anthrax, tularaemia and Q fever agents. This admission followed pressure from Western Government to explain an outbreak of respiratory anthrax in 1979 that apparently originated from a military facility in Sverdlovsk. (See **Chapter 4**). Ken Alibek, a Russian defector who had been a senior scientist in this secret BW programme, said that the facility had developed weapons based on anthrax, glanders, tularemia and melioidosis, and had stockpiled anthrax.[60]

South Africa developed the capability to produce and deploy chemical and biological weapons, during the mid-1980s. The programme, known as Project Coast, included work on cholera, botulism, anthrax, chemical poisoning and the large-scale manufacture of incapacitating drugs for crowd control. Agents were produced for use as murder weapons, e.g. in cigarettes, milk and whiskey. In 1993, President de Klerk ordered the destruction of any remaining chemical and biological substances. The country signed the CWC, and October 1994 hosted the first conference in Africa on the implementation of the Convention.[61]

57 US Army Activity in the US Biological Warfare Programs. 25 February 1977. USA Department of the Army. Published following the US Presidential ban of BW on 25 November 1969. https://archive.org/stream/U.SArmyActivityInTheU.S.BiologicalWarfarePrograms/RNCBW_USABWP_djvu.txt.

58 Carter G.B. Chemical and Biological Defence at Porton Down, 1916-2000. 2000. The Stationary Office, London. p83.

59 Eds Dando, Pearson and Toth. Verification of the Biological and Toxin Weapons Convention. 1991 Springer-Science+Business Media BV. ISBN 978-90-481-5537-B. page47. https://link.springer.com/book/10.1007/978-94-017-3643-5.

60 Alibek K, with Handelman S. Biohazard. 1999. Random House. p298.

61 South Africa's Chemical and Biological Warfare Programme. Special investigation into Project Coast. Truth and Reconciliation Commission Final Report. 29 October 1998. https://fas.org/nuke/guide/rsa/cbw/2chap6c.htm.

WEAPONS OF MASS DESTRUCTION

CHEMICAL WEAPON
A weapon specifically designed to cause death or other harm through the toxic properties of chemicals. It consists of the substance or agent (CWA) and of some form of carrier or container (e.g. ammunition).

BIOLOGICAL WEAPONS
Disease-producing microorganisms, toxic biological products, or organic biocides by either nations or non-governmental bodies designed to induce death or disabilities in humans and/or animals and/or damage to plant crops, etc.

RADIOLOGICAL WEAPON*
A radiological weapon (or radiological dispersion device, RDD) is any device that is designed to spread radioactive material into the environment, either to kill, or to deny the use of an area.

NUCLEAR WEAPON**
An explosive device whose destructive force results from either nuclear fission chain reactions or combined nuclear fission and fusion reactions

CHEMICAL, BIOLOGICAL, AND NUCLEAR

* Wirz, Christoph, and Egger, Emmanuael. Use of nuclear and radiological weapons by terrorists? International Review of the Red Cross. Volume 87 Number 859, September 2005.

** Geneva Academy and the International Law and Policy Institute. "Nuclear Weapons Under International Law: An Overview". October 2014.

C · RADIOLOGICAL WEAPONS

After the development of the nuclear reactor during WW2, it became possible to think of producing radioactive material in sufficient quantities to be weaponised. The subject was openly discussed in the literature and many countries carried out practical tests, some of which have since been described in open sources.

Several problems were foreseen in having a radiological weapon as a stock item. The weapon-fill for use over a large area would be extremely dangerous to prepare, and handling it would need very heavy shielding. The fact that radioisotopes 'decay' in emitting their radiation and thus lose efficacy during storage fitted uncomfortably with classical weapons notions of production and long-term storage, to be deployable for use at short notice. Furthermore, would the delay in the onset of casualties fit with the concept of a tactical battlefield weapon? Using the production capacity of a nuclear reactor to make the materials for atomic weapons, with their great and immediate destructive capacity, must have seemed much more attractive.

However, it is claimed that some countries have developed assassination methods based on radioisotopes. In November 2006, Alexander Litvinenko, a former officer of the Russian secret services who had fled from prosecution in Russia and was given asylum in the United Kingdom, suddenly became seriously ill in London and died three weeks later. This was days after he had met two former KGB officers.[62] Death was ascribed to acute radiation poisoning by polonium-210. The UK investigation found a trail of the polonium across London, but extradition requests for the two Russians were refused by the Russian government.[63]

D · MILITARY PROTECTIVE MEASURES AND CIVIL DEFENCE

Designs of individual PPE for armed forces – masks, suits - steadily improved in the century after the first gas masks and rubberised capes in WW1, so that in the Cold War period they could allow fairly flexible functioning by armed force personnel in a nuclear biological chemical (NBC) attack. Subsequent designs of masks had built in absorbents such as charcoal to protect against gaseous chemicals, and easily replaceable filters for particulate weapons such as biological agents. To protect against agents such as blister agents and nerve agents that harm through contact with the skin, full protective suiting was developed, in some countries based on impermeable rubber coated canvas – which can cause heat stress – and in others as a breathable suit with a charcoal absorbent layer. Recent events such as the COVID-19 pandemic and the use of chemical weapons in the Syria conflict have provided a stark reminder of the plethora of chemical and biological threats that soldiers, medical personnel and first responders face during routine and emergency operations. High breathability (i.e., the transfer of water vapor from the wearer's body to the outside world) is critical in protective military uniforms to prevent heat-stress and exhaustion when soldiers are engaged in missions in contaminated environments. Scientists developed a smart, breathable fabric from carbon nanotubes designed to protect the wearer against biological and

62 The KGB was the main security agency for the Soviet Union from 1954 until its break-up in 1991. The FSB was one of its successor agencies.

63 UK Crown. The Litvinenko Inquiry. Report into the death of Alexander Litvinenko. January 2016. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/493860/The-Litvinenko-Inquiry-H-C-695-web.pdf.

chemical warfare agents. Material of this type could be used in clinical and medical settings as well.[64]

Some military vehicles, ships and installations are fitted with collective NBC protection based on overpressure and air filtration, to relieve troops from wearing masks and protective clothing.

Some military vehicles, ships and installations are fitted with collective NBC protection based on overpressure and air filtration, to relieve troops from wearing masks and protective clothing.
It is now routine for armed forces to train for potential biological and chemical warfare by exercising with protective masks and equipment and decontamination procedures. In preparation for the 1990-91 Gulf War, where there was suspicion that Iraqi forces might use chemical or biological weapons, coalition forces were immunised against potential biological warfare agents – with a licensed toxoid vaccine against anthrax, and a new botulinum toxoid vaccine – and the antibiotic ciprofloxacin was stockpiled.[65]

During WW2, the threat of aerial attack on cities necessitated well organized civil defence planning. There were a few purpose-built air-raid shelters, but for most of the population improvised shelters such as basements and subways were used. During the atomic age of the Cold War and the prospect of 'mutually assured destruction' by the opposing nuclear arsenals, the extent of civil defence varied. The most thorough preparations were probably in the Soviet Union, employing over 100,000 officials by 1978, as part of their strategy to convince enemies that Russia would survive a nuclear war. Their target for 1985 was to accommodate up to 30% of the population in blast resistant shelters, presumably with filtered air. There were compulsory public training and drills, periodic alerts, and widespread dissemination of information.[66] Many countries built blast proof regional centres each able to allow hundreds of officials to carry on government functions for months after a nuclear attack.

64 Lawrence Livermore National Laboratory. Second skin protects against chemical, biological agents (2020, May 7) retrieved 15 May 2020 from https://phys.org/news/2020-05-skin-chemical-biological-agents.html.

65 Reidel S. Biological warfare and bioterrorism: a historical review. 2004. 2004. Proc (Bayl Univ Med Cent) vol 17(4) 400-406. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1200679/.

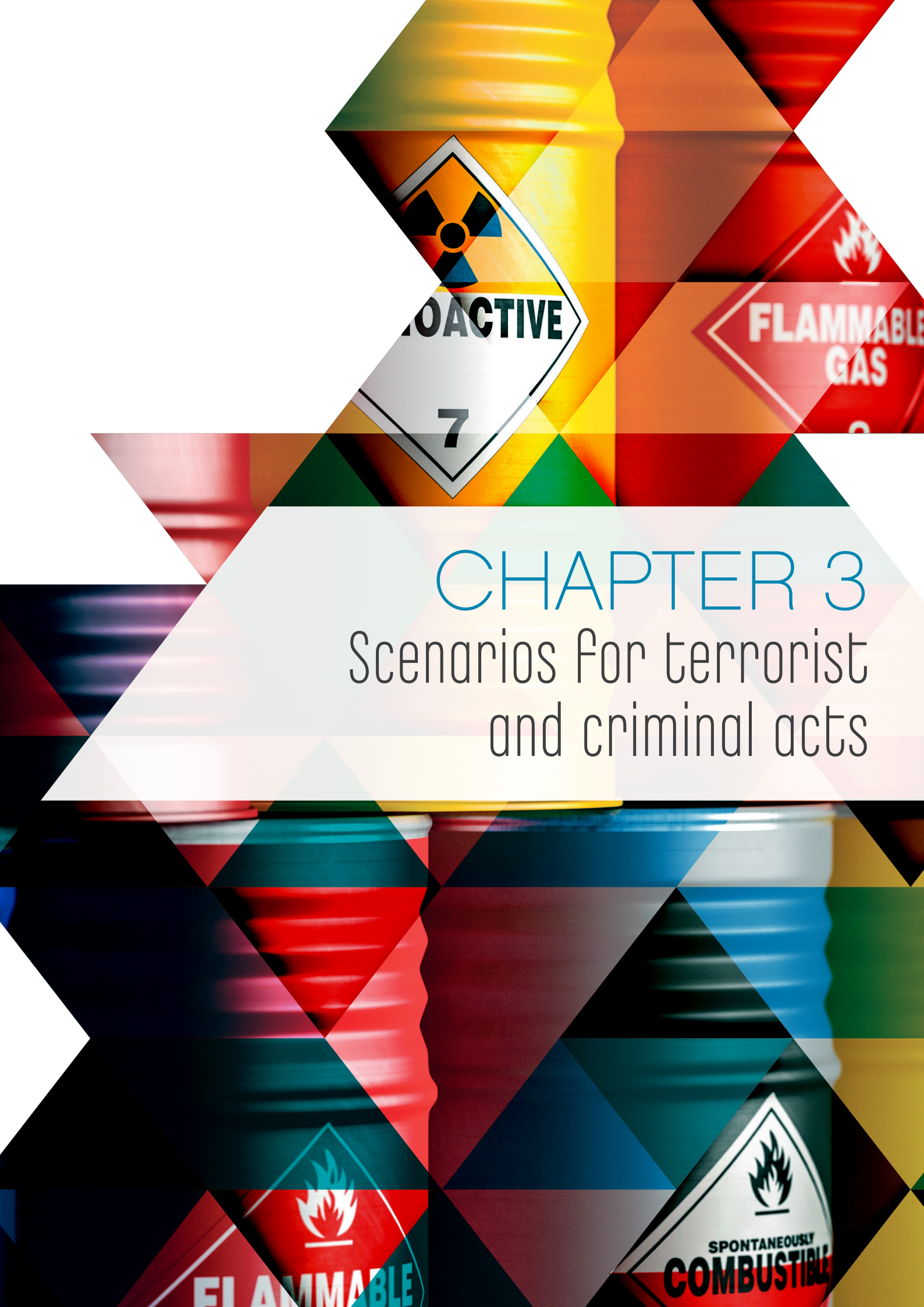
66 Soviet Civil Defence. Director of (US) Central Intelligence. 1978. https://www.cia.gov/library/readingroom/docs/DOC_0000420176.pdf.

ANNEX I

THE CLASSES OF CHEMICAL AGENTS, IN CHRONOLOGICAL ORDER FROM THEIR FIRST APPEARANCE IN WW1:

- *Sensory irritant agents.* These include the tear gases and vomiting agents, used initially by military forces to drive enemy troops out of protective cover. The less deadly of them later came into widespread use by police forces as 'tear gas' to control civil disturbances. (See **Chapter 5** for the interpretation of the CWC)
- *Choking agents, also called asphyxiants.* These attack lung tissue, primarily causing pulmonary oedema (literally downing of the lungs). Examples are phosgene, diphosgene, chlorine and chloropicrin and other industrial chemicals. Phosgene was responsible for 80 percent of all chemical-weapon fatalities during WW1.
- *Blood agents.* As weapons, these would normally be disseminated as aerosols and would take effect by inhalation. They interfere with oxygen utilization in the blood and, in large enough quantity, can kill people quickly. Hydrogen cyanide (HCN) is the best known. It has widespread uses in industry and is used for capital punishment.
- *Vesicants or blister agents.* They burn the skin or other parts of the body contacted. They include the sulphur mustards, the nitrogen mustards and lewisite. Some toxic industrial chemicals show similar effects at much larger dosages.
- *Toxins.* These chemicals of biological origin, extracted from microorganisms or plants, are among the most toxic substances known. Examples that have been considered for use as weapons include the neurotoxin botulinum toxin (from the bacterium *Clostridium botulinum*), ricin (from castor oil beans) and shellfish poison. The lethal dose for botulinum toxin is thought to be orders of magnitude less than for the most toxic of the nerve agents. In domestic life, food poisoning caused by botulinum toxin has a very high mortality rate if not quickly treated.
- *Nerve agents.* The nerve agents (or nerve gases) are a group of highly toxic chemical warfare agents that work rapidly and at much smaller dosages than blood agents, and with the additional advantage that they can also attack through the skin. Discovered just before WW2, they are related chemically to the organophosphate insecticides. Several sub-groups were subsequently developed for potential military use, even including water-contamination. **Tabun or GA** (CAS Number 77-81-6), **Sarin or GB** (CAS Number 107-44-8), **Soman or GD** (CAS Number 96-64-0), **VX** (CAS Numbers 50782-69-9) and **VR or Russian Vx** (CAS Number 159939-87-4) have been the most heavily stockpiled. They work by inhibiting the enzyme acetylcholinesterase throughout the body, resulting in paralysis of nervous transmissions and death by respiratory arrest. Lethal doses for man are typically only of the order of 1mg.
- *Herbicides.* Plant-growth regulators, such as the **2,4-D** (2,4-dichlorophenoxyacetic acid, CAS Number 94-75-7) and **2,4,5-T** (2,4,5-trichlorophenoxyacetic acid, CAS Number 93-76-5) used in Agent Orange, have been the most extensively employed. Their application density against broad-leaved plants is similar to that of nerve gas against people.
- *Psychochemical agents.* Initially developed in the 1950s as a means for causing nonfatal casualties; examples are **LSD** (Lysergic acid diethylamide, CAS Number 50-37-3), mescaline congeners, cannabinoids, and **BZ** (3-Quinuclidinyl benzilate, CAS Number 6581-06-2). Later agents studied reputedly because of state requirements for counterterrorist weapons include **fentanyl or fentanil** (CAS Number 437-38-7) and analogues.[67]

67 United Nations Office on Drugs and Crime. 'Fentanyl Analogues-50 years on'. Online material. Retrieved 10.05.2020. https://www.unodc.org/documents/scientific/Global_SMART_Update_17_web.pdf.



CHAPTER 3
Scenarios for terrorist and criminal acts

CHAPTER 3
SCENARIOS FOR TERRORIST AND CRIMINAL ACTS

The information explosion of the Internet has made it easier than ever to plan for terrorist acts involving CBR agents. A wide range of agent, some of them in widespread use in industries or laboratories, could be chosen because a terror attack need not be highly effective or widespread. Among the differences from a military application, use of a human disease that is highly transmissible may fit the aims of some terrorist groups. Agents able to cause harm through local food and water supplies could be just as attractive as dissemination of other agents by spray or explosion. This emphasises the importance for governments to raise alerts in legitimate organisations handling CBR agents, even by regulation and inspection.

SYNOPSIS

There is no universally agreed definition of the term 'terrorist', and its use in one country may involve political attributions and legal considerations that are not applicable in other countries, where for instance the label 'criminal' may instead be applied. The preferred descriptive term is therefore often 'terrorist act'. This is discussed further in Chapter 1. For simplicity, this chapter uses 'terrorist' to cover all such malicious acts whatever the underlying motive or national legal categorisation.

The information explosion through the Internet has made it easier than ever for individuals and organisations contemplating terrorist acts involving CBR agents to investigate what agents might fit with their objectives, resources and constraints for acquisition and use what is a suitable agent; potential sources and availability, published scientific methodology and outcomes – growth methods in the case of viable biological agents, extraction for toxins, synthesis for chemical agents. Porous country borders and the Dark Web (or Darknet) with payment means such as bitcoin all provide opportunities for the trade of controlled materials/substances. **Chapters 9** and **10** will describe 'security' steps being taken by governments to prevent unwanted access to legitimate facilities respectively handling B or C agents, and to address misuse of those facilities e.g. by the staff. For several of the historic chemical weapons (CW) agents, there is easy access to materials through the internet and in some countries/regions in the world. For chemical weapons, there are readily available starting materials, simple and straight-forward chemical reaction setups, and a promise of relatively high-yields and good-purity. Much the same may apply to the production of biological agents at least in small quantities, but for these it is critical to start with the right strain of a pathogenic microorganism, see below.

This chapter illustrates the range of publicly available information that could determine the choice of a particular CBR agent, and some of the technical factors and production pitfalls for the terrorist. The fact that many opportunities to cause terror would not necessitate a highly effective or widespread attack means that terrorists could have a very wide choice of agents, much wider than for strategic military arsenals typical of the Cold War period. (see **Chapter 2**). Chemicals such as Toxic Industrial Chemicals (TICs), and microorganisms that are common in public or animal health diagnostic laboratories may be relatively easy to source. Agents able

to cause harm through local food and water supplies could be as attractive as dissemination of other agents by spray or explosion. The International Atomic Energy Agency (IAEA) has warned of the terror potential of homemade Radiological Dispersion Devices (RDD) or simply leaving a radioactive source hidden in a public place. Overall, the examples of past incidents show the wide range of agents and scenarios involved.

Hoaxes and misperceptions can also be very disruptive and unsettling to society, and such events well outnumber the published descriptions of terrorist acts with actual agents.

KEY TERMS

- **BATA:** Singapore Biological Agents and Toxins Act
- **Cold War:** The period of geopolitical tension between the Soviet Union or USSR and the US and its allies, between about 1946 and the 1991 collapse of the Soviet Union
- **Dark Web or Darknet:** An encrypted portion of the internet that is not indexed by search engines and requires specific configuration or authorisation to access. It involves the use of an encrypted peer-to-peer (P2P) network connection or an overlay network (eg. Tor) which keeps a user's identity hidden by routing web page requests through a series of proxy servers which renders an IP address untraceable
- **IED:** Improvised Explosive Device
- **RDD:** Radiological Dispersion Device (RDD), a device that causes the purposeful dissemination of radioactive material without a nuclear detonation.
- **Ricin:** a highly potent toxin easily extracted from the plant *Ricinus communis*, known castor oil plant. Ricin is a Schedule 1 compound in the Chemical Weapons Convention. It acts as a toxin by inhibiting protein synthesis. Effective administration routes can be oral or possibly by inhalation.
- **TATP:** Triacetone triperoxide, CAS Number CAS Number 17088-37-8. Also known as **TCAP** (Tri-cyclic acetone peroxide). It is a white crystalline powder. This explosive substance does not contain nitrogen thus elude explosive detectors which are not set to detect non-nitrogenous compounds.
- **TIC:** Toxic industrial chemical. An industrial chemical which has a LCt50 value of less than 100,000 mg.min/m3 in any mammalian species and is produced in quantities exceeding 30 tonnes per year at one production facility. Also known as TIM (Toxic Industrial Material).

A · CHOICES OF BIOLOGICAL AGENTS

Much information about the now-outlawed national CBW programmes of the C20th can be accessed without attracting attention, available either as declassified official papers or as fairly well documented allegations. There are published lists of potential CBW agents, including some from past state CW and biological weapons (BW) offensive programmes. For the novice, there are well documented summaries of programmes and allegations in easily accessible books.[1] (An extensive body of literature all in the public domain has already been cited in **Chapter 2**). Important characteristics of many of these listed agents and indeed why they were chosen after much research is that they can be simple to produce, stable, infective, and capable of producing early incapacitation. Some agents are described in **Chapter 2**. The lists include pathogens that directly affect man, animals or crops. There is public-health information describing the principles of biological warfare; and, for the really expert reader a body of scientific literature that can give clues to some of the potential problems during the growth, handling, transport and dispersal of a pathogen. For example, how a microbial culture may lose its virulence when grown in the lab or on larger scale in fermenter vessels. Fortunately for all of us, people who grow pathogens for malicious purposes risk intellectual errors all along the way.

An example of a technical error by terrorists. In July 1993, a liquid suspension of anthrax bacteria was aerosolised from the roof of an eight-story building in Kameido, Tokyo, Japan, by the religious group Aum Shinrikyo. In 1999, a retrospective survey was conducted to identify potential human anthrax cases associated with the incident, but none was found. The use of an attenuated anthrax strain, low spore concentrations, ineffective dispersal, a clogged spray device, and inactivation of the spores by sunlight are all likely contributing factors to the lack of human cases.[2] The gross mistake was the use of a vaccine strain rather than a virulent one.

Few of the pathogens described in weapons programmes are transmissible from person to person – thus unlikely to spread through the population after an initial attack. But an important example of a transmissible disease is plague. Transmissibility was perhaps often inconsistent with the military and political objectives of state to state conflict, arguably because of the risk of an attack affecting friendly troops or civilians in the days afterwards. (An example of this when Japanese troops became infected was given in **Chapter 2**[3]). However, transmissibility could have been attractive for an anti-animal or anti-plant attack, to have a widespread impact on a country's agricultural resources.

By implication, some of the agents on lists published now, to define national control and/or declaration requirements in regulatory mechanisms designed to limit opportunities for misuse, might be capable of large-scale production and aerosol dissemination over large areas. An example is the list published by the Australia Group, 42 countries plus the European Union (EU), to define national export controls by its members. It comprises 81 viruses, bacteria, fungi that are pathogenic for humans or animals, 18 toxins

1 Examples are: a) A higher form of killing, the secret history of chemical and biological warfare. Robert Harris and Jeremy Paxman. Arrow Books 2002. ISBN 0 09 944159 4. b) Biohazard. Ken Alibek with Stephen Handelman. Random House 1999. ISBN 0 375 50231 9. c) Public health response to biological and chemical weapons. WHO guidance. 2nd edition. World Health Organisation, 2004. ISBN 92 4 154615 8.

2 Takahashi H. et al. Emerging Infectious Diseases. Bacillus anthracis Bioterrorism Incident, Kameido, Tokyo, 1993 CDC EID journal Volume 10 Number 1-January 2004. https://wwwnc.cdc.gov/eid/article/10/1/03-0238_article.

3 Williams P and Wallace D. Unit 731: The Japanese Army's Secret of Secrets. London: Hodder and Stoughton (1989), at pp 28 and 69.

and toxin sub-units,[4] as well as 18 plant pathogens.[5] A list in US legislation of agents deemed to 'pose a severe threat to public health and safety, to animal and plant health, or to animal or plant products', is the Select Agent list.[6] In the CoE SEA Region a comprehensive list of agents for which handling is legally regulated appears in the Singapore Biological Agents and Toxins Act.[7]

Instead of dissemination in large buildings or outside areas, terrorists may equally be attracted to the relatively low logistic burden of using small amounts of agents to attack food or beverage supplies, which could then involve agents absent from most literature about state BW. Many suitable microbial species are to be found in public health and research laboratories. With a high level of skill, genetic modification could be used to modify a natural pathogen, for example by changing its host specificity or increasing its virulence; or a harmful property could be introduced into a naturally harmless organism, e.g. by inserting a gene for toxin production. An agent preparation sufficient to cause harm on a significant scale would be small enough that one person could secretly carry it.

An important concern for governments is that to cause disruption and terror a terrorist group does not have to aim for the same degree of attack efficiency as in a military operation. This means **they could have a very wide choice of agents, some widely available and likely to fall outside strict governmental regulatory measures**: agents with infective doses too high for a military weapon; or agents which are too fragile to satisfy the long-term storage criteria or dissemination efficiencies we would now presume for the former military arsenals. Loss of infectivity or viability of the agent during storage or transfer, a characteristic of some agents and a major issue for the former military programmes, may not be a problem for terrorists able to carry out production shortly before use.

Again, agents that that would not have been chosen for military use because they would not be sufficiently harmful to immobilise troops who are young, fit and well nourished, could have much more serious impacts on civilian populations in poorer health, on children, the elderly, and the increasing numbers of the immunocompromised.

It follows that, in any exercise to **rank** the likely attractiveness of particular BW agents to terrorists, the relevance of historical lists of candidate BW agents should be interpreted with great care.

B · CHOICES OF RADIOLOGICAL AGENTS

Terrorists may be attracted to the fact, or fear in the minds of the public, that radiological agents could cause hidden dangers and long lasting contamination of surfaces. Although military radiological weapons were ruled out early in the atomic age as impractical, not least because of the burden of safe handling, personal risk may not necessarily dissuade terrorists. Speaking at a large international meeting in 2003, International Atomic Energy Agency (IAEA) Director-General Mohammed ElBaradei said: '*Given*

4 Australia Group. List of human and animal pathogens and toxins for export control. https://australiagroup.net/en/human_animal_pathogens.html.

5 Australia Group. List of Plant Pathogens for Export Control. https://australiagroup.net/en/plants.html.

6 CDC. Federal Select Agent Program. Select Agents and Toxins List. https://www.selectagents.gov/SelectAgentsandToxinsList.html.

7 Attorney-General's Chambers, Singapore Government. Biological Agents and Toxins Act, Chapter 24A. Revised edition 2006. https://sso.agc.gov.sg/Act/BATA2005.

the apparent readiness of terrorists to disregard their own safety, the personal danger from handling powerful radioactive sources can no longer be seen as an effective deterrent'.[8]

Media interest in the 'dirty bomb' (radiological dispersion device (RDD)) is hardly surprising. Obviously, to make an RDD, terrorists would need to obtain and handle explosives, another limitation. A simpler approach could be to leave the radioisotope where people would be irradiated unwittingly, say in public places, then announcing these days after the act so as to cause panic.[9]

A good reason for us to be vigilant is that a very large number of radioactive sources are distributed worldwide for a range of important technological functions.[10] (See **Chapter 4**). Discovery of an online auction of a supposed uranium radioisotope in Japan in 2019, outside the IAEA and national licencing systems, shows the need for continued vigilance.[11] The rapid breakup of the Soviet Union was followed by well publicised concern about the future of the large numbers of radioactive sources that would become lost to state oversight, so called orphan sources. This lack of control is a phenomenon widespread in other countries.[12]

C · CHOICES OF CHEMICAL AGENTS

Terrorists could probably find at least general descriptions of the types of specially designed military delivery systems in service from the World War 1 onwards for disseminating chemical fills as droplets, particles or vapour, according to the agent. For terrorists with skills and resources to carry out chemical synthesis if only a laboratory scale, synthesis schemes have been openly published for many of the chemicals developed in CW programmes, including mustard gas,[13] nerve agents[14] and herbicides such as agent orange.[15] The Japanese Aum Shinrikyo sect was able to produce sarin even though it was only known from state CW programmes. Their Tokyo attack, which killed 12 people and sent over 5,000 others to local hospitals, was the first known large-scale terrorist use of a chemical or biological agent. More recent historical information of potential interest to terrorists exists in the findings of UNSCOM on the Iraqi CW programme.

8 Hopper J. Campaign launched to stop dirty bombs. 12 March 2003. The Guardian. https://www.theguardian.com/world/2003/mar/12/usa.johnhooper.

9 Radiological attack. Dirty bombs and other devices. News & Terrorism.

10 For a review, see Commercial Radioactive Sources: Surveying the Security Risks. Ferguson CD. et al. Jan 2003. Monterey, CA: Center for Nonproliferation Studies. Occasional Paper no 11, January 2003. https://www.nonproliferation.org/11-commercial-radioactive-sources-surveying-the-security-risks/.

11 BBC News. Japan investigates alleged uranium online auction. 1 February 2019. https://www.bbc.co.uk/news/world-asia-47084114.

12 UATOM. General Information about radioactive sources. UATOM Website on nuclear and radiation safety and non-proliferation. https://www.uatom.org/en/orphan-radioactive-sources.

13 Wikipedia. Mustard gas. https://en.wikipedia.org/wiki/Mustard_gas#Synthesis_and_reactions scuh as agent orange

14 Barakat N.H. et al. Chemical synthesis of two series of nerve agent model compounds and their stereoselective interaction with human acetylcholinesterase and human butyrylcholinesterase. 2009. Chem Res Toxicol 22(10) 1669-1679. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2763961/.

15 Wikipedia. Agent Orange. https://en.wikipedia.org/wiki/Agent_Orange.

Methods for extracting toxins such as ricin or abrin from their natural sources are also well known. The examples of historic misuse in Annex 1 mention events involving the toxin ricin[16] Because of the ready availability of castor oil beans and the simple procedure for extracting the toxin, ricin continues to be one of the most popular choices for a terrorist. Almost every year now sees ricin incidents published in the press.[17] [18] [19]

Other ways in which a terrorist group might acquire chemical agents include direct use of commercially available poisons, the theft of chemical munitions, or a donation of ready-made chemical weapons by a state sponsor. Insecticides or other industrial or pharmaceutical chemicals could be bought or stolen. In countries where huge quantities of chemical weapons were historically produced and are still awaiting disposal under the provisions of the Chemical Weapons Convention (CWC), the security of stockpiles and of their transport and disposal may create opportunities for theft or illegal purchase. Details of the storage and disposal sites could be quite easy to acquire.

The 2012 acknowledgement by the Assad regime in Syria that they had used CW in the civil conflict has been mentioned in Chapter 2. However, there is also good evidence that the opposing forces and particularly the so-called Islamic State in Iraq and Syria (ISIS) had used CW if only in small quantities. Test results by Organisation for the Prohibition of Chemical Weapons (OCPW), (see Chapter 5), indicated that ISIS used sulphur mustard gas against Kurdish forces in Iraq in August 2015, based on samples taken from 35 affected Kurdish *Peshmerga* fighters near the city of Irbil in the so-called Islamic State in Iraq and Syria (ISIS). The same article refers to a chlorine Improvised Explosive Device (IED) bomb recovered by the Indonesian Police in late March 2015, planted in a supermarket in Jakarta by returning cadres who had been fighting with ISIS in Syria.[20]

Toxic Industrial Chemicals (TICs)[21] have a real potential for misuse, and in some cases could be easily obtained if facilities handling or storing them fail to adopt rigorous security measures, but the large amounts needed if chemicals with only medium toxicity are used may limit effectiveness if target scenarios are not carefully chosen. For instance, when insurgents in Iraq in 2007 exploded trucks containing cylinders of chlorine, there were few direct casualties from toxicity;[22] but a similar amount of chlorine released into a restricted air space such as a building could have had catastrophic results.

16 See also: List of incidents involving ricin; Wikipedia. https://en.wikipedia.org/wiki/List_of_incidents_involving_ricin.

17 Irish Times. Man arrested in Germany on suspicion of planning ricin attack.14 June, 2018. https://www.irishtimes.com/news/world/europe/man-arrested-in-germany-on-suspicion-of-planning-ricin-attack-1.3530580.

18 CNN. Suspected ricin detected in mail sent to Trump, Pentagon. Starr B. et al. 3 October 2018. https://edition.cnn.com/2018/10/02/politics/pentagon-ricin-mail/index.html.

19 BBC. Breaking Bad fan jailed over Dark Web ricin plot.18 September 2015. https://www.bbc.co.uk/news/uk-england-34288380.

20 Asian Military Review. Countering the Chemicals. Andy Oppenheimer. 20 October 2017. April/May 2017. https://asianmilitaryreview.com/2017/10/countering-the-chemicals/.

21 Toxic chemicals often used in large amounts in various industrial processes. They can be in the gaseous, liquid or solid states.

22 Cave D. and Fadam A. Iraq Insurgents Employ Chlorine in Bomb Attacks. 22 Feb, 2007. The New York Times. https://www.nytimes.com/2007/02/22/world/middleeast/22iraq.html.

D · CHOICES OF PRODUCTION FACILITIES AND PROTECTIVE MEASURES

National procedures to monitor staff and activities in legitimate laboratories or production facilities are important, to discourage the covert misuse of resources in order to produce toxic chemicals or microorganisms for illicit uses - work which could be easy to hide if it takes only a few days. Scale up could be achieved at chemical production sites or by using the fermenters (large production vessels) in the vaccine or brewing industries. Attention should also be paid to animal houses, as many of the pathogens could be grown by infecting animals and then using animal parts, perhaps ground up – actually an historic method for producing many types of pathogen. There are known cases where people have misused their employer's laboratories to produce illegal narcotic drugs. Measures that can be taken by governments to help legitimate laboratories to prevent the 'insider threat' from misuse of facilities are described in **Chapter 9**.

As for setting up covert production, providing individuals know the risks and how to work safely, there are commercially available respirators to protect against particulates and toxic gases, and chemical suits, although procurement of these and the starting materials could raise alarm bells. For a significant radioactive source, for perpetrators to avoid disabling harm during the assembly of a weapon could require massive amounts of shielding which would be difficult to acquire, bulky and very heavy.

E · HOAXES AND MISPERCEPTIONS

Perhaps because of the technical complexities in producing CBR agents, the published descriptions of terrorist acts in which agents have actually been released are outnumbered by hoaxes or misperceptions. In **numerous incidents**, harmless substances were disseminated to give the impression of harmful attacks. 'White powder' mailings before and after the mailings of the 'anthrax letters' in the USA in 2001 include many examples of hoaxes. Again, a false allegation of use may be made by the purported victim of an 'attack'. In March 1990, for example, the Yugoslav federal government announced a mass-poisoning hoax staged by ethnic Albanians who were claiming an attack by Serbian forces in Kosovo.[23] Again, the spread of rumours, now increasingly easy by social media, can lead to panic by 'the worried well' which puts pressure on medical services and authorities in general. Thus, in October 2001 more than a thousand students entered health clinics in Manila with 'mundane' flu-like complaints such as cough, colds and mild fever after texts had spread rumours that the symptoms were due to bioterrorrism.[24]

F · EXAMPLES OF TERRORIST ACTS

Annex 1 describes a range of events from the past which have been successful CBRN terrorist acts, or failed attempts or hoaxes. This listing, far from complete, is chosen to illustrate the sheer breadth of scenarios, objectives and harmful agents, as a warning to be vigilant for the future.

23 See the record for 20-22 March in 'News Chronology', Chemical Weapons Convention Bulletin no 8. June 1990, pp 12-13.

24 Wessely S. et al. Psychological implications of chemical and biological weapons. 20 October 2001. British Medical Journal 323: 878-9. https://www.bmj.com/content/323/7318/878.

There is no doubt that **currently** active terrorist groups will continue to consider using CBR agents, perhaps most worryingly now the so called Islamic State (ISIS).[25] We do not here cover terrorist acts that cause harm only through explosions as by IEDs,[26] i.e. without concurrent release of CBR agents, but it is clear that some terrorists are able to access large amounts of explosives, for example the TATP (Triacetone triperoxide, CAS Number 17088-37-8) used in the 2016 Brussels airport improvised explosive devices (IEDs). In the Philippines, a wave of IED attacks in 2000 mounted by the militant organisation Jemaah Islamiyah (JI), has been followed by attacks by other groups, and there are estimates of at least 300 IED-makers active in the Philippines.[27] The bombing of the cathedral on the island Jolo in the Philippines in January 2019 shows how ISIS is turning its attention to SEA.[28]

25 Binder M.K. et al. Combating Terrorism Center at West Point. Islamic State Chemical Weapons: A Case Contained by its Context? CTC Sentinel, vol 11, March 2018. https://ctc.usma.edu/islamic-state-chemical-weapons-case-contained-context/.

26 IED - Improvised Explosive Devices.

27 Sass Rogando Sasot. The IED legacy of foreign terrorists in the Philippines. 27 July 2015. http://www.cbrneportal.com/the-ied-legacy-of-foreign-terrorists-in-the-philippines/.

28 New York Times. SIS Bombing of Cathedral in Philippines Shows Group's Reach Into Asia. By Hannah Beech and Jason Gutierrez. 28 January 2019. https://www.nytimes.com/2019/01/28/world/asia/isis-philippines-church-bombing.html.

ANNEX 1
HISTORIC EXAMPLES OF ATTACKS, ATTEMPTS AND HOAXES

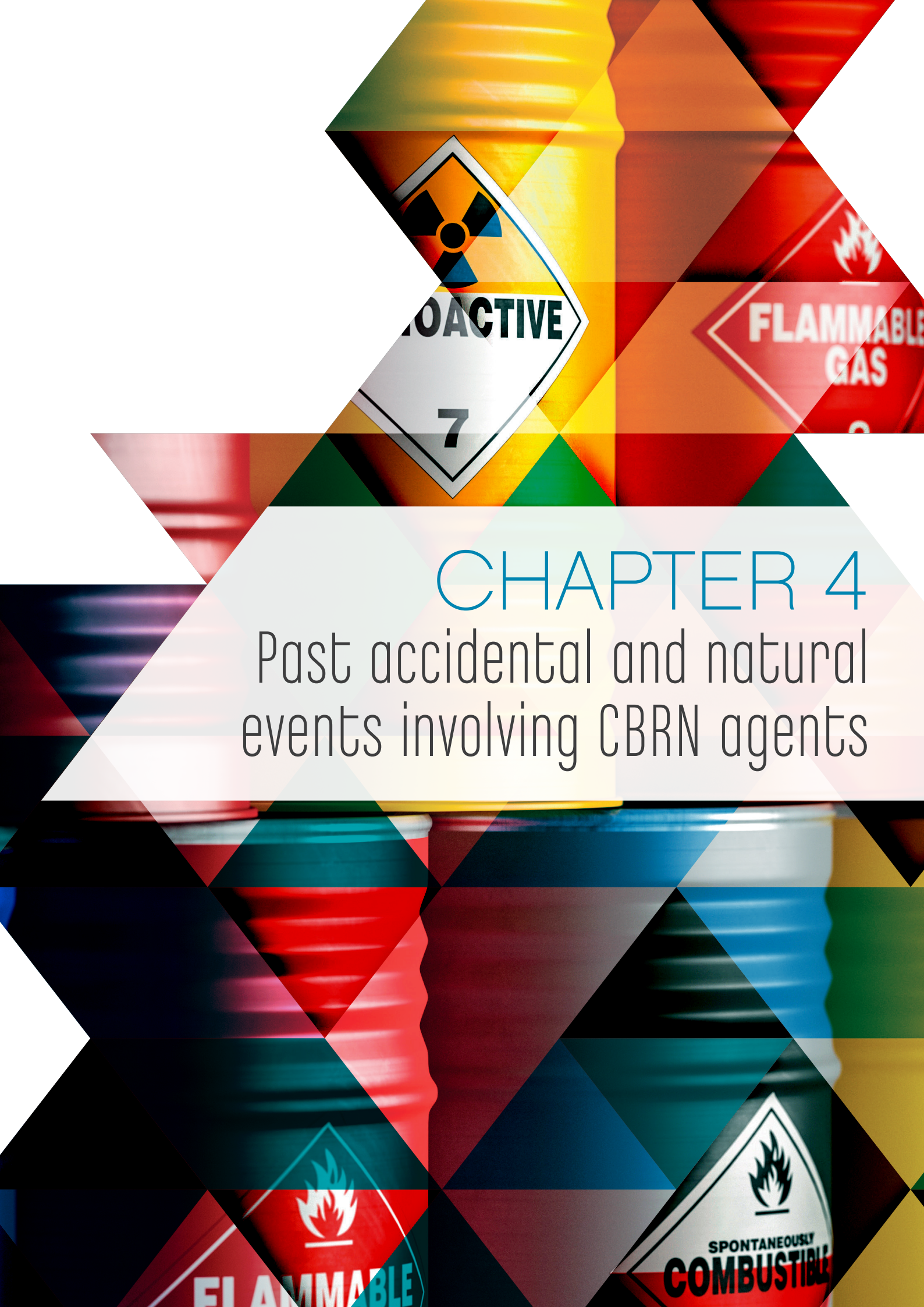
The following table presents examples of the use or threats of use of CBR agents, whether by self-motivated individuals or groups or resulting from implied state sponsored assassinations.

DATE	PLACE	EVENT	REFERENCE
		RADIOLOGICAL	
1979	USA	An employee sent an extortion letter with a sample of uranium dioxide to the general manager of General Electric nuclear facility in Wilmington, USA. He was caught and imprisoned.	Classical radiological disperal devices RDD. January 1979. http://www.johnstonsarchive.net/nuclear/wrjp1855.html
1994	Taiwan	A graduate student was poisoned by radioactive phosphorus-32 placed in his food and drink by a fellow student. He survived.	Taiwan radiological poisoning 1996 - Johnston's Archive. http://www.johnstonsarchive.net/nuclear/radevents/1996ROC1.html
1995	Russia	Chechen rebels placed a caesium-137 radiation source in Moscow's Ismailovsky Park. The source was reportedly recovered undamaged by Russian security forces.	Radiological weapons: how real is the threat? Rusi, 14 November 2007. https://rusi.org/publication/radiological-weapons-how-real-threat
2000	Japan	Letters containing a radioactive thorium were sent to 10 government offices in Tokyo to protest claimed illegal uranium exports to North Korea.	Nuclear terrorism incidents – Johnston's Archive. www.johnstonsarchive.net/nuclear/wrjp1855.html
2003	China	A Chinese nuclear medicine expert used forged official papers to buy radioactive iridium-192 pellets, then placed them in the ceiling of a colleague's office. This colleague and later more than 70 other hospital staff members reported memory loss, fatigue, loss of appetite, headaches, vomiting, and bleeding gums.	Rad Journal – nuclear medicine expert sentenced in radiation poison case. 4 April 2005. www.radjournal.com/news/China/poison case.htm
2006	UK	Alexander Litvinenko, a former officer of the Russian FSB and KGB, who had been given asylum in the UK after fleeing from prosecution in Russia, suddenly became seriously ill and died three weeks later. Death was ascribed to acute radiation poisoning by polonium-210.	Poisioning of Alexander Litvinenko. Wikipedia. https://en.wikipedia.org/wiki/Poisoning_of_Alexander_Litvinenko

DATE	PLACE	EVENT	REFERENCE
		BIOLOGICAL	
1940-41	China	Japanese aircraft dropped packages containing fleas infected with Yersinia pestis, the bacteria causing plague. There are reports of several other such episodes later, including ones in which Japanese state forces released anthrax and glanders bacteria.	Factories of Death. Japanese Biological Warfare 1932-1945, and the American cover-up. Harris S. ISBN 978 156865 6557
1957-63	Brazil	Introduction of smallpox, influenza, tuberculosis and measles into Indian tribal populations via contaminated gifts and mestizos, in furtherance of large-scale land takeover.	The murder of the Indians of Brazil. Dissent magazine, July-August 1970. https://www.dissentmagazine.org/article/the-murder-of-the-indians-of-brazil
1977	Rhodesia	Selous Scouts operations to contaminate the Ruwenya River with cholera organisms; aircraft dissemination of anthrax bacteria near Plumtree by Special Air Service.	CIA. The silent war. https://renchemista.wordpress.com/category/cia
1981	UK	'Dark Harvest Commandos' left a container of soil taken from a former UK bioweapons test area, outside a UK defence research facility. Analysis of soil revealed anthrax bacteria.	Dark Harvest Commando – The Full Wiki. www.thefullwiki.org/Dark_Harvest_Commando
1984	USA	Rajneeshee cult contaminated food in restaurants with salmonella bacteria in attempt to prevent people voting in local elections. The agents and contamination were not confirmed until years later.	1984 Rajneeshee bioterror attack. Wikipedia. https://en.wikipedia.org/wiki/1984_Rajneeshee_bioterror_attack
Early 1990s	Japan	Technical failure. Aum Shinrikyo cult produced large amounts of anthrax bacteria and sprayed it near several US and other facilities in the Tokyo area. No infections were reported, presumably as the group had incompetently used the avirulent strain typically used for vaccination.	Aum Shinryko. Wikipedia. https://en.wikipedia.org/wiki/Aum_Shinrikyo
1995	USA	Larry Harris, a lab technician, a known white supremacist, was arrested for buying cultures of plague bacteria through the mail from a legitimate culture collection, under suspicious circumstances. He had ordered it using letterhead notepaper misappropriated from the lab that he worked in. However, at that time he had broken no law because there was no evidence that he intended a criminal act: he claimed he wanted to use the preparation to kill rats.	Man Arrested in Probe of Illegal Shipment of Plague Bacteria. LA Times. 17 May 1995. https://www.latimes.com/archives/la-xpm-1995-05-17-mn-2852-story.html
1998	USA	Hoax. 800 people at a night club in Pomona were quarantined for four hours while police, emergency teams and the FBI responded to an anonymous phone call stating that anthrax bacteria had been released into the air of the club.	Anthrax hoaxes- white powder, black heart. http://members.tripod.com/anthrax_hoaxes/id4.html

DATE	PLACE	EVENT	REFERENCE
2001	USA	Several letters containing spores of anthrax were sent through the US postal system to individuals in the Senate or media. Eleven cases of inhalational anthrax (five of them fatal), 11 cases of suspected cutaneous anthrax. Much disruption and more than 10,000 potentially exposed people received prophylaxis.	2001 anthrax attacks. Wikipedia. https://en.wikipedia.org/wiki/2001_anthrax_attacks
1977-79	Rhodesia	Covert operations by Selous Scouts and Rhodesian Police Special Branch were said to have used organophosphates, warfarin and thallium salts to contaminate clothing, food, medical supplies, cigarettes &c. Similar episodes were later reported in South Africa.	Thallium poisoning. Wikipedia. https://en.wikipedia.org/wiki/Thallium_poisoning The silent war. CIA. https://renchemista.wordpress.com/category/cia
1978	UK	Georgi Markov was a dissident writer in Bulgaria who defected to London in 1978. He was assassinated in a London street, reputedly by the Bulgarian Secret Service, by means of a pellet containing ricin that was fired into his leg from an umbrella.	Georgi Markov. Wikipedia. https://en.wikipedia.org/wiki/Georgi_Markov
1982	USA	An unknown perpetrator contaminated supplies of the over-the-counter analgesic Tylenol with cyanide. Seven fatalities. Wide media coverage then sparked copycat attacks. Concerns led to the development of tamper proof capsules and packaging.	Chicago Tylenol Murders. Wikipedia. https://en.wikipedia.org/wiki/Chicago_Tylenol_murders
1993	US	Thomas Lavy tried to smuggle 130 grams of the ricin, as a white powder, across Alaska's border with Canada in 1993.	List of incidents involving ricin; Wikipedia. https://en.wikipedia.org/wiki/List_of_incidents_involving_ricin
1995	US	Two members of a paramilitary group called the Minnesota Patriots Council were convicted in March of planning to use ricin to kill Federal employees and law-enforcement agents	Antiterrorism Law Used In Poison Smuggling Case. Kifner J. 23 December 1995. The New York Times. https://www.nytimes.com/1995/12/23/us/antiterrorism-law-used-in-poison
2003	UK	False positive tests. In London, police discovered in a house a small amount of material which initially tested positive for the ricin toxin, but this later turned out to be a false positive. All suspects were acquitted.	Poison find sparks terror alert. The Guardian. 8 January 2003. https://www.theguardian.com/uk/2003/jan/08/terrorism.alqaida

DATE	PLACE	EVENT	REFERENCE
1990	Sri Lanka	Tamil Tigers used a cylinder filled with chlorine gas to attack a Sri Lankan army camp in Kiran. Reports of 20 soldiers being taken seriously ill.	Allegations of chemical weapons use in the Sri Lankan Civil War. Wikipedia. https://en.wikipedia.org/wiki/Liberation_Tigers_of_Tamil_Eelam
1994-5	Japan	The Aum Shinrikyo doomsday cult released sarin nerve-gas in Matsumoto, targeting three judges involved in a court case concerning land purchase. Seven local residents died and 200 seriously injured. The same group later released sarin in the Tokyo subway; they placed packages containing sarin in subway cars and stations, then punctured them with umbrellas to release the thick liquid. There were seven deaths and around 120 serious casualties. Some 5,000 'worried well' casualties sought medical attention.	Aum Shinrikyo: Ex-leader of Japan doomsday cult involved in sarin subway attack executed. ABC News. 6 July 2018. https://www.abc.net.au/news/2018-07-06/leader-of-japan-doomsday-cult
1995-2000	Chechnya	Accusations that Chechen separatists used TICs against Russian forces, including chlorine, ammonia and phosgene. Numerous accusations of attacks with chemical agents by both sides.	World Genocide and Conflict. Spanglefish. www.spanglefish.com/WorldGenocide/index.asp?pageid=467707
2018	UK	In Salisbury, on 4 March, the former Russian spy Sergei Skripal and his daughter Yulia were found seriously ill on a park bench. Laboratory tests showed that they had been poisoned by the nerve agent Novichok. The UK government claimed that the attack had been carried out by the Russian state. A number of Western countries supported this UK view by expelling Russian diplomats and imposing international sanctions. The aftermath of this attack was a second poisoning incident in June when two local residents found the discarded container of the Novichok apparently used in the Skripal incident, and one of them died. The direct costs of these incidents included the security measures to close off several commercial and street locations for months, the sophisticated laboratory procedures to check for remaining traces of Novichok, and the specialist military units to carry out decontamination. The bill for all this and compensating for the impact on the town and its tourism ran into many millions of pounds.	Poisoning of Sergei and Yulia Skripal. Wikipedia. https://en.wikipedia.org/wiki/Poisoning_of_Sergei_and_Yulia_Skripal



CHAPTER 4

Past accidental and natural events involving CBRN agents

CHAPTER 4

PAST ACCIDENTAL AND NATURAL EVENTS INVOLVING CBRN AGENTS

As technology and globalised information exchange progresses, our attention is increasingly drawn to serious events involving CBRN agents. This chapter examines events across the CBRN spectrum that are accidental or natural in origin, including disease, where the consequences are not merely local and immediate but widespread and even international and long term. This is important because history shows that countries can be slow to assess and control a developing situation, perhaps through lack of regulation to mitigate risks and/or inadequate infrastructure to respond; and countries can be slow to make admissions at an international level for complex political reasons. Animal disease affecting livestock can be as disruptive as human disease, especially in developing countries where local livelihoods can be devastated, as in the case of Foot and Mouth Disease and the most recent African Swine Fever outbreak. The biggest influence on disease spread has been the huge increase in human movement over past decades, both for globalised trade and now tourism, and on a more local scale as in the migrations from villages to shanty towns in West Africa which allowed the spread of Ebola virus. The inability to halt the global spread of the corona virus COVID-19 is tragic for many societies, and the final extent of the global damage can only yet be imagined. In addition to disease episodes, the chapter below discusses:

- accidents from military CBRN defence programmes
- accidents involving radiation sources and accidents at nuclear power (electricity generating) plants including the Japanese Fukushima-Daiichi power plant accident in 2011
- industrial accidents in facilities making and storing Toxic Industrial Chemicals (TICs)

SYNOPSIS

It is increasingly realised that the consequences of events caused by CBRN agents may not just be local but widespread and even international. History shows that countries can be slow to assess and control a developing situation and slow to make admissions at an international level. The progression of the 2002 epidemic of SARS (Severe Acute Respiratory Syndrome) is a good example of this and how matters quickly escalated by the movement of people around the world. It follows from the range of the technologies involving various CBRN agents that there is a broad spectrum of past accidents which can provide useful pointers should a similar event occur. There can be human health impacts, socio-psychological impacts, political and economic impacts, as well as environmental impacts. The wide-ranging picture in this chapter includes internet references to allow further reading.

When accidents occur at defence facilities, serious consequences are highly likely, given the nature of some of the materials being studied, and the international political interactions that follow can raise questions as to whether an activity is consistent with national obligations under the disarmament treaties. Case study investigations can demonstrate how the source of any airborne release – malevolent or otherwise - can be determined retrospectively, by tracking the casualties downwind from the supposed source, as is explained below for the Russian anthrax casualties

at Sverdlovsk. According to a 1997 review, 120 different microorganisms had by then caused more than 3,500 laboratory infections and 160 deaths.[1] Strikingly, for 20 diseases, this was the first evidence of an ability to infect humans. In spite of improvements in laboratory and hospital procedures over the last half century, as described in Chapter 9, infections of hospital patients with antibiotic resistant microorganisms are increasingly problematic. New diseases occur – Legionnaires Disease, SARS, swine flu (H1N1), MERS and now COVID-19. The SARS, swine flu and MERS outbreaks had a potential for human to human transmission which raised the spectre of a global pandemic running into the millions of people. Though this fear was largely unrealised, the COVID-19 pandemic ongoing at the time of writing is highly transmissible among humans and, with a high mortality rate, was already causing severe social disruption and economic hardship in many countries by April 2020. Until a vaccine can be developed nothing seems to stop it from spreading and creating long lasting and in some cases catastrophic social and economic effects in every country.

The sheer scale of the 2014 Ebola outbreak in West Africa and involvement of the rest of the world indicates what can happen when an outbreak in impoverished post-conflict countries becomes embedded in congested urban areas and then spreads transnationally, uncontrollably and very rapidly through global travel, as is now the case of the on-going Covid-19 pandemic. With the severe ongoing course of the Covid-19 pandemic, the expected global impact will be unprecedented in modern times, especially with other socio-economic and political factors coming into play such as crowded migrant settlements, undocumented workers living under the radar of local authorities, including the repatriation of large numbers of overseas workers who lost jobs because of the economic downturn all over the world, and are now returning to their home-countries. These are examples of issues to be addressed, in particular by the Southeast Asia Region, as an integral part of their response to the ongoing pandemic.

Even if a disease of animals does not transmit to humans, historic diseases of livestock such as Foot and Mouth Disease (FMD) can have significant impacts for a developed country because of the high costs of outbreak control and loss of international trade; and for a developing country because of the importance of livestock for family sustenance and basic economic survival. Even when vaccines have been developed, as for FMD, their use in developing countries may be impractical because of cold chain requirements for transportation and storage. Fortunately, a new inactivated FMD vaccine is stable at temperatures up to 56°C and could revolutionise vaccine deployment in areas of Africa and Asia, where the disease continues to circulate.[2] There is no current commercially available vaccine for African Swine Fever (ASF), which is highly contagious and often lethal to domestic and wild pigs and devastates swine production in Eastern Europe and parts of Africa and Asia; however, experimental ASF vaccines are showing promise.[3]

Technologies that make use of radiation sources and radioactive material are widespread, with applications in agriculture, industry, medicine, mining and research. The safety and security record is generally good, but, on occasion, radiological accidents have happened due to absence of controls or their circumvention. Energetic national measures are needed to make sure that radioactive sources do not go missing through carelessness, especially during transport, raising a concern about the potential for terrorist use. The accident at the Chernobyl nuclear reactor that

1 Wedum A.G. History & Epidemiology of laboratory-acquired infections (in relation to the cancer research program). 1997. Journal of the American Safety Association, 2(1), 12-29.

2 Pirbright grants licence for new foot-and-mouth disease vaccine. The Pirbright Institute. Posted 2 September 2019. https://www.pirbright.ac.uk/news/2019/09/pirbright-grants-licence-new-foot-and-mouth-disease-vaccine.

3 FarmingUK Team. New ASF vaccine 'more effective' than previous ones. 27 January 2020. https://www.farminguk.com/news/new-asf-vaccine-more-effective-than-previous-ones_54841.html.

occurred on 26 April 1986, with evidence of poor operating procedures, was the most serious accident ever to occur in the nuclear power industry.
Large amounts of Toxic Industrial Chemicals (TICs) are used in some of the industry sectors that are increasingly widespread around the world. Major accidents involving dangerous chemicals have serious consequences for life, the environment, with major economic costs and disruption to sustainable growth.

The impact of a natural disaster on a facility storing or processing chemical substances can result in the release of hazardous materials with possibly severe neighbourhood or wider consequences through toxic-release, fire or explosion. Accidents initiated by a natural hazard or disaster which result in the release of hazardous materials are commonly referred to as **Natech accidents**. This includes releases from fixed chemical installations and spills from oil and gas pipelines. The European Commission's Joint Research Centre (JRC) operates a searchable data base which systematically collects information on Natech accidents worldwide, to help to inform risk assessment methodologies and tools.[4]

KEY TERMS

- **Arboviruses**: an informal term for viruses that spread disease through the bite of infected arthropods (insects) such as mosquitoes and ticks
- **ASEAN:** Association of Southeast Asian Nations
- **COVID-19:** a human respiratory infection outbreak that became known as COVID-19 (Coronavirus disease 2019), caused by a newly discovered betacoronavirus referred to as SARS-CoV-2.
- **Ebola Virus Disease (EVD):** an infectious disease of humans caused by two distinct types of viruses (Zaire ebolavirus and Sudan ebolavirus) endemic in parts of West Africa
- **FMD:** Foot and mouth disease is a highly contagious viral disease of livestock with significant economic impact. The virus, FMDV (foot-and-mouth disease virus, a picornavirus) causes vesicles (blisters) and lesions in the mouth, on the teats and between the hooves of bovids and other cloven-hoofed animals like cattle and pigs, which necessitates culling.
- **MERS:** Middle East Respiratory Syndrome is a disease caused by a betacorona virus known as MERS-CoV or EMC/2012 (HCoV-EMC/2012). The first confirmed case was in Saudi Arabia in 2012. The virus is believed to have originated from bats which jumped to dromedary (camels) as intermediate host, before infecting humans.
- **SARS:** Severe Acute Respiratory Syndrome, a disease caused by another betacorona virus known as SARS-CoV or SARS-CoV-1. It was first detected in Guangdong, China in 2002. The virus is believed to have originated from bats which jumped to civet cats as intermediate host, before infecting humans.
- **Teletherapy:** the use of radioactive material, such as Cobalt-60, for production of an external beam of gamma rays for medical treatment at a distance from the radioactive source (tele, meaning "at a distance")
- **TICs:** Toxic Industrial Chemicals
- **UNSCEAR:** United Nations Scientific Committee on the Effects of Atomic Radiation
- **WHO:** World Health Organisation
- **Zoonosis:** a disease that can be transmitted between animals and humans via direct or indirect contacts (through vectors). Adjective 'zoonotic'

4 EC JRC. eNatech Database. http://enatech.jrc.ec.europa.eu/.

A · EVENTS ASSOCIATED WITH MILITARY PROGRAMMES.

Downwind spread during nerve agent trials at Dugway Proving Ground in 1968

On March 13, 1968, in the United States (US), a high-speed jet had sprayed 320 gallons of nerve gas VX[5] across the Dugway military test ranges in a weapons test. Investigating the death of thousands of farmed sheep, local health officials found that the jet had accidentally released the gas at a much higher altitude than intended, allowing it to be blown far from the testing grounds.[6]

Anthrax-related incident near Sverdlovsk military facility in 1979

In April and May 1979, an unusual anthrax epidemic occurred in the Soviet City of Sverdlovsk, now called Ekaterinburg.[7] At least 64 people died within six weeks. Soviet officials initially claimed this resulted from consumption of contaminated black-market meat and contact with diseased animals, as cutaneous infections. However evidence published subsequently from Russian autopsies of the fatal cases showed that these were inhalation infections. US agencies attributed the incident to inhalation of spores accidentally released from the large military microbiology facility in the city. In May 1992, Russian President Boris Yeltsin admitted, but without any details, that the anthrax outbreak was the result of military activity at the facility.

Epidemiological data collected by a visiting team of US academics in August 1993 showed that most victims worked or lived in a narrow zone extending from the large military facility to the southern city limit. Farther south, livestock died of anthrax along the zone's extended axis. Meteorological records showed that on that day a prevailing northerly wind had run along this zone from the military facility. The team concluded that an aerosol of anthrax bacteria must have escaped from the facility to cause the outbreak.[8]

B · OUTBREAKS INVOLVING THE SPREAD OF INFECTION

Laboratory acquired infections and nosocomial infections.

Worldwide interest in laboratory infections began to accelerate in the 1950s.[9] Unexpected outbreaks often triggered costly local reaction, official enquiries and determination to improved governmental measures for the control and monitoring of work with dangerous pathogens. For instance, this happened after a surprise death from smallpox in the United Kingdom (UK) in 1978 when a university staff member was infected probably by air flows from a nearby research laboratory. Sixty doctors and more than 200 other staff worked with the local population for six weeks to ensure there were no further cases, even though most people would have been vaccinated against smallpox in childhood.[10]

5 VX is one of the most toxic of the nerve agents. Tasteless and odourless, 10 milligrams can kill a human by asphyxiation through paralysis of the respiratory muscles.

6 Boisssoneault L. How the Death of 6,000 Sheep Spurred the American Debate on Chemical Weapons. 9 April 2018. Smithsonian.com. https://www.smithsonianmag.com/history/how-death-6000-sheep-spurred-american-debate-chemical-weapons-cold-war-180968717/#lHkV7Aw4jAMxxC8A.99.

7 Anthrax is an acute disease that primarily affects domesticated and wild herbivores and is caused by the spore-forming bacterium Bacillus anthracis. Human anthrax typically results from cutaneous infection. Natural infection by ingestion or inhalation from contaminated animal products is rare, but the deliberate generation of liquid aerosols or powders to cause respiratory infection is a weapon design that has received much attention.

8 Meselson M et al. The Sverdlovsk anthrax outbreak of 1979. 1994. Science, 266: 1202-1208.

9 Medum AG. History & epidemiology of laboratory-acquired infections (in relation to the Cancer Research Program). Journal of the American Biological Safety Association, 2(1) pp. 12-29 https://journals.sagepub.com/doi/10.1177/109135059700200107.

10 Bakhsi SS. 1978 Accidental Birmingham laboratory Release of smallpox virus - Are lessons learnt relevant today? 2002. BMJ. 325: p 1371. https://www.bmj.com/rapid-response/2011/10/29/1978-accidental-birmingham-laboratory-release-smallpox-virus-are-lessons-l.

Measures to reduce risks of disease transmission in laboratories by invisible aerosolisation of liquid samples or from inoculated test animals are now accepted practice. Guidance from national bodies and from organisations such as the World Health Organisation (WHO) describes how to work safely, e.g. avoiding mouth pipetting, eating and drinking in the laboratory and by using appropriate PPE and biological safety cabinets and negative air flows.[11] However, in the late 1970s, the WHO had to re-examine control measures in hospitals because the number of immunocompromised patients increased and succumbed to infection by 'opportunistic' pathogens, which were becoming increasingly antibiotic resistant.[12] Currently, the resistant bacterium of most concern, often leading to the closure and fumigation of hospital wards, is methicillin-resistant *Staphylococcus aureus* (MRSA). WHO guidance on safe working in laboratories is covered in detail in **Chapter 9**.

Legionnaires' disease – a newly discovered bacterium, 1976

The bacterium Legionella causes a serious type of pneumonia after inhaling water droplets or swallowing water containing the bacteria. There is also a milder form of infection called Pontiac fever.[13]

Legionella was discovered after an outbreak in 1976 at convention of the American Legion in Philadelphia, US. 149 Legionnaires, and 33 other persons in the area became sick, and 29 of them died. The epidemiological data showed that people aged 50 years or older are at high risk. The bacterium was finally identified and found to have bred in the cooling tower of the hotel's air conditioning system, and so spread through the building. This finding prompted new regulations worldwide for air systems and hot water supplies in workplaces, to ensure temperatures are too high for bacteria to grow. In spite of this, occasional deaths from Legionella were still occurring in 2019 particularly in hospitals and old peoples' homes.[14]

The SARS outbreak in 2002

SARS stands *for* Severe Acute Respiratory Syndrome. It is a severe respiratory illness caused by a virus first recognised in 2002.[15] There is no cure for SARS, and as yet no vaccine. The only recourse is to expensive treatment with antiviral medications and supportive therapy.

The first case of SARS was reported in Guangdong, China in November 2002. The virus then spread to over 20 countries, including as far away as Canada. The rapid spread was aided by the ease of global travel and fact that authorities were slow to recognise that this was a **highly transmissible new disease** requiring strict isolation and infection control. In the absence of protective measures, many health care workers, relatives, and hospital visitors became infected. Human-to-human spread of SARS was declared to have stopped in July 2003.[16] Once infection control measures were in place, the number of new cases of SARS arising from a single SARS source case was greatly reduced.

During the outbreak period, from 1 November 2002 to 31 July 2003, there was a total of 8,098 probable SARS cases, with 774 deaths. In Canada, the outbreak began in March 2003 among people who had travelled to Hong Kong. During the outbreak, thousands of Canadians were quarantined and the WHO

11 Negative pressure air flows that move air from the corridor into the room and hence out of the building through special ducting.

12 WHO. Hospital Acquired infections, guidelines to laboratory methods. Ed M T Parker. 1978. http://apps.who.int/iris/bitstream/handle/10665/272697/9290201045-eng.pdf?sequence=1&isAllowed=y.

13 CDC. Legionella (Legionnaires' Disease and Pontiac fever). CDC 24/7. https://www.cdc.gov/legionella/about/history.html.

14 HC Info. Recent Legionnaires' Disease Outbreaks. https://hcinfo.com/about/outbreaks/recent/.

15 The SARS virus is a coronavirus. Coronaviruses normally cause mild-to-moderate upper-respiratory illnesses such as the common cold.

16 WHO. Severe Acute Respiratory Syndrome (SARS) - multi-country outbreak - Update 30. Status of diagnostic test, significance of "super spreaders", situation in China 15 April 2003. WHO. https://www.who.int/csr/don/2003_04_15/en.

issued a travel advisory for Toronto. In total, 251 Canadians were infected with SARS and 43 died.[17] In early 2004, China reported another SARS outbreak; it was contained without spreading outside the country.[18]

Countries quickly reacted by instituting travel restrictions on inward travellers, sometimes continuing after the risk had apparently ended. For example, Jordan in 2003 placed travel restrictions on **all** Canadian travellers, even though the SARS outbreak had only been in one Canadian city and by then the WHO had deemed the outbreak there as having ended. Taiwan required visitors from SARS-affected countries, including Canada, to obtain a visa and a boarding permit that certified travellers to be free from the virus.[19]

Singapore. SARS first reached Singapore in late February 2003 with the return of three Singaporean women from Hong Kong. One of them, Esther Mok, infected 22 close contacts and sparked the outbreak in Singapore. Five persons were classified as super-spreaders; a series of transmissions spread the SARS virus to 238 people, 33 of whom died. Most of those infected during the outbreak were healthcare workers (41 percent) and family members (24 percent). The last SARS case was isolated in early May and Singapore was removed from the WHO's list of SARS-affected areas on 31 May 2003. Visitor arrivals, hotel occupancy, shop and restaurant takings were all reduced, and people lost their jobs; stock prices fell and during the April-June quarter, when the full impact was felt, the economy contracted sharply by 4.2 percent year-on-year.[20]

MERS outbreaks from 2012 onwards

The Middle East Respiratory Syndrome (MERS) is caused by another novel betacorona virus, MERS-Cov or EMC/2012 (HCoV-EMC/2012). Most patients develop severe respiratory illness with symptoms of fever, cough and shortness of breath. Health officials first reported the disease in Saudi Arabia in September 2012 and through retrospective investigations, established that the first known cases of MERS occurred in Jordan in April 2012. All of the known cases have been traced to the Middle East, linked through travel and residence in and around the Arabian Peninsula.[21]

MERS-CoV virus spreads from person-to-person, from an infected person's respiratory secretions, such as through coughing. Transmission occurs through close contact, like caring for a sick person or living with one. Reported transmissions were in health care settings such as hospitals. There was no evidence of community transmission observed to date, and public health agencies continue to investigate clusters of cases in several countries to better understand the mechanism of transmission. According to WHO, MERS-CoV is a zoonotic virus that has repeatedly entered the human population via direct or indirect contact with infected dromedary camels in the Arabian Peninsula. Limited and non-sustained human-to-human transmission mainly in health care settings continues to occur primarily in Saudi Arabia and the risk of exported cases to areas outside the Middle East due to travel remains significant.[22]
MERS affects everyone, young and old alike. Cases have been reported for people from 1 to 99 years old. There is currently no vaccine for MERS. The WHO R&D Blueprint and Global Programme on MERS convened

17 Canada.com. SARS (Severe Acute Respiratory Syndrome). https://bodyandhealth.canada.com/channel/infection/sars/sars-severe-acute-respiratory-syndrome.

18 Rae R. SARS (Severe Acute Respiratory Syndrome). 7 February, 2006. The Canadian Encyclopedia. https://www.thecanadianencyclopedia.ca/en/article/sars-severe-acute-respiratory-syndrome.

19 The Globe and Mail (Canada), 17 May, 2003. https://www.theglobeandmail.com/life/sars-restrictions-issued/article1015324.

20 National Library Board, Singapore. Severe acute respiratory syndrome (SARS) outbreak, 2003. http://eresources.nlb.gov.sg/infopedia/articles/SIP_1529_2009-06-03.html.

21 Center for Disease Control and Prevention. About MERS. https://www.cdc.gov/coronavirus/mers/about/index.html.

22 World Health Organisation. MERS-Factsheet. https://www.who.int/en/news-room/fact-sheets/detail/middle-east-respiratory-syndrome-coronavirus-(mers-cov).

a group of experts in November 2018 to discuss methodological issues and agree a priori on principles in the design, conduct and analysis of Phase2b/Phase 3 clinical trials to evaluate Middle East respiratory syndrome coronavirus (MERS-CoV) therapeutics and vaccines.[23]

There is no specific antiviral treatment recommended for MERS-CoV infection. Individuals with MERS often receive medical care to help relieve symptoms, and for severe cases, care to support vital organ functions. Preventive measures include proper hygiene (washing hands thoroughly), avoiding touching the eyes, nose and mouth with unwashed hands, covering nose and mouth when coughing and sneezing, avoiding close contact and sharing utensils and food with infected individuals and cleaning and disinfecting frequently touched surfaces. These are also recommended preventive measures for SARS in the preceding section and Covid-19 in the following section, zoonotic diseases caused by novel corona viruses.

According to WHO data, by the end of November 2019, there were a total of 2,494 laboratory confirmed cases of MERS, including 858 associated deaths reported globally, giving a 34.4% case-fatality rate. The majority of the cases and fatalities were reported from Saudi Arabia.[24]

> **The Republic of Korea.** The largest known outbreak of MERS outside the Arabian Peninsula occurred in the Republic of Korea in 2015. The outbreak was associated with a traveller returning from the Arabian Peninsula. By the end of the outbreak, 186 laboratory-confirmed cases (185 in Republic of Korea and 1 in China) and 38 deaths had been recorded. The Republic of Korea notified the WHO on 20 May 2015 under the International Health Regulations (2005). On 28 May 2015, the WHO activated the Regional Emergency Operations Centre and established an Event Management Team. In June 2015, a joint mission was conducted by the Ministry of Health and Welfare and WHO to assess the risks posed by the outbreak and make recommendations on response measures.[25]

Key actions taken in responding to disease outbreaks included intensified public health measures, including contact tracing, quarantine and isolation of all contacts and suspected cases, and infection prevention and control, all of which brought the Middle East respiratory syndrome coronavirus (MERS-CoV) under control in the Republic of Korea. Continued vigilance for any new cases of MERS-CoV through an early detection and rapid response system in particular, was highly recommended and put in place.[26] This readiness played a significant role in the rapid and aggressive response displayed by the country in testing, monitoring and contact tracing, including distribution of surgical masks and information packets to individuals, to slow down Covid-19 in the current epidemic. Similar to Singapore which learned much from the SARS outbreak in 2002, The Republic of Korea, was prepared (from their experience in the MERS 2015 outbreak) to mount the appropriate and timely response to the on-going Covid-19 epidemic, when most advanced countries around the world struggled.

MERS is continuously being monitored by the WHO and Public Health Agencies as it remains a significant threat to public health (with the potential to become a global pandemic) until an effective vaccine is developed.

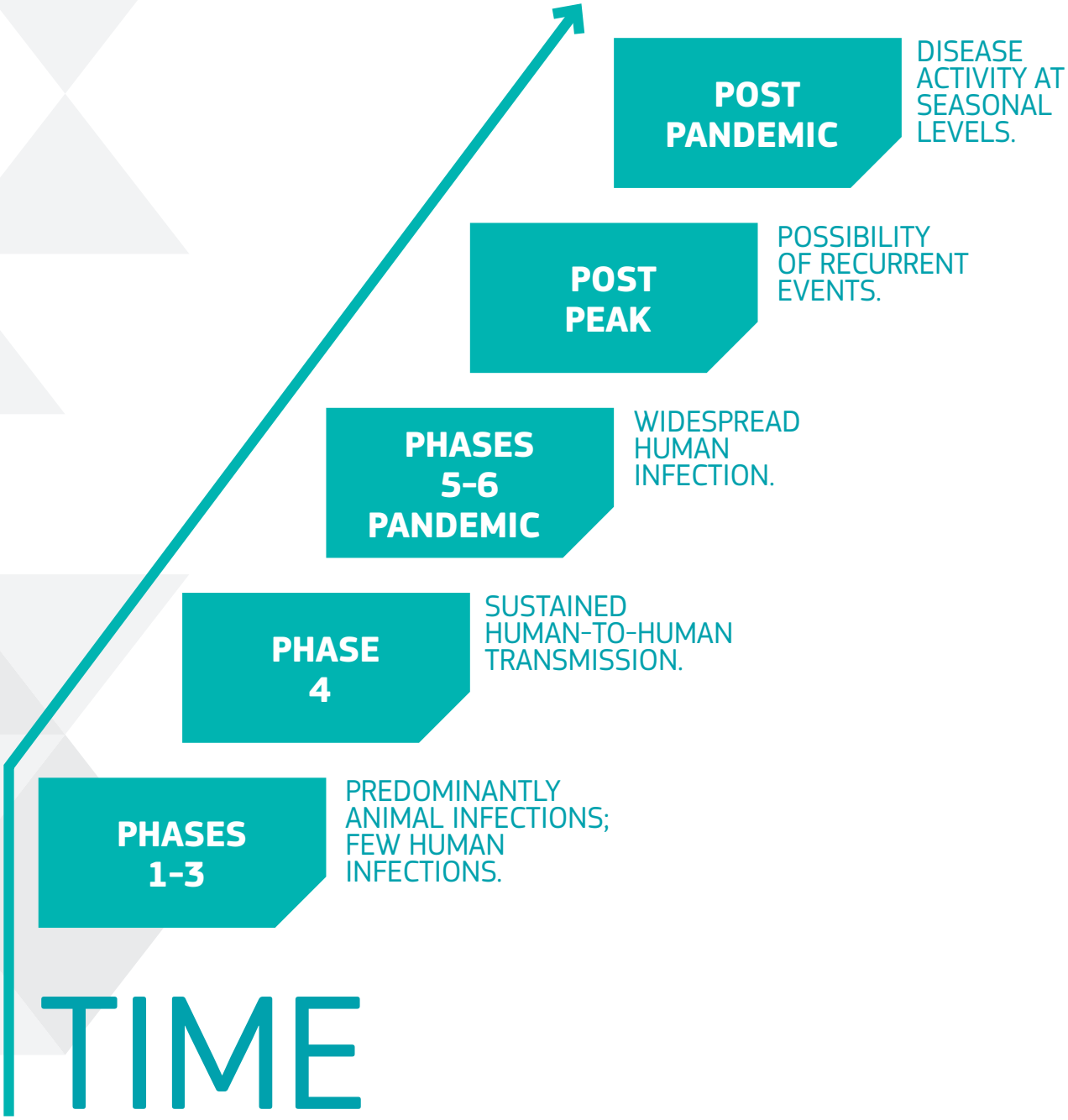
23 World Health Organisation. MERS-Vaccine. https://www.who.int/blueprint/what/norms-standards/mers-vaccines-workshop-30-november-2018/en/.

24 World Health Organisation. MERS Updates. https://www.who.int/emergencies/mers-cov/en/.

25 World Health Organisation. MERS-Outbreaks. https://www.who.int/westernpacific/emergencies/2015-mers-outbreak.

26 World Health Organisation. Intensified public health measures help control MERS outbreak in the Republic of Korea. https://www.who.int/westernpacific/news/detail/28-07-2015-intensified-public-health-measures-help-control-mers-cov-outbreak-in-the-republic-of-korea.

PANDEMIC INFLUENZA PREPAREDNESS AND RESPONSE



Reproduced from "Pandemic Influenza Preparedness and Response: A WHO Guidance Document", World Health Organization, Pandemic Influenza Phases, Page 24, Copyright 2009. Last accessed on 10.05.2020 at https://www.ncbi.nlm.nih.gov/books/NBK143062/pdf/Bookshelf_NBK143062.pdf.

The COVID-19 pandemic of early 2020

Another coronavirus is responsible for the current COVID-19 human epidemic (for coronavirus disease 2019). The disease was first reported to WHO on December 31, 2019 for three patients with pneumonia associated with a cluster of acute respiratory illness cases in Wuhan, China, a port city of 11 million inhabitants in the central Hubei province. Several of those infected worked at the Wuhan Seafood Market which was closed on January 1, 2020. The coronavirus whose RNA was sequenced and identified by Chinese researchers is a novel coronavirus, initially called 2019-nCoV (2019-novel coronavirus) and later formally named by WHO as SARS-Cov-2 or COVID-19 virus.[27] It quickly became clear that this was highly transmissible between humans, with a much higher mortality rate than typical of coronavirus infections. By the third week of January, China reported 17 deaths and more than 550 infections which included medical staff and with cases in Beijing, Shanghai and Shenzen. By this time, Thailand and Japan have reported their first cases to WHO. The number of infections and death toll in Wuhan continued to rise. By the end of January 2020, through the beginning of February 2020, India, Russia, Spain, Sweden, The United Kingdom, Australia, Canada, Germany, Singapore, The United States, United Arab Emirates and Vietnam have all reported confirmed cases of the COVID-19, including the first-reported death outside of China— that of a Chinese man from Wuhan who travelled to the Philippines. The outbreak was declared a Public Health Emergency of International Concern or Global Emergency on 30 January 2020, to mobilise resources to better assist countries with lesser capabilities.

Despite robust local 'lock down' measures in that region of China forbidding local interactions and all travel, the disease spread rapidly to other countries. By 12 March 2020, by which time more than 20,000 confirmed cases and 1000 deaths had been reported in the WHO's European Region alone, the WHO declared a pandemic.[28]

According to the EU's European Centre for Disease Prevention and Control (ECDC), even by the end of March 2020 robust estimates for case fatality risk for COVID-19 were still lacking and potentially biased by incomplete outcome data and differences in testing policies. They reported the mean crude case-fatality (proportion of deaths among total cases reported) from the EU/EEA and the UK by 23 March 2020 as 5.4% (median country-specific estimate: 0.5%; range: 0.0-9.3%). Based on a large dataset from cases in China, the overall case fatality risk (CFR) among laboratory-confirmed cases was higher in the early stages of the outbreak (17.3% for cases with symptom onset from 1-10 January) but reduced over time to 0.7% for patients with symptom onset after 1 February. Based on data from COVID-19 cases reported in China and South Korea, overall CFR was 2.3% and 0.5%, respectively, and increased with age in all settings, with the highest CFR among people over 80 years (14.8% and 3.7%, respectively). Similarly, age-specific estimates of crude case-fatality for Germany, Italy and Spain increased rapidly with age, particularly above 60 years of age. The absolute numbers of deaths also increased with age in each country: those aged 70–79 years accounted for 19% (Germany), 36% (Italy) and 20% (Spain) of all deaths per country; these proportions rose to 74% (Germany), 50% (Italy) and 67% (Spain) among those aged 80 years and above.

Estimates by then suggested a median incubation period of five to six days, with a range from one to up to 14 days. Over the course of the infection, the virus has been identified in respiratory tract specimens

27 WHO, "Naming the coronavirus disease (COVID-19) and the virus that causes it." https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-(covid-2019)-and-the-virus-that-causes-it.

28 WHO announces COVID-19 outbreak a pandemic. 12 March 2020. http://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/news/news/2020/3/who-announces-covid-19-outbreak-a-pandemic.

1-2 days before the onset of symptoms and it can persist up to 8 days in moderate cases and up to 2 weeks in severe cases. Major uncertainties remain regarding potential pre-symptomatic transmission on the overall dynamics of the pandemic since data concerning the transmission by asymptomatic cases from case reports are suboptimal. According to modelling, it is prudent to consider an incubation period of 14 days.[29] Such assumptions have been taken up by many countries as the basis for various lock down restrictions – such as social distancing, closure of schools, businesses and public events, and travel restrictions - imposed by national governments. Given the very recent emergence of this disease no vaccine has completed clinical trials, but there are more than 70 attempts underway to develop such a vaccine.[30] In late February 2020, the World Health Organization (WHO) said it did not expect a vaccine to become available in less than 18 months.[31]

While the Covid-19 Pandemic is still at its height, data coming in continuously changes within the hour, as the number of cases and mortalities are verified and officially reported by the Public Health Agencies of affected countries to the WHO. Nevertheless, to give a sense of the magnitude and speed at which the devastating impact of SARS-CoV-2 ravages through the population of the world, the available information on the number of cases and reported deaths due to Covid-19 is presented below.

By 23 March 2020, the WHO's Global Risk Assessment was "Very High", with more than 330,000 cases globally, nearly 41,000 of them reported in the previous 24 hours. Among the WHO regions, the highest figures reported were from the European Region, at 171,424 confirmed cases with 8,742 deaths; the toll in the 10 countries of the EU-CBRN CoE SEA region was 3,661 confirmed and 86 deaths.[32]

A month later, on 25 April 2020, the WHO reporting indicates that the situation had greatly worsened.[33] The global total was 2,719,896 confirmed cases and 187,705 deaths. The highest numbers were again in the WHO European Region, at 1,314,666 confirmed and 119,463 deaths. Like the European figures the cases in SEA region had increased roughly ten-fold, to 36,769 confirmed and 1,331 deaths; almost 90% of these cases were in Indonesia, Malaysia, Philippines and Singapore. Over this month period the data reported by China had changed little for confirmed cases, from 81,601 to 84,324, and for deaths from 3,276 to 4,642.

One important thing to note during the pandemic is how the epicentre shifted from its origin in Wuhan, China to Europe (Italy, Spain, France, Germany, Switzerland, UK, etc.) and to the United States (with New York City reporting from 1800 to 8021 cases per day from March 20-April 25).[34] From January

29 European Centre for Disease Prevention and Control. Disease background of COVID-19. Page last updated 25 March 2020. https://www.ecdc.europa.eu/en/2019-ncov-background-disease.

30 WHO. DRAFT landscape of COVID-19 candidate vaccines. 20 March 2020. https://www.who.int/blueprint/priority-diseases/key-action/novel-coronavirus-landscape-ncov.pdf?ua=1.

31 Here's Why It's Taking So Long to Develop a Vaccine For The New Coronavirus. Grenfell R and Drew T. The Conversation. 17 February 2020. https://www.sciencealert.com/who-says-a-coronavirus-vaccine-is-18-months-away.

32 WHO daily situation reports: Coronavirus disease 2019 (COVID-19) Situation Report – 63. Data as reported by national authorities by 10:00 CET 23 March 2020. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200323-sitrep-63-covid-19.pdf?sfvrsn=d97cb6dd_2.

33 WHO daily situation reports: Coronavirus disease 2019 (COVID-19) Situation Report – 96. Data as received by WHO from national authorities by 10:00 CEST, 25 April 2020. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200425-sitrep-96-covid-19.pdf?sfvrsn=a33836bb_4.

34 The New York Times. New York coronavirus map and case count. https://www.nytimes.com/interactive/2020/us/new-york-coronavirus-cases.html. For specific details on New York city, see here: https://www.nytimes.com/interactive/2020/nyregion/new-york-city-coronavirus-cases.html.

to February 2020, countries in SEA (Thailand, Singapore, Philippines, Malaysia and Vietnam), together with other countries in the Asia-Pacific region (Japan, South Korea and Australia) were among the early countries which reported confirmed Covid-19 cases. By mid-March, Iran reported over 17,000 cases and Italy's Lombardi region reported 35,000 cases, the highest in Europe and shortly after, by the third week of March 2020, Europe has clearly become the new epicentre with combined total reported cases from Italy, Spain, Germany, France, Switzerland and the United Kingdom surpassing 350,000.[35] In fact, more than 1100 deaths occurred in one day in the UK on April 21.[36] From the end of March, the United States became the country with the highest number of reported cases, (close to 200,000) mostly in New York City, which recorded on April 8 close to 800 deaths in a single day due to Covid-19.[37] Covid-19 is predicted to continue its sweep through Europe, Asia and through South America and Africa, with probable new epicentres like Brazil, Russia, India and South Africa.[38]

Highlights reported by the WHO on 25 April were:

- The WHO, together with heads of state, global health leaders, private sector partners and other stakeholders had launched the *Access To COVID-19 Tools (ACT) Accelerator*, a global collaboration to accelerate the development, production and equitable access to new COVID-19 diagnostics, therapeutics and vaccines.
- Some governments have suggested that the detection of antibodies to SARS-CoV-2, the virus that causes COVID-19, could serve as the basis for an "immunity passport" or "risk-free certificate". However the WHO view is that there is currently no evidence that people who have recovered from COVID-19 and have antibodies are protected from a second infection.
- WHO had seen a dramatic increase in the number of cyber-attacks directed at its staff, and email scams targeting the public.

The WHO's strategic objectives for this response are to:

- Interrupt human-to-human transmission including reducing secondary infections among close contacts and health care workers, preventing transmission amplification events, and preventing further international spread;[39]
- Identify, isolate and care for patients early, including providing optimized care for infected patients;
- Identify and reduce transmission from the animal source;
- Address crucial unknowns regarding clinical severity, extent of transmission and infection, treatment options, and accelerate the development of diagnostics, therapeutics and vaccines;

35 Devex. Covid-19 a timeline of corona virus update. JL Ravelo and S Jerving. https://www.devex.com/news/covid-19-a-timeline-of-the-coronavirus-outbreak-96396.

36 Worldmeter. Coronavirus cases. https://www.worldometers.info/coronavirus/country/uk/.

37 City & State, The Coronavirus in New York by the numbers. https://www.cityandstateny.com/articles/politics/new-york-state/new-coronavirus-numbers.html.

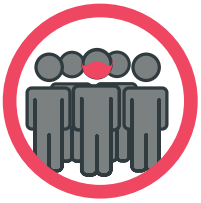
38 The data gathered relies on the accuracy of numbers reported by the countries to the WHO.

39 The WHO view in Sitrep 96 is that this can be achieved through a combination of public health measures, such as rapid identification, diagnosis and management of the cases, identification and follow up of the contacts, infection prevention and control in health care settings, implementation of health measures for travellers, awareness raising in the population and risk communication.

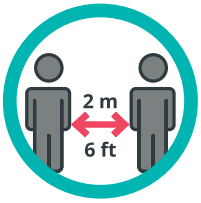
- Communicate critical risk and event information to all communities and counter mis-information;
- Minimize social and economic impact through multisectoral partnerships.

Explanations of the apparently differing caseloads in different countries are expected to be complex and influenced by differing governmental actions in terms of speed of response, social distancing, rigour of lock down, test allocation and timing, contact tracing, availability of Personal Protective Equipment (PPE), etc., not to mention the different socio-cultural, economic-status or religious sensibilities among the general population. Preliminary evidence suggests the possibility of more than one-type of SARS-CoV-2 circulating among the populations in the world, notwithstanding the expected mutations that accumulate in the viral sequence. At this time of writing, there is no consensus among experts on the different pathogenicity of the possible strains of SARS-CoV-2.

PROPER* HYGIENE PRACTICES
BASIC PROTECTIVE MEASURES AGAINST COVID-19



Avoid crowds



Stay 2 m (6 ft) apart

Avoid direct contact with others
(cheek and nose greetings, shaking hands, kissing and hugging)

No Hand shaking or hugging

Wear gloves if necessary

Avoid direct contact with surfaces

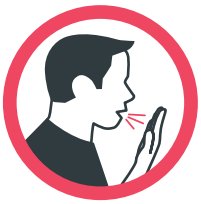
Clean and Disinfect surfaces

Wash your hands with soap and water frequently

Use hand alcohol-based hand rub
if soap and water are not available

Wear face mask

Do not touch your eyes, nose and mouth with unwashed hands



Do not cover your mouth and nose with your hand when you cough or sneeze

Cover your mouth and nose with your bent elbow when you cough or sneeze

Or cover your mouth and nose with tissue when you cough or sneeze

Dispose of the used tissue immediately

Avoid travel

Stay home if you feel unwell

If you have fever, cough and difficulty breathing, seek medical care

Work from home if possible

Stay home

* Image licenced from Ints Vikmanis.

Zoonoses in developing countries

Over 200 zoonoses[40] have been described, usually classified according to the main host and the type of microbial agent as in 'avian influenza ('Flu) virus'. These diseases represent significant public health burdens, and although most of them can be prevented, many are not prioritised by health systems at national and international levels, despite many of these diseases being tagged as "emerging threats by the WHO.[41] These diseases can be transmitted directly by contact with an animal, via a contaminated environment, via food or indirectly via vectors such as mosquitoes or ticks. Both domestic and wild animals act as reservoirs for these pathogens. Zoonoses are of increasing concern for human health: according to the WHO, approximately 60% of all human diseases are thought to be of zoonotic origin, and up to 75% of newly emerging infectious diseases. Many zoonotic agents responsible for disease in humans cause little or no obvious clinical sign in their animal hosts, suggesting that unidentified zoonotic diseases may exist and pose a risk to human health. Particularly important for developing countries, in addition to being a public health problem, many of the major zoonotic diseases prevent the efficient production of food of animal origin and at an extreme can lead to real societal distress; and they create obstacles to international trade in animal products.

Humans can become infected by avian (bird), swine and other zoonotic influenza viruses. Human infections are primarily acquired through direct contact with infected animals or contaminated environments, but these viruses have not acquired the ability of sustained person-person transmission. The majority of human cases of influenza A (H5N1) and A (H7N9) virus infection have been associated with direct or indirect contact with infected live or dead poultry. Unfortunately, with the vast silent reservoir of aquatic and migratory birds, these viruses are considered impossible to eradicate.[42]

By the second decade of this century there was increasing concern about the prevalence of zoonoses in **South East Asia**, because environmental factors and the socio-economic context favoured the establishment of well-known diseases and the emergence of new pathogens at the human-wildlife interface. Calls were made for new measures to address more effectively zoonotic diseases in the region, such as the allocation of funds for research and for surveillance and control programs, and a multi-sectoral and multi-disciplinary approach at various levels.[43] By 2013, Association of Southeast Asian Nations (ASEAN) experts where asking whether countries in the region were prepared for further outbreaks such as H7N9 bird 'flu and SARS.[44]

> **The H5N1 bird 'flu epidemic in Asia in 2004.** H5N1 avian influenza spread to eight countries in eastern Asia including China, Japan, South Korea, Vietnam, Laos, Cambodia, Thailand, and Indonesia in early 2004. This serotype of influenza A virus is extremely virulent in poultry such as chickens and ducks, and it killed millions of birds throughout the region. After the first report *of* **transmission from animals to humans** in 1997 during a poultry outbreak in Hong Kong, the virus was again transmitting to humans (mainly children) in Vietnam, Cambodia, and Thailand,

40 A zoonosis is a disease that can be transmitted to humans from animals.

41 WHO. "List of zoonotic diseases." https://www.who.int/zoonoses/diseases/en/.

42 WHO. Influenza (Avian and other zoonotic).13 November 2018. https://www.who.int/news-room/fact-sheets/detail/influenza-(avian-and-other-zoonotic).

43 Bordier M. and Roger F.L. Zoonoses in South-East Asia: a regional burden, a global threat. Animal Health Research Reviews, vol 14, June 2013, pp 40-67. https://www.researchgate.net/publication/235956321_Zoonoses_in_South-East_Asia_a_regional_burden_a_global_threat.

44 RSIS Commentaries. Re-emerging Infectious Diseases: Is ASEAN Prepared? Caballero-Anthony M. and Amul G.G. No. 093/2013, 15 May 2013. https://www.academia.edu/3616796/Re-emerging_Infectious_Diseases_Is_ASEAN_Prepared.

killing 54 of 100 diagnosed persons. There was probably also **human to human transmission**.[45] It was thought that migrating birds were involved in the spread throughout Asia.[46] As of October 17, 2005, no further cases of H5N1 avian influenza were detected in Singapore, either in humans or poultry; however, new outbreaks affecting humans are expected to occur. The total number of human H5N1 cases reported in Indonesia from 2005 to the end of 2013 was 195 with 163 fatalities.[47] Because this particular influenza virus is likely to continue to **mutate,** with the spectre of a worldwide human epidemic on the scale of the 'Spanish Flu' that killed at least 20 million people in 1918-19, these Asian events stimulated many countries to improve their disaster plans and increase anti-viral research.

The A(H7N9) bird 'flu outbreaks in China in 2013. Human infections with an Asian lineage avian influenza A(H7N9) virus were first reported in China in March 2013. Annual epidemics associated with sporadic human infections have been reported for China since then, but since October 2017 there have been only 3 reported human infections. The fifth outbreak, from October 2016 for about a year, involved 766 reported human infections, the highest number to date; about 40% died. A handful of human infections were reported outside of mainland China, Hong Kong or Macao but in all cases these were people who had travelled to China before becoming ill. There is no evidence of sustained person to person spread of this particular strain. This strain has not been detected in people or birds in the US.[48]

The H1N1 outbreaks in 2009. In 2009, human cases of a novel strain of an influenza virus were identified, first in Mexico and then North America, before rapidly spreading to other parts of the world, resulting in the first influenza pandemic of the 21st century. By February 2010, the Vietnamese Ministry of Health had received reports of 11,186 laboratory-confirmed cases, including 58 deaths. This virus was a combination of influenza virus genes never previously identified in either animals or people, probably a re-assortment of genes from bird, swine and human 'flu viruses; which led to the label 'swine 'flu'. In August 2012, the WHO declared the outbreak to be over.[49]

The Ebola outbreak of 2013

West and East Africa is the region where most of the world's outbreaks caused by Risk Groups (RG) 3 and 4 pathogens occur, being an endemic zone[50] for arboviruses such as Ebola/Marburg (although not before 2013 in West Africa), Lassa, Crimean Congo Hemorrhagic Fever, Yellow Fever, Rift valley fever and Chikungunya.[51] Growing human populations and increasing mobility within those countries mean that livestock, wildlife, and people provide circumstances for the rapid spread of these highly infectious diseases.

45 Brown H. WHO confirms human-to-human avian flu transmission. 2004. Lancet 7 February, 462.

46 Webster RG et al. The spread of the H5N1 bird flu epidemic in Asia in 2004. 2005. Arch. Virol Suppl (19): 117-29. https://www.ncbi.nlm.nih.gov/pubmed/16358424.

47 WHO. Avian influenza. Avian influenza in the South-East Asia Region in 2013. 2013. Surveillance and outbreak alert, http://www.searo.who.int/entity/emerging_diseases/topics/avian_influenza/en/.

48 Centers for Disease Control and Prevention. Asian lineage avian influenza A(H7N9) virus. https://www.cdc.gov/flu/avianflu/h7n9-virus.htm.

49 WHO. Influenza (Avian and other zoonotic).13 November 2018. https://www.who.int/news-room/fact-sheets/detail/influenza-(avian-and-other-zoonotic).

50 Endemic means the disease is regularly found in an area.

51 See Chapter 9 for an explanation of Risk Groups.

The Ebola virus was first recognised in 1976 near the Ebola River, in what is now the Democratic Republic of Congo. Since then, the virus has emerged periodically from its natural reservoir (which remains unknown) to infect people in several African countries. It spreads readily through direct human-to-human contact or through contact with body fluids, surfaces, bedding etc. Mortality can be up to 90%, and there is no specific cure.

The Ebola disease outbreak which started in December 2013 was the largest to date with more than 28,000 cases and 1,100 deaths in West Africa. There were 881 confirmed health worker infections and 513 deaths.[52] This caused a major socio-economic impact in Guinea, Liberia, and Sierra Leone. On the assumption that that healthcare services were reduced by 50% in these countries, an additional 10,000 or so lives must have been lost to HIV, tuberculosis and malaria during the epidemic. According to the World Bank, $2.2 billion was lost in 2015 to the gross domestic product (GDP) of the three countries.[53]

> **EU contribution.** The European Union (EU) has funded three types of mobile laboratory for deployments in African countries experiencing outbreaks of serious infectious virus disease.[54] **EMLab**, tent based, was the first mobile laboratory to be sent into the field in the Ebola outbreak in West Africa in 2014. Within three days it was operational in Guinea, reducing the time to achieve a validated laboratory result from 3-4 days to 3-4 hours. By March 2015 the unit had identified over 1,000 positive cases. The point of such rapid diagnosis is that it prevents much wasting of effort in isolating people who subsequently test negative, and in unnecessary tracing of their contacts.[55]

The BSL-3[56] mobile laboratory developed under **CoE Project 45** is truck based and thus more suitable for use in extremes of temperature. *Project 45 (IfS): Establishment of a mobile laboratory for in situ interventions on VHF outbreak sites in combination with CBRN capacity building in West Africa (EUWAM-Lab).* It is now under the responsibility of the Institut Pasteur in Dakar. A broad training programme for European and African staff is planned: courses at EU and African institutes possessing BSL4 laboratories, and in the mobile lab itself at various sites in African countries, with a stand-by pool of scientists in at least four EU countries.

During the 2013 outbreak, the reactions by some countries to restrict inbound travel from West Africa drew criticism from the WHO. For instance, in 2014, Canada decided not to issue new travel or permanent residency visas for residents or citizens of countries experiencing widespread and persistent Ebola transmission. In reaction, the WHO pointed out that under the International Health Regulations, *countries should not impose unilateral trade or travel sanctions beyond what the WHO had recommended.*[57]

52 Centers for Disease Control and Prevention. Ebola Virus Disease Distribution Map: Cases of Ebola Virus Disease in Africa Since 1976.page last update 19 December 2018. https://www.cdc.gov/vhf/ebola/history/distribution-map.html.

53 CDC. Ebola (Ebola Virus Disease). Cost of the Ebola Epidemic. 8 Aug 2106. CDC. https://www.cdc.gov/vhf/ebola/history/2014-2016-outbreak/cost-of-ebola.html.

54 There were two EU projects, one directly managed by DG DEVCO B5, the other managed through the CoE initiative as Project 45.

55 EU EMLab. European Mobile Laboratory Project. https://www.emlab.eu.

56 Biological Safety Level 3, see Chapter 9.

57 The Canadian Press. WHO asks Canada to justify Ebola visa ban. Branswell H. 4 November, 2014. https://www.ctvnews.ca/health/who-asks-canada-to-justify-ebola-visa-ban-1.2087022.

Foot and mouth disease (FMD)

Foot and mouth disease (FMD) is highly contagious, affects livestock and other species, and is not easily contained within one farm or one population. FMD has been eradicated by some wealthy nations consistent with a strategy to maintain large scale trade in foodstuffs in national and international marketplaces; but it remains endemic in much of the world. Outbreaks have two types of consequence: (1) direct losses due to reduced fertility and changes in herd structure; and (2) indirect losses caused by costs of FMD control, and poor access to lucrative markets even when there is only an unproven fear of FMD. In countries free of FMD, outbreaks have still occurred if rarely and the costs then involved in regaining free status have been enormous – see UK examples below. FMD production losses have a big impact on the world's poorest where many people are directly dependent on livestock.[58] Although FMD vaccines have been developed, their use in developing countries is often impractical because they need refrigeration for transportation and storage. Fortunately, a new inactivated FMD vaccine is stable at temperatures up to 56°C and could revolutionise vaccine deployment in areas of Africa and Asia.[59]

FMD impacts in CoE SEA countries. FMD is a major disease of livestock in Asia, with drastic impacts on the livelihood of people and the economy. FMD is endemic in SEA countries due to the traditional farming system and livestock trade. However, proven FMD-free countries in a broad region can also become affected. This happened in Japan in 2010, when the causative virus in an unexpected FMD outbreak was found to be closely related to viruses occurring recently in PR China, Hong Kong SAR, R.O. Korea, Myanmar and Thailand. Such analyses emphasise the need for regional cooperation, information sharing, and transparency in disease reporting, all critical for control and eradication of FMD.[60]

The FMD outbreak in UK, 2001. On 19 February 2001, a FMD outbreak was confirmed in the UK, turning out to be much larger than the last major outbreak in 1967-68. The source case, was discovered on a pig farm, but not until several weeks after the event and by then at least 57 farms had been infected with the virus. The main transmitters of the virus were sheep, difficult to diagnose because of the few clinical signs of disease, and at that time of year being sold and moved around the country in large numbers.

In the epidemiologic investigation the index case for the whole epidemic is considered to have been a pig finishing unit at Burnside Farm, Heddon on the Wall, Northumberland (outbreak FMD/04), which was licensed to feed processed waste food under the Animal By-products Order 1999. All possible means for the introduction of FMD into Burnside Farm have been investigated and there was no evidence found that the disease was introduced to the farm by animals, people, vehicles, equipment, vermin, wildlife, etc. There was no evidence of disease on premises within 3km of Burnside Farm which predates that found there. The report suggested that the most likely source of infection in the pig farm was meat or meat products containing or contaminated with FMD virus. The virus could have been introduced to the pigs through the consumption of unprocessed or inadequately processed waste food or the consumption of contaminated processed waste food.[61]

58 Knight-Jones TJD and Rushton J. The economic impacts of foot and mouth disease – What are they, how big are they and where do they occur? 2013. Prev Vet Med 112 (3-4): 161-173. https://www.ncbi.nlm.nih.gov/pmc/about/disclaimer/.

59 The Pirbright Institute. Pirbright grants licence for new foot-and-mouth disease vaccine. Posted 2 September 2019. https://www.pirbright.ac.uk/news/2019/09/pirbright-grants-licence-new-foot-and-mouth-disease-vaccine.

60 OIE. OIE/JTF Project for FMD control in Asia (2011-2015). http://www.rr-asia.oie.int/activities/regional-programme/fmd/oiejtf-project-for-fmd-control-in-asia/.

61 Department for Environment, Food and Rural Affairs. June 2002. Origin of the UK Foot-and-Mouth Disease 2001. http://adlib.everysite.co.uk/resources/000/095/936/fmdorigins1.pdf.

By the end of the outbreak in September, over four million animals had been killed for disease control purposes and over two million for welfare reasons. The direct cost to the public sector was estimated at over £3 billion and the cost to the private sector at over £5 billion. At the height of the crisis, more than 10,000 vets, soldiers, field and support staff, and thousands more contractors, were involved. Up to 100,000 animals were slaughtered and disposed of each day in a massive logistical operation. Tourism was greatly affected by the closure of footpaths and by media images of mass pyres. On 22 January 2002, the United Kingdom was re-instated on the OIE list of countries free of foot and mouth disease, and in February the European Commission lifted all meat and animal export restrictions. The Commissioner for Health and Consumer Protection commented that the nature and magnitude of these events were such that any country would have struggled under the circumstances. Many countries revised their contingency planning in light of Britain's experience.[62] One of the more recent developments was the use of marker vaccines which can differentiate affected and vaccinated animals, helpful in reducing the number of culled animals during an outbreak.[63]

The Pirbright FMD escape in UK, 2007. A faulty drainage pipe at a research facility was the most likely source of an outbreak of FMD in Britain on 3 August 2007. Official reports said the drainage system was poorly maintained, rarely inspected, and not fully contained".[64] Within hours, a national ban on livestock movement and trade was brought into force. Infected castle were identified on two nearby farms, and immediately culled. It was considered that these prompt actions prevented the spread of the disease. In accordance with EU requirements, there was a total ban on the export of UK animal and meat products from susceptible species. Major international trading partners such as Canada and the Republic of Ireland placed temporary restrictions on meat and dairy exports.[65]

African Swine Fever (ASF). ASF is highly contagious and usually lethal to domestic and wild pigs; it devastates swine production in Eastern Europe and parts of Africa and Asia. The Food and Agriculture Organisation publishes approximately fortnightly updates of outbreaks in Asia.[66]

As the world's attention focuses mainly on the Covid-19 pandemic, there is growing concern that countries are not doing enough to halt the spread of ASF through better biosecurity practices, cooperation on intensive vaccine development, or transparency regarding outbreaks. ASF kills almost 100% of the animals it infects, and despite being in circulation for nearly 100 years, there is still no vaccine. When ASF reached China in 2018, the disease quickly spread in Asia and 2019 saw huge numbers of deaths. The official count was around 1.1 million pigs culled in the year after that according to the UN Food and Agriculture Organization (FAO). Unofficial estimates put that number closer to 200 million, a "reasonable estimate" according to the World Organisation for Animal Health (OIE). Data from OIE shows that global ASF numbers by the end of April 2020 are close to or already above levels for all of 2019. Currently,

62 Report by the Comptroller and Auditor General. The 2001 Outbreak of Foot and Mouth Disease. 21 June 2002. HC 939 Session 2001-2002. https://www.nao.org.uk/wp-content/uploads/2002/06/0102939.pdf.

63 Porphyre T. et al. Assessing the Economic Impact of Vaccine Availability When Controlling Foot and Mouth Disease Outbreaks. 13 March 2018. Front.Vet Sci. https://www.frontiersin.org/articles/10.3389/fvets.2018.00047/full.

64 Coglan A. Faulty pipe blamed for UK foot and mouth outbreak. 7 September 2007. The New Scientist. https://www.newscientist.com/article/dn12615-faulty-pipe-blamed-for-uk-foot-and-mouth-outbreak.

65 Anderson I. Foot and Mouth Disease 2007: A Review and Lessons Learned. 11 March 2008, Presented to the Prime Minister and the Secretary of State for Environment, Food and Rural Affairs. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/250363/0312.pdf.

66 Food and Agriculture Organisation. ASF situation in Asia update. Emergency Prevention System for Animal Health (EMPRES-AH). Aas at 05 March 2020, 08:00 hours, Rome. http://www.fao.org/ag/againfo/programmes/en/empres/ASF/situation_update.html.

focal locations of the virus are primarily in China, Vietnam, the Philippines and a wide swath of Eastern Europe.[67] Deaths from sickness total more than 100,000, nearly the same as 2019, and the number officially culled stands at 5.4 million compared to the 6.9 million figure from 2019. The disease has now spread to northern India for the first time, as well as to Papua New Guinea. Recent outbreaks among wild boar populations in Belgium, now under control, have also heightened monitoring in western Europe. Overall numbers of reported outbreaks are "far above" what had been reported by the end of May last year. There are concerns that China is underreporting the data for 2020.[68]

There is no current commercially available vaccine; however, experimental ASF vaccines are showing promise.[69]

67 World Orgnisation for Animal Health (OIE). WAHIS Interface. https://www.oie.int/wahis_2/public/wahid.php/Diseaseinformation/Diseasedistributionmap?.

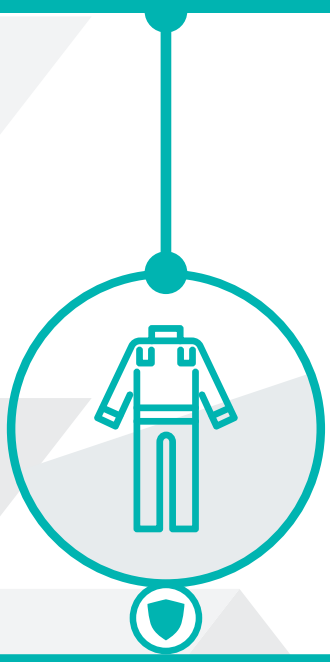
68 The Guardian. Unstoppable. African Swine Fever deaths to eclipse record 2019 toll. https://www.theguardian.com/environment/2020/may/27/unstoppable-african-swine-fever-deaths-to-eclipse-record-2019-toll?CMP=share_btn_fb&fbclid=IwAR3sJBjD-ELEED9soMKU1G1qAPoUJXSWcl2iSZFjVPiUQgF4NTLYpvRmFsw.

69 Farming UK. New ASF vaccine 'more effective' than previous ones. FarmingUK Team. 27 January 2020. https://www.farminguk.com/news/new-asf-vaccine-more-effective-than-previous-ones_54841.html.

EU CONVENTIONS FROM LOWEST TO HIGHEST LEVEL OF PPE

PERSON PROTECTIVE EQUIPMENT (PPE):
Specialised equipment consisting of respiratory protection, protective suit, hard hats, boots and gloves. To be worn by staff during work to prevent exposure or contamination.

PPE: CATEGORIES



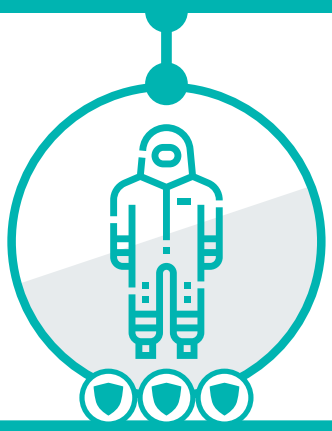
CATEGORY I

Includes exclusively the following minimal risks:

- **A.** superficial mechanical injury;
- **B.** contact with cleaning materials of weak action or prolonged contact with water;
- **C.** contact with hot surfaces not exceeding 50 °C;
- **D.** damage to the eyes due to exposure to sunlight (other than during observation of the sun);
- **E.** atmospheric conditions that are not of an extreme nature.

CATEGORY II

Includes risks other those listed in Categories I and II



CATEGORY III

Includes exclusively the risks that may cause very serious consequences such as death or irreversible damage to health relating to the following:

- **A.** substances and mixtures which are hazardous to health;
- **B.** atmospheres with oxygen deficiency;
- **C.** harmful biological agents;
- **D.** ionising radiation;
- **E.** high-temperature environments the effects of which are comparable to those of an air temperature of at least 100 °C;
- **F.** low-temperature environments the effects of which are comparable to those of an air temperature of –50 °C or less;
- **G.** falling from a height;
- **H.** electric shock and live working;
- **I.** drowning;
- **J.** cuts by hand-held chainsaws;
- **K.** high-pressure jets;
- **L.** bullet wounds or knife stabs;
- **M.** harmful noise.

Reference: European Commission, "PPE Regulation Guidelines - Guide to application of Regulation EU 2016/425 on personal protective equipment"

C · ACCIDENTS INVOLVING RADIATION SOURCES

By 2004, the International Atomic Energy Agency (IAEA) was becoming concerned that sources outside of control - orphan sources[70] - had caused multiple fatalities or serious injuries when unknowing individuals find them. This problem, along with concern that orphan or vulnerable sources might be acquired for malevolent purposes, led countries to try to improve controls. The IAEA published a model methodology for a preventative and remedial action plan.[71]

Surveying past experience, the IAEA summarised the main causes for loss of control of sources as:

- Mobile sources are lost or stolen while in transit;
- Sources are abandoned, either deliberately or through lack of awareness;
- Sources are stolen, either for the scrap value of the source or its container. (Sources are often perceived as having more value than they do because of the care with which they are treated).

The IAEA developed an internationally harmonised basis for risk informed decision making, by a ranking of sources and practices according to their potential hazard, the most dangerous being Category 1.[72] The Category 1 sources are:

- Radioisotopic thermoelectric generators (RTGs);[73]
- Sterilisation and food preservation irradiators;[74]
- Self-shielded irradiators, or blood/tissue irradiators;[75]
- Teletherapy units, in medical institutions.[76]

70 An orphan source is a radioactive source that poses sufficient radiological hazard to warrant regulatory control, but which is not under regulatory control because it has never been so or because it has been abandoned, lost, misplaced, stolen or otherwise transferred without proper authorisation. A vulnerable source is one, which is currently under regulatory control, but its level of control is weak.

71 IAEA. Strengthening control over radioactive sources in authorized use and regaining control over orphan sources National strategies. IAEA-TECDOC-1388. 2004. https://www-pub.iaea.org/MTCD/Publications/PDF/te_1388_web.pdf.

72 IAEA. Categorization of radioactive sources. IAEA-TECDOC-1344. 2003. https://www-pub.iaea.org/MTCD/publications/pdf/te_1344_web.pdf.

73 RTGs: devices that use the decay heat of a radioisotope to produce electricity. They tend to be deployed unattended in remote areas, and there they tend to be susceptible to being moved, or taken for malevolent purposes, or dismantled for the scrap value of their shielding material.

74 Sterilisation and food preservation irradiators. These sources are installed in dedicated, large, shielded enclosures that use either a deep pool of water or massive lead or concrete to shield the source when not in use. Because the source 'array' moves around the goods being irradiated, there is the potential for a source to fall out of a badly maintained array and leave the facility in the line of goods.

75 Self-shielded irradiators. Few of these fixed devices have been involved in orphan source incidents because of their robust nature and design.

76 Teletherapy units, in medical institutions: a large source being used externally to irradiate a tumour. Colbalt-60 sources are generally in a solid metallic form with a source capsule comprising a number of pellets or discs. Caesium-137 teletherapy sources are usually caesium chloride, as a powder which is soluble and easily dispersed. Although these hospital staff should be well trained in radiological protection, there are well documented examples of escape of radioisotope causing fatalities and serious environmental contamination.

Radioisotope escape examples

A teletherapy head incident in Goiânia, Brazil, 1989. A private medical clinic ceased to trade, but a 50 TBq 137Cs teletherapy unit was abandoned in an empty building. After two years, the source was dismantled by unskilled workers in order to sell the housing for scrap, but in so doing they ruptured the source and the radioactive caesium chloride spread in the city by contact. The problem was revealed by the increasing health effects on the population. 249 people were externally contaminated, 129 internally; 10 needed specialised medical treatment and 4 people died. The decontamination of the environment took 6 months and produced 3,500 tonnes of radioactive waste.

> **SEA Region**. A teletherapy head accident in Samut Prakarn, Thailand, 2000. A company in Bangkok purchased several teletherapy devices without authorisation from the Thailand Office of Atomic Energy for Peace. In autumn 1999, the company transferred the teletherapy heads to an unsecured storage location. In late January 2000, unauthorised individuals broke into the site and partially disassembled a teletherapy head containing 15.7 TBq of 60Co. They did not recognise the symbol and language on the radiation trefoil and warning label. They took the device to a scrapyard, where the source fell out of its housing unobserved. Within a fortnight, several of them began to feel ill, and doctors recognised the symptoms and alerted the authorities. The source was ultimately found, but 10 people received high doses and three of them died. Under the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, the Thai authorities requested advice from the IAEA on the medical treatment of the exposed people.[77]

Other episodes reported by the media include: a moisture density gauge containing radioisotopes went missing from Norzagaray town, Bulacan in the Philippines in August 2018.[78] In the same month, Malaysian authorities reported the disappearance of an industrial device containing radioactive iridium. This was lost from a truck while being transported by company that provides testing, calibration and inspection services to heavy industries.[79]

At an IAEA conference in December 2018, a spokesman for the Vietnam Agency for Radiation and Nuclear Safety (VARANS) recalled losses of radioactive sources including Cs-137 in 2003, Eu-152 in 2006, Ir-192 in 2014 and the illegal trafficking of radioactive cards in some provinces in 2006 and 2014. However, with external support including through the CBRN CoE, many projects focusing on enhancing legal frameworks, technical capability and inter-agency coordination for security of CBRN materials have since been implemented in SEA. Through such cooperation activities the security of radioactive sources in Viet Nam in particular and SEA in general has been enhanced.[80]

> **Inter-agency cooperation in ASEAN.** The ASEAN Network of Regulatory Bodies on Atomic Energy (ASEANTOM) focusses on sharing best practices, enhancing regulatory frameworks, and capacity building through training courses and technical collaboration with other international

77 IAEA. "The Radiological Accident in Samut Prakarn". 2002. https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1124_scr.pdf. The Radiological accident in Samut Prakarn.

78 Kromek. Radioactive material missing in the Philippines. 27 September 2018. https://www.kromek.com/news/radioactive-material-missing-in-the-philippines/.

79 Caballero-Anthony M. and Trajano J.C. East Asia Forum. Stopping dirty bombs in Southeast Asia. 4 December 2018. https://www.eastasiaforum.org/2018/12/04/stopping-dirty-bombs-in-southeast-asia/.

80 Dang A. Strengthening International Cooperation for Prevention and Detection in Viet Nam and in South East Asia. 3-7 December 2018. https://www.iaea.org/sites/default/files/18/12/cn-269-synopses.pdf.

organisations such as the IAEA and European Commission. Another key regional collaboration on nuclear security is the Regional Radiological Security Partnership in Southeast Asia (RRSP), which brings together South East Asian states, Australia, the United States and the IAEA.[81]

D · ACCIDENTS AT NUCLEAR POWER PLANTS

The Chernobyl nuclear power plant accident in 1986

According to the subsequent investigation by the United Nations (UN) agency (UNSCEAR),[82] the reactor of the Chernobyl nuclear power plant had design flaws, and furthermore on 26 April 1986 the operators had ignored safety regulations by switching off control systems and allowing the reactor, to reach unstable, low-power conditions. The reactor was destroyed and considerable amounts of radioactive material were released into the environment. Within a few weeks 30 workers had died, and radiation injuries were caused to over a hundred others. The authorities evacuated about 115,000 people from surrounding areas, and subsequently relocated 220,000 people from Belarus, the Russian Federation and Ukraine. The accident caused serious social and psychological disruption and huge economic losses over the region. Large areas of these three countries were contaminated with radioactive material, and radionuclides were measurable in all countries of the northern hemisphere. However, for the most part, people were exposed to radiation levels comparable or not much higher than annual levels of natural background, and future exposures would diminish as the radionuclides decay; UNSCEAR concluded that the prospects for the future health of most exposed individuals were good. In 2011 Chernobyl was officially declared a tourist attraction.[83]

The Fukushima-Daiichi nuclear power plant accident in 2011

On 11 March 2011, the Fukushima-Daiichi nuclear power plant in Japan suffered major damage from the failure of equipment after the magnitude 9.0 East-Japan earthquake and subsequent tsunami. It was the largest civilian nuclear accident since Chernobyl. The 15-metre tsunami disabled the power supply and cooling system for three reactors, and all three cores largely melted in the first three days. The accident was rated 7 on the INES scale, due to high radioactive releases over days 4 to 6, eventually a total of some 940 PBq (I-131 eq). **Thus, although the reactors proved robust seismically, they were vulnerable to the tsunami.**

By July the reactors were being cooled with recycled water from the new treatment plant. Apart from cooling, the priority was to prevent release of radioactive materials, particularly in contaminated water leaked from the three units. Some of the facility staff had lost homes and families in the tsunami, and were initially living in temporary accommodation under great difficulties and with personal risk. A hardened emergency response centre on site was contaminated and couldn't be used.

There were no deaths or cases of acute radiation sickness from the nuclear accident, but over 100,000 people were evacuated. Government caution was said to have delayed the return of many. There is no data about the possible long-term effects of the radiation exposure, for example linked to the incidence of some types of cancer.

81 Caballero-Anthony M. and Trajano J.C. East Asia Forum. Stopping dirty bombs in Southeast Asia. 4 December 2018. https://www.eastasiaforum.org/2018/12/04/stopping-dirty-bombs-in-southeast-asia/.

82 United Nations Scientific Committee on the Effects of Atomic Radiation.

83 UNSCEAR. The Chernobyl accident. UNSCEAR's assessments of the radiation effects. http://www.unscear.org/unscear/en/chernobyl.html.

In May 2011, UNSCEAR[84] started an initial two-year assessment of the levels and effects of radiation exposure from the accident. Findings were reported to the UN General Assembly in October 2013 and then annually as new published evidence emerged. For example, the 2016 paper covered the same six thematic areas as previously - radionuclide releases to atmosphere, dispersion and deposition; radionuclide releases to water, dispersion and deposition; evaluation of doses for the public; evaluation of doses for workers; health implications for workers and public; and, evaluation of doses and effects for non-human biota – and also a further topic, the transfer of radionuclides in terrestrial and freshwater environments.[85]

E · ACCIDENTS INVOLVING TOXIC INDUSTRIAL CHEMICALS (TICS)

To minimise the risks of accidents to workers and releases to the locality, national regulatory measures including inspections of facilities handling and storing TICs were increasingly put in place from the 1970s onwards. Major explosions involving fireworks and causing scores of deaths are common,[86] and an example in The Netherlands is given below.

The Seveso dioxin accident in 1976

On 10th July 1976 a bursting disc on a chemical reactor ruptured at a plant in Italy and a dense white cloud containing dioxins drifted over the nearby town of Seveso, with 17,000 inhabitants. Dioxin, a Class 1A human carcinogen, was present as a result of incomplete combustion caused by the explosion. The plant was producing TCP for the disinfectant hexachlorophene. Dioxin is highly toxic and a known carcinogen.[87] Responses were slow: it was several days before the announcement that a gas containing dioxin had been released from the facility, and evacuation of the area then started. Thousands of animals in the contaminated area died and huge numbers were slaughtered to prevent dioxin entering the food chain. No human deaths were attributed to the release but many individuals fell ill. The incident received much global attention, not least because of uncertainty about the health risks of dioxin and about how to decontaminate dioxin-containing waste. The waste was rendered safe in a specially constructed oven at a facility in Basel, Switzerland, but this took a further ten years with all the specialised testing needed.

In the aftermath of an explosion at a UK chemical plant at Flixborough in 1974[88] and the Seveso incident, a number of countries acted to tighten their regulatory regimes for TIC production, and the European Commission decided on action at the European level. The first European Council Directive concerned with controlling major accident hazards involving dangerous substances was adopted in 1982.[89] The Directive covers facilities where dangerous substances are used or stored in large quantities, i.e. mainly

84 United Nations Scientific Committee on the Effects of Atomic Radiation.

85 UNSCEAR. Developments since the 2013 UNSCEAR report on the levels and effects of radiation exposure due to the nuclear accident following the great East-Japan earthquake and Tsunami. A 2016 white paper to guide the Scientific Committee's future programme of work. UN New York, 2016. http://www.unscear.org/docs/publications/2016/UNSCEAR_WP_2016.pdf.

86 The Wikepedia entry "List of fireworks accidents and incidents" cites 18 accidents between 1983 and 2018. https://en.wikipedia.org/wiki/List_of_fireworks_accidents_and_incidents.

87 Dioxin is 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD), CAS Number 1746-01-6.

88 UK Health and Safety Executive. Flixborough (Nypro UK) Explosion 1st June 1974. Accident summary. https://www.hse.gov.uk/comah/sragtech/caseflixboroug74.htm.

89 The so-called Seveso-Directive was later amended in view of the lessons learned from later accidents such as Bhopal, Toulouse or Enschede the most recent version being Seveso-III (Directive 2012/18/EU, This takes into account, amongst others, the changes in the Union legislation on the classification of chemicals and increased rights for citizens to access information and justice.

in the chemical and petrochemical industry but also in fuel wholesale and storage (including liquefied petroleum gas (LPG) and liquefied natural gas (LNG) sectors. It is widely considered as a benchmark for industrial accident policy and has been a role model for legislation in many countries worldwide.[90]

The Union Carbide MIC accident in India in 1984

In 1984, an accident at the Union Carbide pesticide plant in Bhopal, India, released at least 40 tons of the toxic gas methyl isocyanate,[91] as well as a number of other poisonous gases. Poor design and maintenance are thought to have led to an uncontrollable reaction, with gases exiting the top of a chimney and drifting over the shanty towns of Bhopal city in a dense cloud. More than 600,000 people were exposed, causing burning to throats and eyes, nausea, and many deaths - the government estimate was 15,000. 3,800 people died immediately, mostly in the poor slum colony. The city had no mass casualty emergency response system. Local hospitals were overwhelmed, unsure of what gas was involved and what its effects were. Human rights groups maintained that thousands of tons of hazardous waste remain buried underground. There has, however, been no long-term epidemiological research to prove a relationship between contaminated water and birth defects. After five years of wrangling over the corporate responsibility and legal jurisdiction, in February 1989 the Supreme Court of India directed the company to pay $470 million to settle all claims. In June 2010, seven former employees of the company were convicted of causing death by negligence, fined and sentenced to two years' imprisonment. It became one of the worst chemical disasters in history and the name Bhopal became synonymous with industrial catastrophe.[92]

The Enschede fireworks accident in 2000

There was a catastrophic fire and explosion at the SE Fireworks depot in the Netherlands on 13 May 2000. The explosion killed 23 people including four firefighters, and injured nearly 1,000. 400 homes were destroyed and 1,500 buildings damaged. The first explosion was equivalent to about 800 kg TNT, the final explosion was in the range 4000–5000 kg TNT. The biggest blast was felt up to 30 kilometres away. In April 2002, the owners were sentenced to six months' imprisonment for violation of environmental and safety regulations and dealing in illegal fireworks.[93]

The Tianjin harbour chemical storage explosions in 2015

This was a series of explosions that killed more than 170 people, including more than 100 first responders and fire fighters. The first two explosions happened within 30 seconds of each other; the next explosion was larger and involved the detonation of about 800 tons of ammonium nitrate fertiliser. An investigation by Chinese authorities concluded in February 2016 that an overheated container of dry nitrocellulose was the cause of the initial explosion when wetting agents had evaporated in the August summer heat. The investigators recommended the creation of a national system for monitoring hazardous chemical storage; and that firefighters be better equipped. The State Council estimated the direct financial losses caused by the explosion at about $1 billion. This included damages to 304 buildings, 12,428 cars, and 7,533 shipping containers. However, a Swiss insurance company said claims are likely to exceed $2 billion; it called the explosion the 'largest ever man-made loss event in Asia for the insurance industry.[94]

90 EU. Major accident hazards. The Seveso Directive - Technological Disaster Risk Reduction. European Commission. http://ec.europa.eu/environment/seveso/index.htm.

91 Methyl isocyanate MIC (CAS Number 624-83-9) is considered to be significantly more toxic than the WWI gases phosgene and hydrogen cyanide.

92 Broughton E. The Bhopal disaster and its aftermath: a review. 2005. Environ Health, (4) p 6. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1142333/

93 OMICS International. Open Access Articles. Top Results for Enschede fireworks disaster. 2014. http://research.omicsgroup.org/index.php/Enschede_fireworks_disaster.

94 C&En, Chinese Investigators identify cause of Tianjin explosion. Vol 94 Issue 7 p. 5, 15 February, 2016. https://cen.acs.org/articles/94/i7/Chinese-Investigators-Identify-Cause-Tianjin.html.

BSL LABS CATEGORIES AND LABORATORY PRACTICES

RELATION OF RISK GROUPS TO BIOSAFETY LEVELS, PRACTICES AND EQUIPMENT

RISK GROUP	BIOSAFETY LEVEL	LABORATORY TYPE	LABORATORY PRACTICES	SAFETY EQUIPMENT
1	Basic - Biosafety Level 1	Basic teaching, research	GMT	None; open bench work
2	Basic - Biosafety Level 2	Primary health services; diagnostic services, research	GMT plus protective clothing, biohazard sign	Open bench plus BSC for potential aerosols
3	Containment - Biosafety Level 3	Special diagnostic services, research	As Level 2 plus special clothing, controlled access, directional airflow	BSC and/or other primary devices for all activities
4	Maximum containment - Biosafety Level 4	Dangerous pathogen units	As Level 3 plus airlock entry, shower exit, special waste disposal	Class III BSC, or positive pressure suits in conjunction with Class II BSCs, doublended autoclave (through the wakk), filtered air

Reproduced from "Laboratory biosafety manual", WHO. Third edition. Page 2. 2004. Last accessed 10.05.2020 at https://www.who.int/csr/resources/publications/biosafety/en/Biosafety7.pdf

BIOLOGICAL SAFETY - PERSONAL PROTECTIVE EQUIPMENT (PPE) REQUIREMENTS'

BSL - 1	BSL - 2	BSL - 3	BSL - 4
• **Protective laboratory coats, growns, or uniforms** recommended to prevent contamination of personal clothing • **Protective eyewear** worn when conducting procedures that have the potential to create splashes of microorganisms or other hazardous materials. • Personnel who wear contact lenses in laboratories should also wear eye protection • **Gloves** must be worn to protect hands from exposure to hazardous materials	• **Protective laboratory coats, growns, smocks, or uniforms** must be worn while working with hazardous materials • **Eye and face protection** (googles, mask, face shield or other splatter guard) must be used for anticipated splashes or sprays of infectious or other hazardous materials when the microorganisms are handled ourside the Biological Safety Cabinet ((BSC) or physical containment device. • Personnel who wear contact lenses in laboratories should also wear eye protection. • **Gloves** must be worn to protect hands from exposure to hazardous materials. • **Eye, face and respiratory protection** should be used in rooms containing infected animals.	• **Protective laboratory clothing with a solid-front**, such as tieback or wrap-around gowns, scrub suits, or coveralls must be worn. • **Eye and face protection** (googles, mask, face shield or other splash guard) must be used for anticipated splashes or sprays of infectious or other hazardous materials. [All procedures involving the manipulation of infectious materials must be conducted within a BSC, or other physical containment devices]. • Personnel who wear contact lenses in laboratories must also wear eye protection. • **Gloves** must be worn to protect hands from exposure to hazardous materials. • **Respiratory** protection must be used in rooms containing infected animals.	• Special PPE is necessary. • Please refer to the CDC/ NIH document, "Biosafety in Microbiological and Biomedical Laboratories" for more information

Reference: Based on table in "ASU Fact Sheet Personal Protective Equipment (PPE) Requirements for Work with Biological Materials". Arizona State University Department of Environmental Health & Safety Biosafety & Biosecurity. 2016.

CHAPTER 5

The evolution of the international arms control regimes

CHAPTER 5

THE EVOLUTION OF THE INTERNATIONAL ARMS CONTROL REGIMES

There are several international treaties designed to prohibit CBR warfare and promote the peaceful uses of these agents. All ASEAN countries are members of the Chemical Weapons Convention (CWC) and the Biological Weapons Convention (BWC). United Nations Security Council Resolution 1540 is one of the key international instruments requiring countries to take specific actions to prevent non-state actors such as terrorists acquiring the means to carry out CBRN attacks. Understanding the provisions of these treaties, and interacting with the national bodies tasked with implementing them, is an important first step for national CBRN risk mitigation systems – enabling these to then **take advantage of the advice, training and assistance available under the treaties,** features which are explained in **Chapter 6**.

SYNOPSIS

This chapter outlines the structures of the main CBRN treaties and how they evolved. Understanding this is important because it explains why these treaties are designed to promote peaceful activities and strengthen national actions to prevent the misuse of CBRN agents including by terrorists and other non-state actors. Chapter 6 goes on to describe activities and assistance organised through the treaties, in the way that they provide immediate assistance and support for treaty implementation - and how this can have important benefits for **capacity building in risk mitigation at national and regional levels.**

The Conference on Disarmament (CD) and its predecessors have negotiated major multilateral arms limitation and disarmament agreements. For CBRN the main legally binding non-proliferation instruments for State Parties[1] (SPs) are the following:

- Treaty on The Non-Proliferation of Nuclear Weapons (NPT) , which prevents the spread of nuclear weapons and weapons technology;
- Chemical Weapons Convention (CWC),[2] which bans chemical weapons (CW);
- Biological and Toxin Weapons Convention (BTWC or BWC),[3] which bans biological weapons (BW);
- Comprehensive Nuclear-Test-Ban Treaty (CTBT), which bans nuclear explosions; and
- United Nations Security Council Resolution 1540 (UNSCR 1540) which requires United

1 Definitions of State Party vary according to the treaty, but generally a state that has not only signed the treaty but has legally committed to be bound by it in a process of Ratification or Accession including domestic legislation.

2 Full title: Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction.

3 Full title: Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction.

Nations (UN) states to enact specific measures to combat non-state actor involvement in the proliferation of Weapons of Mass destruction (WMD) materials.

There are no international treaties to determine exactly **what measures countries should take to mitigate the potential effects of a terrorist attack.** However, individual countries will have their own national plans; for Association of Southeast Asian Nations (ASEAN) countries the ASEAN Comprehensive Plan of Action on Counter Terrorism adopted in September 2017.[4]

A number of important treaties that address terrorist actions **do explicitly include the use of CBRN agents** to cause death, serious bodily injury or substantial material damage. They are:

- the 1997 UN International Convention for the Suppression of Terrorist Bombing;
- the 2005 Protocol to the 1988 Convention for the Suppression of Unlawful Acts against the Safety of Maritime Navigation;
- UN Security Council Resolution 1373 (2001), which requires each UN member state to take specific measures to combat terrorism; to comply fully, most states will have to make changes in their laws, regulations, and practices.[5]
- UNSCR 1624 (2005), which called on states to co-operate in order to strengthen the security of their international borders by enhancing terrorist screening and passenger security procedures.[6]
- UNSCR 1373, which provides a directory of best practices, codes and standards to aid in implementation.[7]

On 31 May 2003, US President George W. Bush announced his *Proliferation Security Initiative (PSI).* The objective is to create international partnerships allowing the US and others to search planes and ships suspected of carrying WMD, delivery systems and related materials. To date, 105 countries have endorsed the PSI, all SEA Region countries except Myanmar.[8]

We start with an examination of two conceptual problems that have complicated progress towards international agreement of verifiable treaties that prohibit the use of chemical and biological agents as weapons. Firstly, decades were lost in coming to agreement over a CW treaty because of uncertainty about what would be an acceptable degree of verification, i.e. the proof of disarmament and that chemistry is only being used for peaceful purposes. In the end there developed a view, that, imperfect as a future CW or BW treaty must be in respect of 'detection', it would still bring major benefits. Secondly, it is often difficult to distinguish offensive intents from defensive or other legitimate activities. This is particularly a problem for a BW prohibition treaty,

4 ASEAN Comprehensive Plan of Action on Counter Terrorism. Adopted by the 11th AMMTC, 20 September 2017. https://asean.org/wp-content/uploads/2012/05/ACPoA-on-CT-Adopted-by-11th-AMMTC.pdf.

5 Federation of American Scientists. Report to the Counterterrorism Committee pursuant to paragraph 6 of Security Council resolution 1373 of 28 September 2001 Implementation of UNSCR 1373. 19 December 2001. https://fas.org/irp/threat/unsc.html.

6 UNSCR. Security Council Resolutions. Resolution 1624. http://unscr.com/en/resolutions/1624.

7 Security Council Counter-terorism Committee. United Nations Security Council resolution 1373 (2001). Directory of International Best Practices, Codes and Standards. https://www.un.org/sc/ctc/resources/databases/recommended-international-practices-codes-and-standards/united-nations-security-council-resolution-1373-2001/.

8 US Department of State. Proliferation Security Initiative. https://www.state.gov/t/isn/c10390.htm.

because in many countries the widespread nature of facilities handling biological agents could make the task of a verification regime hugely onerous and intrusive. In the event, for the BWC it has not yet been possible to agree a legally binding verification regime based on declarations and inspections (The Protocol), as an analogy of the regime built into the CWC; the BWC can only rely on a voluntary set of Confidence Building Measures (CBMs),

We here examine the regimes that are most important to the promotion and implementation of CBRN risk mitigation strategies:

- We first outline Radiological regimes: the Nuclear Suppliers Group (NSG), which implementing guidelines for nuclear exports. And the International Atomic Energy Agency (IAEA). The IAEA works worldwide to promote safe, secure and peaceful nuclear technologies and inhibit military use. It is dealt with separately in detail in **Chapter 11**.

And we detail the structures and key provisions of the following, in regards to declarations, other exchanges of information, and inspections:

- UN Security Council Resolution 1540 (2004): how the 1540 Committee of Security Council members, assisted by a Group of Experts, is a cooperation platform to assist national implementation of the requirements of the Resolution. This Resolution requires countries to take active measures to close down the opportunities for non State actors including terrorists to access materials and technology.
- The Biological Weapons Convention (BWC): the Implementation Support Unit (ISU) was established at the Sixth Review Conference in 2006 to provide administrative support to the BWC and facilitate the Confidence Building Measures (CBMs) and communication between SPs.
- The Chemical Weapons Convention (CWC): the CWC establishes an international organisation, the Organisation for the Prohibition of Chemical Weapons (OPCW), which has its headquarters HQ in The Hague, The Netherlands. It requires each State Party to set up a National Authority and national legislation and measures to implement the Convention Articles. The OPCW provides guidance on implementation and assistance in promoting the peaceful uses of chemistry and the strengthening of risk mitigation capacities.

KEY TERMS

- **BWC (or BTWC):** Biological and Toxin Weapons Convention. The full title is Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction. The BWC was the first multilateral disarmament treaty banning an entire category of weapons. It opened for signature in 1972, entered into force in 1975, and enjoys almost universal membership today
- **CBMs:** Confidence Building Measures. Important for the exchange of information between BWC States Parties.
- **CWC:** Chemical Weapons Convention. The full title is Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction. Signed in 1993, it entered into force in 1997.

- **DAT:** Declaration Assessment Team was established in 2014 to engage the relevant authorities of the Syrian Arab Republic to resolve the identified gaps and inconsistencies in the Syrian declaration.
- **FFM:** Fact-Finding Mission by OPCW was set up in 2014 "to establish facts surrounding allegations of the use of toxic chemicals, reportedly chlorine, for hostile purposes in the Syrian Arab Republic".
- **IAEA:** The International Atomic Energy Agency. A UN organization that seeks to promote the peaceful use of nuclear energy, and to inhibit its use for any military purpose, including nuclear weapons. Though established independently of the United Nations through its own international treaty, the IAEA Statute, the IAEA reports to both the UN General Assembly and Security Council.
- **ISU:** Implementation Support Unit of the BWC. Established by the sixth BWC review conference, in November 2006, to provide administrative support to the BWC and facilitate the CBMs and communication between State Parties.
- **NA:** National Authority, for examples as explicitly required for each CWC State Party.
- **OPCW-UN JIM:** The OPCW and UN Joint Investigative Mechanism created by the UN Security Council Resolution 2235 (2015) to identify the perpetrators in the use of chemical weapons in the Syrian Arab Republic based on the FFM findings of confirmed use. JIM mandate expired in November 2017.
- **OPCW-IIT:** OPCW Investigation and Identification Team to carryout out the expanded mandate of OPCW to independently investigate and assign attribution in the alleged use of chemical weapons.
- **Protocol:** In international law, this is a treaty or international agreement that supplements an existing one. A protocol can amend the previous treaty, or add additional provisions.
- **UNSCR 1540:** United Nations Security Council 1540 (2004)
- **Verification:** verification measures under an arms control treaty can include on-site inspections and exhibitions, data exchanges and notifications related to offensive arms and facilities covered by the treaty, and the use of technical means for treaty monitoring.
- **WMD:** Weapons of Mass Destruction. UN Security Council Resolution 1540 implicitly defines weapons of mass destruction as nuclear, chemical and biological weapons, including their means of delivery (missiles, rockets and other unmanned systems).

A · CONCEPTUAL PROBLEMS IN CBR DISARMAMENT TREATY DESIGN

History illustrates that there are two key conceptual problems which have dogged international attempts to agree CBR treaty designs based on practical measures that would then instil confidence.

The objective of verification clauses in a disarmament treaty.

Discussions after World War 2 (WW2) about future disarmament agreements, regardless of the weapon category, tended to be fixated on the premise that a treaty mechanism designed to detect non-compliance must always be 100% efficient. But for a future treaty banning CW or BW it was clear that no such method could be found, because weapons production could always be hidden in legitimate industrial or R&D facilities, for which total access could never be proposed because of the impact on commercial proprietary information or legitimate defensive technologies. Notwithstanding, there developed a view, that, imperfect as a future CW or BW treaty must be in respect of 'detection', it would still bring major benefits: by pressure on SPs to disarm the known arsenals; by acting as a deterrent; and from the continuing transparency from declarations of relevant fields of activity – research, industrial etc. The accounts below for the CWC and BWC explain this in more detail.[9]

Difficulties in distinguishing offensive from defensive and other peaceful intents.

Defensive work permitted under the CWC and BWC, quite reasonably because of the right of any country to make defensive preparations for a worst case scenario, nevertheless sometimes attracts negative comment when details emerge. But in fact the distinction between offensive and defensive R&D is often not a matter of technical difference but *intent* – intent to wage war. Some defensive preparations, such as the development of sophisticated protective clothing and agent detectors, is laudable at one level but of course could also be part of offensive preparations. The technical possibilities that may justifiably be examined in a purely defensive programme may surprise the uninitiated observer. An example in respect of the BWC was in 2001 when an article in the US press described three government projects in the US biological defence programme. One project was to genetically engineer anthrax bacteria, in order to test whether such a bacterium, like one that had been produced earlier by the Russians, could be countered by the standard US anthrax vaccine. Another project assembled a 'germ factory' to see whether this could easily be achieved by terrorists without alerting the authorities. The third project built and tested what was claimed to be a model of a Soviet designed bomb.[10]

Given the ability of microorganisms to multiply, a BW arsenal might be built on the smallest scale. The sheer number of legitimate science applications of this size in any country, spanning several fields - public and animal health, defence research, vaccine and diagnostic R&D etc.- would make it almost impossible for a verification regime to cover such a broad scope of activities sufficiently to inspire confidence in compliance. In the event, for the BWC it has not yet been possible to agree a legally binding verification regime based on declarations and inspections; the treaty still depends on a voluntary set of Confidence Building Measures (CBMs).

9 For a summary of the sequence of events, including official statements and actions, leading to this view, see Chapter 2, The Chemical Weapons Convention and the Worldwide Chemical Industry; and the UK view on deterrence, on page 176, in "Preventing Biological Warfare, the Failure of American Leadership". Dando M.R., Palgrave 2002. ISBN 0 33-79483 4.

10 Miller J. et al. U.S. Germ Warfare Research Pushes Treaty Limits. 4 September 2001. New York Times. https://www.nytimes.com/2001/09/04/world/us-germ-warfare-research-pushes-treaty-limits.html.

Provisions in the BWC and CWC which are most relevant to States Parties in CBR Risk Mitigation, as for example, Article X in BWC and CWC promoting the peaceful use of science, including the convergence of chemistry and biology in the area of natural toxins, are presented below and in **Chapter 6**.

B · RADIOLOGICAL REGIMES

The Nuclear Suppliers Group (NSG) is an informal arrangement that enforces the Nuclear Non-Proliferation Treaty by implementing guidelines for nuclear exports with regard to nuclear supplier countries, to ensure that peaceful nuclear trade does not contribute to the proliferation of nuclear weapons.

The International Atomic Energy Agency (IAEA). The IAEA is an international UN organisation that is the world's centre of cooperation in the nuclear field. It was established as the "Atoms for Peace" organization in 1957. The Agency works with its Member States and partners worldwide to promote safe, secure and peaceful nuclear technologies and inhibit military use, so as to protect people and the environment from harmful exposure to radiation. The IAEA is dealt with in detail in **Chapter 11**.
The Agency has responsibilities under other treaties and agreements, principally the 1980 Convention on the Physical Protection of Nuclear Material, which combats the unlawful taking, use, disposal or dispersal of nuclear material or threats to cause harm.

C · UN SECURITY COUNCIL RESOLUTION 1540 (2004)

In order to close down the opportunities for terrorists to access materials and technology, the UN Security Council adopted Resolution 1540 (2004) on 28 April 2004.[11] It requires all UN Member States (MS) to enact measures to deny any form of support to non-state actors (in effect terrorists, criminals etc), to develop, acquire, manufacture, possess, transport, transfer or use nuclear, chemical or biological weapons and their means of delivery. It specifies measures in these areas: physical security measures for weapons, delivery systems, and related materials; export and trans-shipment controls; border and law enforcement to counter illicit trading of WMD materials; prohibitions on proliferation financing, unauthorized transport, and any other services that would assist would-be non-State proliferators. Twelve operational paragraphs collectively require states to establish and enforce more than 200 specific measures. Because its stipulations would also address the actions of non-state actors in supporting proliferation by states, 1540 implementation may be expected to strengthen synergies with national implementation of other non-proliferation measures, including non-proliferation treaties, multilateral export control regimes and United Nations Office for Disarmament Affairs (UNODA) sanctions resolutions – all of which often require states to implement similar measures.[12]

The Resolution sets up the 1540 Committee of Security Council members, assisted in their work by a Group of Experts, as a cooperation platform to assist national implementation of the requirements of the Resolution.[13] The initial mandate of Resolution 1540 lasted two years; however, with the slow

11 UN. Resolution 1540 (2004) Adopted by the Security Council at its 4956th meeting, on 28 April 2004. https://undocs.org/S/RES/1540(2004).

12 Chatham House. UNSCR 1540 Ten years on: challenges and opportunities. Meeting at International Security Department. London, 5 November 2014. https://www.chathamhouse.org/sites/default/files/field/field_document/UNSCR%201540-summary.pdf.

13 UN. 1540 Committee. Security Council Committee established pursuant to resolution 1540 (2004). https://www.un.org/en/sc/1540/national-implementation/general-information.shtml.

rate of implementation progress it was extended by Resolutions 1673, 1810 and then again for ten years by Resolution 1977 (2011). As an example of the slow progress, by 2012 only 39 states and 2 regional organizations had requested assistance through a specific 1540 mechanism. Although visits were on offer at the invitation of a state, to discuss any matter, the first request was not made until 2011 and by February 2018 there had only been 21. By 2018, only 31 National Action Plans - which are voluntary - had been adopted. However, all but fourteen UN MS had submitted at least a first national report.[14] The 1540 Committee has a website that provides information on MS responsibilities and reporting and assistance modalities. (See **Chapter 6** for details). According to the 1540 website, 103 States have now provided national Points of Contact.[15]

An international conference in November 2014[16] considered challenges facing the Committee and UN MS if the target of 'full' implementation by 2021 is to be met. It was argued that states should not all have to implement UNSCR 1540 in the same way. The implantation of States that do not manufacture or hold WMD-relevant material, for example, will require less stringent laws, regulations and enforcement processes than states possessing relevant programmes or export industries. For many states, implementation of 1540 was judged not to be a high priority, often not helped by a lack of bureaucratic and economic resources to institute new measures. Regional dialogues supported by UNODA were intended to help, with increased reporting by African states a clear result. The UN system under which states can request guidance in the design and implementation of national action plans is detailed below.

As part of the European Union (EU) Common Foreign and Security Policy, the EU has provided multiannual funding support to the work of the 1540 Committee, through two Council Joint Actions and then a Council Decision, each one linked to several thematic areas of work of the Committee. The objectives of the EU support were: to boost national and regional efforts and capacity building in close cooperation with other EU programmes to ensure synergies and complementarity; to contribute to the practical implementation of UNSCR 1540, in particular on technical assistance, international cooperation and raising public awareness; to help states develop and implement national action plans, when they request this. There was also EU action on the ground: for example, the European External Action Service carried out targeted outreach through the network of EU Delegations towards the 17 states that had not submitted a first report to the 1540 Committee. The EU has also made detailed proposals for more effective work by the Committee, bearing in mind the limitation of the UN resources and the need to prioritise.[17] The Committee should strengthen its engagement with assistance providers. It should step up its efforts to promote greater regional cooperation in support of UNSCR 1540 implementation. And to facilitate transparency it should increase its engagement with stakeholders in industry, academia and civil society.

There is no doubt that the 1540 Committee experts recognise the direct relationship between their work and the objectives and programme activities under the EU-CBRN CoE Initiative. Many of the contributions of the CoE projects to the development of national capacities in CBRN risk mitigation are of direct relevance to meeting the objectives of UNSCR 1540. However, in practice the degree of synergy may be less than might be expected, as explored in **Chapter 6**.

14 UNSC 1540. At the 25th Asian Export Control Seminar, Tokyo, 27 February 2018. Gennady Lutay, Member, Group of Experts assisting the UNSCR 1540 Committee. ttps://supportoffice.jp/outreach/2017/asian_ec/pdf/21Mr.GennadyLutayUNSecurityCouncil1540(2004).pdf.

15 1540 Committee. Security Council Committee established pursuant to resolution 1540 (2004). https://www.un.org/en/sc/1540/faq.shtml#13.

16 Royal Institute of International Affairs. 'UNSCR 1540 Ten years on: Challenges and opportunities'. Chatham House, London. 5 November 2014.

17 EU. Report by the European Union on EU support to the full and universal implementation of UN Security Council Resolution 1540(2004). Ref. Ares(2016)2646123 - 07/06/2016. https://eeas.europa.eu/sites/eeas/files/eu_support_to_1540.pdf.

D · BW DISARMAMENT: THE BIOLOGICAL WEAPONS CONVENTION (BWC)

The Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction — commonly known as the Biological Weapons Convention BWC or BTWC[18] — was drawn up for signature on 10 April 1972 and entered into force on 26 March 1975. As of September 2018, there were 182 SPs, including all EU-CBRN CoE SEA Region countries, and five signatories including Syria.

The core of the BWC is Article I, in which States Parties undertake "*never in any circumstances to develop, produce, stockpile or otherwise acquire or retain:*

- *1. microbial or other biological agents, or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes; [emphasis added]*
- *2. weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict."*

The part of Article I emphasised above has become known as the *General Purpose Criterion* – it allows for peaceful uses of biological agents but bans all other purposes. The wording also clearly covers any types of agents which were not known in 1972, and so includes genetically modified ones.
The key provisions of the BWC, as stated by the Implementation Support Unit (ISU), are as follows:[19]

Key Provisions of the Biological Weapons Convention

ARTICLE	PROVISION
Article I	Never under any circumstances to acquire or retain biological weapons.
Article II	To destroy or divert to peaceful purposes biological weapons and associated resources prior to joining.
Article III	Not to transfer, or in any way assist, encourage or induce anyone else to acquire or retain biological weapons.
Article IV	To take any national measures necessary to implement the provisions of the BWC domestically.
Article V	To consult bilaterally and multilaterally to solve any problems with the implementation of the BWC.
Article VI	To request the UN Security Council to investigate alleged breaches of the BWC and to comply with its subsequent decisions.
Article VII	To assist States which have been exposed to a danger as a result of a violation of the BWC.
Article X	To do all of the above in a way that encourages the peaceful uses of biological science and technology

18 The shorthand used is either the Biological Weapons Convention or Biological and Toxins Weapons Convention.

19 UN. Key Provisions of the Biological Weapons Convention. About the Biological Weapons Convention. Implementation Support Unit, United Nations Geneva. https://www.unog.ch/80256EE600585943/(httpPages)/77CF2516DDC5DCF5C1257E520032EF67?OpenDocument.

Though the BWC does not specify **actual use** of 'microbial or other biological agents or toxins' as weapons , the **1925 Geneva Protocol does prohibit use** of biological weapons and Article VIII of the BWC recognizes that nothing in the Convention conflicts with Geneva Protocol obligations. Article IX reflects the fact that many of the negotiating countries felt that BW and CW should have been dealt with at the same time.

Why is there no BWC verification mechanism?

Although in force for almost 50 years, this is still the only international disarmament convention that has no verification mechanism, despite intensive negotiations throughout the 1990s. In fact, from the 1940s onwards the difficulties of verification had dogged attempts to agree a BW convention at all. There were technical difficulties: that inspections of civil biological facilities could threaten the increasing needs for commercial secrecy; and the fact that production of biological weapons on a significant scale could involve a production facility so small that it would be difficult to detect - much smaller facilities than for CW. (See **Chapter 2**). Also, declarations and inspections would need to be wide ranging because of the widespread footprint of biological agents in any society, in organisations spanning industry, health, research, defence etc. Given this backcloth, a protocol would never be perfect in detecting violations, but some thought it could have value as a deterrent. And there were political difficulties: the US pressed for tight control but the Soviet Union was unwilling to accept verification by direct inspection. Conclusion of the convention followed quickly after the US in 1969 cancelled their offensive BW programme. Many reasons for this unilateral US step have been suggested, perhaps the most likely being to clear the route to agreements with the Soviet Union on nuclear issues. Ironically, it seems to have encouraged the Soviets to actually expand their secret BW program, as they did at about that time. (**Chapter 2**)[20]

Overall, the additional transparency that adding a verification protocol to the BWC would have brought would also build trust and confidence among SPs, an important objective given the breaches of faith with the provisions of the BWC by Russia and some other countries. (See **Chapter 2** for documented evidence of these breaches). Until 1986, there was no BWC mechanism to provide transparency between SPs, but then a voluntary system was agreed for exchanging information in the form of Confidence-Building Measures (CBMs) "*in order to prevent or reduce the occurrence of ambiguities, doubts and suspicions and in order to improve international cooperation in the field of peaceful biological activities*".[21] (The CBMs were revised at the Third and Seventh Review Conferences, in 1991 and 2011 respectively. See Chapter 6 for the current modalities of the six CBMs). Between 1992 and 2001, there was intense activity in the UN in Geneva to try to agree a broad set of mandatory verification measures to be added to the Convention as protocol. A system of declarations, visits and 'challenge' inspections would be very similar to that nearing agreement in the CWC negotiations - see below. States would be required to establish national authorities, penal legislation, agent transfer rules and provisions for assistance. Mandatory declarations would replace and hugely amplify the information provided under the voluntary CBMs. New arrangements for consultation and complaint would replace the practically unused Article V and Article VI measures. However, in July 2001, the US delegation effectively put an end to the intense, decade

20 Dando M.R. For a summary of the sequence of events, including official statements and actions, see Chapter 1, The problem of biological warfare, and Chapter 3, Developing the BTWC 1975-1995, and the UK view on dete-rrence, on page 176, in "Preventing Biological Warfare, the Failure of American Leadership". Palgrave 2002. ISBN 0 33-79483 4.

21 UNODA. Guide to Participating in the Confidence-Building Measures of the Biological Weapons Convention. https://www.un.org/disarmament/publications/more/cbm-guide/.

long process by announcing that the composite Chairman's Text was flawed and could not be mended.[22] Since then there have been Annual Meetings of SPs as well as Annual Meetings of Experts directed at specific technical topics, and increased contact with NGOs. The limited exchange of information between SPs through the CBMs remains the only permanent transparency building pool of the BWC. Unlike the situation with CWC (see below), no validated sampling and analysis procedures for use with biomedical or environmental samples have been agreed by BWC SPs.

The Implementation Support Unit (ISU).

As one minor element of progress, the sixth (five yearly) BWC review conference, in November 2006, agreed to fund three permanent employees as an Implementation Support Unit, to provide administrative support to the BWC and facilitate the CBMs and communication between SPs. Nevertheless, proposals to reform the CBMs failed against the argument that participation in the existing mechanisms was poor – even by the end of 2017, 55 SPs had still never submitted a CBM.[23] The ISU can be found on a UN web site;[24] ISU web sites provide guidance on CBMs,[25] and there is a secure web-based platform for SPs to offer or request assistance or cooperation under the rubric of Article X.[26] The EU has supported the work of the ISU through five Council Joint Actions/Council Decisions, totalling EUR 9,336,856, directed at specific outreach projects and part funding a BWC brochure.[27], [28] (See **Chapter 6** for detail of types of assistance and activities organised by the ISU). The Sixth Review Conference in 2006 also urged each SP to designate a national focal point. These exhortations was repeated during the Article IV discussions at the succeeding Review Conferences, the most recent the Eighth in November 2016.[29] Names of NFPs are held in a restricted access area of the ISU web site. As at January 2019 there were 182 BWC SPs.

E · CW DISARMAMENT: THE CHEMICAL WEAPONS CONVENTION (CWC)

The CWC is a complex instrument, with several active functional areas that are important to understand because countries can make use of them to promote their CBRN risk mitigation strategies and programmes. In view of this complexity, we divide our descriptions into two. The section below describes the basic structure and logic of the Convention and the functional areas that are led by the implementing international body, the Organisation for the Prohibition of Chemical Weapons (OPCW), from its headquarters in The Hague, Netherlands. The responsibilities and duties of the States Parties, and the advice, training and assistance available to them and relevant to risk migration, through activities led by,

22 Statement. United States Delegation to the Ad Hoc Group, Geneva. 25 July 2001. Ambassador Donald Mahley. https://www.unog.ch/80256EDD006B8954/(httpAssets)/853606DB11E91D0FC12582EB0056D626/$file/010725+Amb+Don+Mahley+Protocol+Statement+to+AHG.pdf.

23 BWC. Annual report of the Implementation Support Unit, 4-8 December 2017. BWC/MSP/2017/4. http://undocs.org/bwc/msp/2017/4.

24 UNOG (The United Nations Office in Geneva). Implementation Support Unit. https://www.unog.ch/80256EE600585943/(httpPages)/16C37624830EDAE5C12572BC0044DFC1?OpenDocument.

25 UNODA. Guide to Participating in the Confidence-Building Measures of the Biological Weapons Convention. https://www.un.org/disarmament/publications/more/cbm-guide/.

26 BWC Article X. Assistance and Cooperation. https://bwc-articlex.unog.ch/.

27 European Union Support to the BWC. UNOG, Geneva. https://www.unog.ch/80256EE600585943/(httpPages)/1ABD96932A955C6AC1257F9B0031C22E?OpenDocument.

28 The Biological Weapons Convention. An Introduction. June 2017. United Nations Publication. https://www.unog.ch/80256EDD006B8954/(httpAssets)/6D16C7B1933F0937C125815D00349763/$file/BWS%20brochure.pdf.

29 BWC. Final Document of the Eighth Review Conference. 11 January 2017. BWC/CONF.VIII/4. file:///C:/Users/Anthony/Documents/ALL%20WORK%20FOLDERS%2020%20Jan%202020/B&S%20OSA%20REVIEW%20DOCS%20%20March%202020/BWCCONF.VIII4+English+.pdf.

for the most part, the OPCW, are the subject of **Chapter 6**.
The Chemical Weapons Convention (CWC) sets out the rules for a non-proliferation chemical weapons regime, whereby signatories accept the prohibition to develop, produce, store and use chemical weapons and destroy any existing ones. The Convention had widespread membership from the outset (opened for signature in Paris, 13 January 1993): 165 signatory states; 87 SPs at enforcement of the Convention on 29 April 1997, and 193 SPs as of June 2018, including all countries in the EU-CBRN CoE SEA Region. According to the OPCW, 98% of the global population live under the protection of the Convention; and 96% of the chemical weapons stockpiles declared by possessor states have been verifiably destroyed.[30]
In 2013, the **Nobel Peace Prize** was awarded to the UN organisation that implements the CWC, the OPCW (see below), for "its extensive efforts to eliminate chemical weapons".

How the concept evolved.
After WW2, the impressive toxic characteristics of the newly discovered nerve gases and the consequent need for enhanced technological performance in personal and collective protection, created the philosophy that stocks of such weapons could have significant advantages for major industrialised states: they could be useful for small troop formations to mount multiple effective attacks against much larger numbers of less sophisticated troops, by using agents to deny access to enemy territories and deter counter-attacks by the incapacitated enemy. . However, by the 1960s, when the vast destructive arsenals of the more superior nuclear weapons were being built up, the technical limitations of chemical weapons became more obvious; and the risks that CW could be used by developing states as 'force multipliers' began to be a major concern.[31]

During the 20 odd years it took for the States Parties to finalise the provisions of the CWC, the single most contentious issue was the conduct of on-site inspections to determine compliance. The West began with a view that to be effective, a ban on CW needed 'anytime, anywhere' inspections, with no right of refusal, but in the face of protests from the Soviet Union and some other countries about the potential threat to legitimate confidentiality concerns, the original inspection proposals were eventually watered down. In 1989, as East-West relations improved with the collapse of the Soviet Union, the US position changed to an acceptance that no ban on CW would ever be fully verifiable. This is in recognition of the fact that chemical (and later, pharmaceutical) manufacturing plants needed for the production of industrially important materials considered as a peaceful purpose, could just as easily be used/repurpose in making chemical weapons. This is particularly true for multi-purpose plants, where the entire process assembly, including the effluent system, is often constructed from corrosion resistant materials to allow the plant built-in flexibility to be used for different production processes according to need. It became accepted that a future CW Convention should be designed to concentrate on providing reassurance through voluntary transparency of States Parties by making declarations, as well as allowing inspections based on the agreed verification regimes as a means of deterrence.[32]

A renewed impetus in the negotiations followed the realisation in 1991 that CW had been used in the Gulf War. US President Bush then stated that, as soon as a treaty were to enter into force, the US

30 OPCW. Member States. https://www.opcw.org/about-us/member-states.

31 Dando M. Preventing Biological Warfare: The Failure of American Leadership. 2002. Palgrave. pp25,26.

32 For a summary of the sequence of events, including official statements and actions, leading to this view, see Chapter 2, The Chemical Weapons Convention and the Worldwide Chemical Industry; and the UK view on deterrence, on page 176, in "Preventing Biological Warfare, the Failure of American Leadership". Dando M.R., Palgrave 2002. ISBN 0 33-79483 4.

would commit not to use CW for any reason, including retaliation, and would destroy all weapons stocks within ten years of that.[33] (In the end, destruction of the large US and Russian CW arsenals have taken rather longer, largely because of the technical and safety complexities and the need to build dedicated facilities).

The standard chemical reactions for modifying chemical 'building blocks' to make larger chemical molecules for legitimate commercial uses, would also be used in making the many candidate CW agents known from the WW1 era through to the nerve agents. Though CW agents are reactive to humans or other life for the very reason that they are so reactive, the panoply of potential production processes in the end became even more complex with the concept of 'binary' weapons in which two relatively safe chemicals are manufactured and only combined during deployment of the weapon. Given the huge global extent of commercial chemical industries, it became clear that to provide reassurance a convention would require considerable transparency of perhaps thousands of industrial manufacturing plants, by means of declarations and visits. Against this backcloth, chemical industry associations played active roles in the treaty negotiations.[34]

The rationale of the CWC prohibition logic.

The Convention side steps the difficulty of having to define a CW agent in terms of its properties, by using the General Purpose Criterion concept of the BWC (see above) – a definition in terms of the intended purpose for which that particular production of a chemical has been performed. Article II, I (a) defines chemical weapons as '*Toxic chemicals and their precursors, except where intended for purposes not prohibited under this Convention, as long as the types and quantities are consistent with such purposes…*'. The 'purposes not prohibited' are then defined in Article II.9, and in Article II.2 a toxic chemical is defined as '*Any chemical which, through its chemical action on life processes can cause death, temporary incapacitation or permanent harm to humans or animals…*' With this definition structure, the CWC cannot be circumvented by technological change - it applies to all possible toxic chemicals. The Articles of the Convention are listed in **Annex I** below, and the whole CWC text at Reference.[35] **Annex I** also describes the Annexes to the Convention.

The Convention does not prevent the domestic use of temporarily disabling agents such as CS gas[36] in police operations; it defines these gases as 'Riot control agents'.[37] But it does ban the use of riot control agents as a means of warfare such as bombardment to force unprotected soldiers out from cover – the use of CS gas as a military tactic of US forces fighting the Viet Cong in Vietnam three decades earlier.[38] The CWC establishes an international organisation, the Organisation for the Prohibition of Chemical

33 Dando M. Preventing Biological Warfare: The Failure of American Leadership. 2002. Palgrave. pp 25,26.

34 For a summary of the sequence of events, including official statements and actions, leading to this view, see Chapter 2, The Chemical Weapons Convention and the Worldwide Chemical Industry; and the UK view on deterrence, on page 176, in "Preventing Biological Warfare, the Failure of American Leadership". Dando M.R., Palgrave 2002. ISBN 0 33-79483 4.

35 Text of the CWC. Organisation for the Prohibition of Chemical Weapons, OPCW. https://www.opcw.org/sites/default/files/documents/CWC/CWC_en.pdf.

36 Wikipedia. CS gas. The compound 2-chlorobenzalmalononitrile (also called o-chlorobenzylidene malononitrile; chemical formula: C10H5ClN2), a cyanocarbon, is the defining component of tear gas, commonly referred to as CS gas. https://en.wikipedia.org/wiki/CS_gas.

37 The CWC definition of Riot Control Agent is : "Any chemical not listed in a Schedule, which can produce rapidly in humans sensory irritation or disabling physical effects which disappear within a short time following termination of exposure'.

38 Harris R and Paxman J. A higher form of killing. Arrow Books 2002. pp 197-198, ISBN 0 09 944159 4.

Weapons (OPCW), which has its headquarters in The Hague, The Netherlands. It requires each SP to set up a National Authority and national legislation and measures to implement the Convention Articles. The OPCW provides guidance on implementation.[39]

The Schedules of Chemicals.

To define the declarations under Article VI, the **Annex on Chemicals** sets out three Schedules of chemicals – i.e. lists. Schedule 1 chemicals are those deemed to pose a high risk to the objectives of the Convention; those on Schedule 2 a significant risk and on Schedule 3 the lowest risk.

Schedule 1 chemicals include those that have been or could easily be used as CW agents. Synthesis of Schedule 1 chemicals for research, medical or pharmaceutical purposes is allowed in aggregate amounts of less than 100 grams per year per facility for laboratories. The requirement to notify the OPCW of transfers of Schedule 1 chemicals between States Parties 30 days in advance is relaxed when saxitoxin is being transferred for emergency diagnosis of paralytic shellfish poisoning.[40] Schedule 1 chemicals are sometimes produced for protective purposes such as testing protective equipment and chemical agent alarms. The fact that the list includes two toxins that had been weaponised, saxitoxin[41] and ricin [42] , illustrates how the scope of the CWC overlaps with that of the BWC. Schedule 2 chemicals include those that are precursors to warfare agents (Schedule 2B - Precursors) and those that can be used themselves for CW (Schedule 2A -Toxic chemicals); but in both cases for which there are a number of commercial uses, such as in insecticides, herbicides, and pharmaceuticals. Schedule 3 chemicals may have been used as weapons, but are widely used for peaceful purposes. For example, phosgene and hydrogen cyanide were used as weapons in WW1, but are also intermediates in plastics manufacture. Triethanolamine is a precursor for nitrogen mustard gas, but is found in household detergent and industrial lubricants and surfactants.

The scheduling thus reflects the extent of industrial use of the chemicals, Schedule 3 for those chemicals being produced in large quantities and Schedule 1 chemicals having little or no use for purposes not prohibited. Altogether, 43 species or families of chemicals are listed. The grading of the quantitative declaration triggers follows the same logic.

How to make a declaration.

Requirements on each State Party for monitoring and declaration of chemicals are extremely complex; these are summarised below, but more extensive guidance is available from the OPCW.[43] Consistent with the complexities involved, Article VII, 'National Implementation Measures', requires (not merely encourages) each State Party to designate or establish a **National Authority** to serve as the national focal point for effective liaison with the Organisation (the OPCW) and other States Parties.

Declarations are of two types: one concerned with the chemicals, the other with production facilities. The amount of detail to be declared is the most for Schedule 1 and least for 3. The trigger for a facility

39 OPCW. National Legislation Implementation Kit. https://www.opcw.org/resources/national-implementation/national-legislation-implementation-kit.

40 UK Dept. for Business, Energy & Industrial Strategy. Chemical Weapons Convention Guidance. Updated 3 January 2020. https://www.gov.uk/guidance/chemical-weapons-convention-guidance#schedule-1-chemicals.

41 Saxitoxin. From food poisoning to chemical warfare. Edwards N. September 1998. The Chemical Laboratories, University of Sussex at Brighton. http://www.chm.bris.ac.uk/motm/stx/saxi1.htm.

42 Garrett B.C. Historical dictionary of Nuclear, Biological and Chemical Warfare. 2nd edition 2017, p 322. Rowman and Littlefield. ISBN 9781538106839.

to be declared is the specified quantity processed in the case of Schedule 3 chemicals, but processed or consumed for Schedule 1 and 2 chemicals. There are graded rules for import, exports and use. If the annual amounts exceed a threshold, the facility becomes liable to a *Routine Inspection* by the Technical Secretariat (TS) of the OPCW. The rules for these were worked out with chemical industry representatives, and are tightly constrained to protect commercial proprietary information. The inspectors are only given access to areas of a plant site relevant to the declaration. Thus the objective of a routine inspection is to verify the accuracy and consistency of the declaration.

The Declarations Branch of the OPCW Technical Secretariat conducts regular training sessions for National Authorities, including the use of the Electronic Declaration Tool for National Authorities (EDNA), a software application designed to enable National Authorities to create and submit Article VI declarations in electronic format.[44] Modules on EDNA and making declarations are made available on the OPCW e-Learning website.[45]

Inspections

In essence, the Convention divides responsibility between the OPCW and the National Authorities. The OPCW oversees the implementation of the Schedules under the Convention, but the National Authority must implement the Convention for the vast majority of chemicals covered by the General Purpose Criterion. The CWC also allows any SP to seek to address concerns about another's compliance, by requesting a *Challenge Inspection*, whether or not the relevant site has been declared. (Article IX). The request cannot be refused. Although early expectations were that the tool of challenge inspections would be used occasionally, to date there has been none. Several actions were taken in the context of Syria's CW, but these were not carried out under the regime of challenge inspections.

In the Convention, the **Annex on Implementation and Verification**, known as the *Verification Annex*, contains the detailed instructions for implementing and complying with the CWC. It is where most answers to operational questions can be found. The General Rules for Verification, (Part II), establishes the Techinical Secretriat inspectors' right to conduct verification activities, including:

- Interviewing facility personnel;
- Inspecting documentation and records;
- Having photographs of relevant materials/facilities/equipment taken;
- Requesting clarification of ambiguities; and
- Having samples taken and performing chemical analysis.

The goal of sampling and analysis will depend largely on the type of inspection or verification regime being carried out, whether it is a routine inspection or a Challenged inspection. Routine inspections refer to verification regimes under Article IV (for chemical weapons storage and destruction facilities, including emergency destructions of leaking munitions and old and abandoned chemical weapons) and Article VI (normally referred to as industry inspections).

44 https://www.opcw.org/sites/default/files/documents/EDNA/EDNA_Manual.pdf.
45 https://www.opcw.org/opcw-e-learning.

Other routine inspections under Article IV include Fact-Finding Visits by OPCW Inspection Team to evaluate the proposed destruction technologies and building plans for new chemical weapons destruction facilities to be built and Final Engineering Reviews to review and evaluate the destruction process, including the analytical methods and safety features in newly built destruction facilities before they go into operation. Confidentiality and chain-of-custody is maintained all throughout the inspection process, including during sampling and analysis and documentation. Inspection reports are written by the OPCW Inspection Team and reviewed and agreed to by the Inspected State Party. Unresolved issues are normally raised and taken up to the national government of the Inspected State Party.

Sampling and analysis.
The OPCW has complex arrangements for performing chemical analyses of any samples taken by OPCW inspectors during inspections, to ensure the highest technical and probity standards. The analytical protocols, OPCW Inspection Team Equipment, all analytical instrument and reagents, including PPEs are approved by the Executive Council. OPCW implements best practices under a Quality Management System in all activities related to inspection. The procedures and protocols are designed to maintain strict confidentiality of proprietary destruction technologies and commercial business information decided by the States Parties and agreed to by OPCW Inspection Team. Chain-of-custody is strictly implemented.

The goal of sampling and analysis depends on the type of verification regime/inspection being carried out. Under Article IV, sampling and analysis in chemical weapons destruction facilities is carried out to verify the identity of the declared schedule 1 chemical, to check for the presence of undeclared scheduled chemicals and to verify the destruction of the declared agent. The maximum number of samples taken for analysis will depend on the rate of destruction. Wastewater and air samples are likewise taken and analysed to monitor the working environment for the health and safety of the facility personnel and the inspection team. All samples are taken and analysed by site personnel and witnessed by an inspection team member, usually the Analytical Chemist Inspector.

Under Article VI, sampling and analysis is done to confirm the absence of Schedule 1 and other non-declared chemicals, to confirm the identity of the declared chemicals and to verify non-diversion of the declared chemicals. Samples may be taken from any point of the declared plant site, including raw materials (solid, liquid or bulk organic), feed-water, wastewater, finished products (aqueous or organic), in-process, etc. as agreed with the National Authority. Samples are collected by site personnel, using OPCW-approved equipment and witnessed by an OPCW inspector.

For Article VI inspections involving Schedule 2 and Schedule 3 chemicals, the splitting of samples, sample preparation and analyses are performed in the OPCW on-site laboratory which the Analytical Chemists Inspectors setup within the premises of the inspected plant site, using only the OPCW approved analytical equipment and following the OPCW On-Site Laboratory procedures. For Schedule 2 inspections, sampling and analysis must be completed within 48 hours and within 24 hours for Schedule 3. The strict timings are implemented to minimise the disruption caused by the presence of the Inspection Team to the daily operations of the inspected plant site. Consequently, the Inspected State Party shall ensure that the OPCW Inspection Team reaches the inspection site within 12hours after arrival at the Point of Entry (POE). During Challenge Inspections or Investigations of Alleged Use, the goal of sampling and analysis is to determine if the alleged chemical as identified in the challenge is present or if toxic chemicals were used in any way which is banned under the Convention. Report must be submitted within 72 hours, after the start of the inspection activities.

For challenged inspections, or inspections involving the alleged use of chemical weapons, sampling is taken by either the site personnel or the OPCW inspection team following sampling and analysis procedures under hazardous conditions. Analysis is performed at an inspected site where techniques allow, or at the OPCW Laboratory, or in a system of OPCW Designated Laboratories around the world. As of May 2014, there were 21 Designated Laboratories in 17 countries.[46] Samples, including blanks are first split into eight parts (three for the Inspected State Party, three for OPCW and two to be sent to the chosen designated laboratory). These split samples are transported using rigorous technical procedures and chain-of-custody. To be designated a lab must have a quality system and technique accreditation in accordance with international standards, and must perform successfully in an annual proficiency test programme of samples distributed by the OPCW.[47] In practice, the wide range of samples collected could include toxic chemicals, environmental samples, and biomedical samples. Presentations by OPCW staff outlining the technical procedures are readily available on the Internet.[48], [49] The OPCW publishes the results of requested analyses: recently, from the fact-finding mission in Syria confirming the use of sarin and chlorine;[50] and from sampling after the Novichok poisoning incident in Salisbury, UK, in 2018.[51]

Fact-Finding Mission in the Investigation of Alleged Use and Assigning Attribution.

Despite the signing and ratification of the CWC by the Syrian Arab Republic in October 2013 and after submitting to the immediate destruction of its declared stockpile of chemical weapons and precursor chemicals under the CWC (spearheaded by the OPCW-UN Joint Mission) as per UN Security Council Resolution 2118 (2013), the alleged use of chemical weapons during the armed conflict in the country continued. In 2014 the Declaration Assessment Team (DAT) was established to work with the relevant Syrian authorities to resolve the identified gaps and inconsistencies made in the Syrian declarations to OPCW.[52] In the same year, OPCW was tasked to clarify whether chemical weapons were used in the Syrian Arab Republic through the OPCW Fact-Finding Mission (FFM).[53] In the 83 alleged chemical attacks investigated, OPCW FFM reported 14 confirmed cases of chemical weapons use, notably chlorine gas and sarin as described above in the preceeding section.[54]

The OPCW FFM task was confined to establishing the facts related to the use of chemical weapons and did not include identifying the perpetrators for these attacks. The latter task fell on the OPCW-UN Joint

46 OPCW Designated Laboratories. 'An OPCW Designated Laboratory must be able to perform off-site analysis of chemical samples collected by OPCW inspectors from chemical production facilities, storage depots and other installations, or from the site of an alleged use of chemical weapons..... In designating a laboratory the [OPCW] Director-General takes the following into account: whether the laboratory has established a quality system in accordance with international standards.....; and, whether the laboratory has performed successfully in the proficiency testing programme of the OPCW.' https://www.opcw.org/designated-laboratories.

47 OPCW Designated Laboratories. https://www.opcw.org/designated-laboratories-0.

48 OPCW. Chemical Analysis in the Verification of the Chemical Weapons Convention. Presentation given in the series Science for Diplomats. 9 July 2014. https://www.opcw.org/sites/default/files/documents/Science_Technology/Diplomats_Programme/S_T_VER_Gregg.pdf.

49 OPCW. Sampling and analysis relevant to the Implementation of the Chemical Weapons Convention. https://www.opcw.org/sites/default/files/documents/Science_Technology/Sampling_and_Analysis_-_LAB.pdf.

50 OPCW Confirms Use of Sarin and Chlorine in Ltamenah, Syria, on 24 and 25 March 2017.
13 OPCW. June 2018. https://www.opcw.org/media-centre/news/2018/06/opcw-confirms-use-sarin-and-chlorine-ltamenah-syria-24-and-25-march-2017.

51 OPCW Issues Report on Technical Assistance Requested by the United Kingdom. 12 April 2018. https://www.opcw.org/media-centre/news/2018/04/opcw-issues-report-technical-assistance-requested-united-kingdom

52 OPCW, "Declaration Assessment Team". https://www.opcw.org/declaration-assessment-team.

53 Ibid.

54 OPCW. FFM Reports within the https://www.opcw.org/fact-finding-mission; https://www.opcw.org/media-centre/news/2018/04/opcw-director-general-allegations-chemical-weapons-use-douma-syria.

Investigative Mechanism (JIM) – a collaborative effort created under UN Security Council Resolution 2235 (2015) to identify "individuals, entities, groups, or government who were perpetrators, organisers, sponsors or otherwise involved in the use of chemical weapons".[55] JIM findings reported that the Syrian Government of President Bashir Al Ashad was responsible for at least four chemical weapons attacks which killed more than 80 people, including many children. The JIM also reported that the Islamic State used chemical weapons in at least two instances. The JIM was terminated in November 2017 after the Russian Federation vetoed its extension, alleging JIM to have acted in an unprofessional and subjective manner.[56]

Attempts to address the accountability gap through human rights mechanism (with a lower standard of proof than investigations in the context of arms control or criminal law) and through the UN-Secretary General's Mechanism (for example, the OPCW-UN Joint Investigative Mechanism) have fallen short in establishing culpability of individuals and organisations, that is unilaterally acceptable by all States Parties and beyond protest based on reasonable doubt. To date, no State Party has ever invoked the CWC's Challenge Inspection mechanism.[57]

The major gap is the inability of OPCW to assign attribution to the use of these chemical weapons. This is seen as the main weakness of OPCW as the CWC watchdog, as highlighted by the blatant use of chemical weapons in Syria, in Kuala Lumpur Airport in 2017 and in Salisbury, UK in 2018.

Prompted by these recent events, on June 26-27, 2018 the Fourth Special Session of the Conference of States Parties in The Hague met to reiterate the ban on chemical weapons as per CWC provisions and to task the OPCW with identifying those responsible for the chemical weapons attacks in Syria. This was an initiative put forth by the United Kingdom to push for an expanded role of the OPCW against the continued use of chemical weapons. OPCW, being the technical body in charge of the implementation of CWC would be in the best position to carryout investigations and assign attribution. The representatives of the States Parties present voted 82 to 24 in favour of establishing attribution mechanism for the OPCW. This enables the Secretariat of the OPCW to conduct independent investigations of alleged use of chemical weapons with a view to facilitating universal attribution of all chemical weapons attack.[58] The OPCW's Investigation and Identification Team (OPCW-IIT) is tasked to determine the responsible parties that violated the CWC by using chemical weapons in Syria. The expanded mandate of OPCW is expected to result in an increased accountability for the use of chemical weapons and to deal more effectively with non-compliance.

55 OPCW. UN Security Council Resolution 2235 (2015) accessed through the https://www.opcw.org/media-centre/news/2016/11/opcw-executive-council-adopts-decision-regarding-opcw-united-nations.

56 OPCW. JIM Reports as accessed through https://www.opcw.org/media-centre/news/category/72.

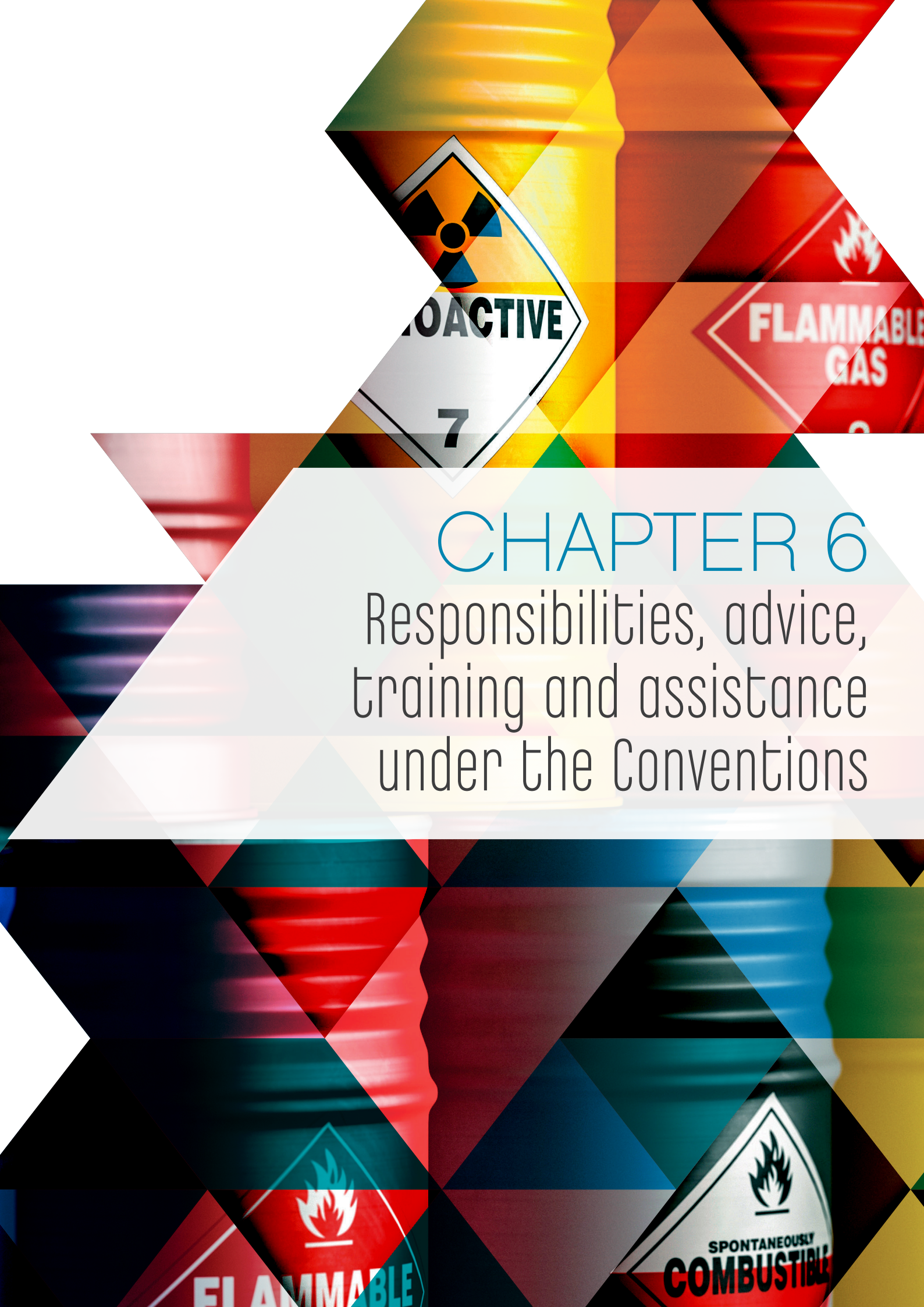
57 The Bulletin. https://thebulletin.org/2018/06/playing-politics-with-chemical-weapons-the-uks-initiative-on-chemical-weapons-accountability/.

58 OPCW. Decision addressing the threat from chemical weapons used as accessed through https://www.opcw.org/media-centre/news/2018/06/cwc-conference-states-parties-adopts-decision-addressing-threat-chemical.

ANNEX I

THE STRUCTURE OF THE CHEMICAL WEAPONS CONVENTION.

- PREAMBLE
- ARTICLE I. General Obligations
- ARTICLE II. Definitions and Criteria
- ARTICLE III. Declarations
- ARTICLE IV. Chemical Weapons
- ARTICLE V. Chemical Weapons Production Facilities
- ARTICLE VI. Activities not Prohibited Under this Convention
- ARTICLE VII. National Implementation Measures
- ARTICLE VIII. The Organization
- ARTICLE IX. Consultations, Cooperation and Fact-Finding
- ARTICLE X. Assistance and Protection Against Chemical Weapons
- ARTICLE XI. Economic and Technological Development
- ARTICLE XII. Measures to Redress a Situation and to Ensure Compliance, including Sanctions
- ARTICLE XIII. Relation to Other International Agreements
- ARTICLE XIV. Settlement of Disputes
- ARTICLE XV . Amendments
- ARTICLE XVI. Duration and Withdrawal
- ARTICLE XVII. Status of the Annexes
- ARTICLE XVIII. Signature
- ARTICLE XIX. Ratification
- ARTICLE XX . Accession
- ARTICLE XXI. Entry into Force
- ARTICLE XXII. Reservations
- ARTICLE XXIII. Depositary
- ARTICLE XXIV. Authentic Texts
- Annex on Chemicals
- Annex on Implementation and Verification (“Verification Annex”)
- Annex on the Protection of Confidential Information (“Confidentiality Annex”)



CHAPTER 6

Responsibilities, advice, training and assistance under the Conventions

CHAPTER 6

RESPONSIBILITIES, ADVICE, TRAINING AND ASSISTANCE UNDER THE CONVENTIONS

In the previous chapter we described the history and basic structure of three important international CBRN prohibition instruments, and we go on here to consider how the obligations on the States Parties bring with them opportunities for advice, training and assistance. These instruments are: the two disarmament treaties of the Chemical Weapons Convention (CWC) and the Biological Weapons Convention (BWC); and the United Nations Security Council Resolution 1540 which requires countries to take specific actions to prevent non-state actors such as terrorists acquiring the means to carry out CBRN attacks. By establishing linkages with the national bodies tasked with implementing the treaties, significant benefits of advice, training and new regulatory initiatives could be channelled into national and regional CBRN risk mitigation infrastructures.

SYNOPSIS

In the previous chapter, **Chapter 5**, we described the historical development and basic structures of several international treaties designed to prohibit CBR warfare and promote the peaceful uses of these agents, and also to prevent non-state actors such as terrorists from acquiring the means to acquire CBRN weapons and use them. Two prohibition treaties are particularly important for countries developing CBRN risks mitigation strategies, because these treaties provide immediate assistance and support for treaty implementation – including activities that can have important benefits for capacity building in CBRN risk mitigation at national and regional levels. They are:

- the Chemical Weapons Convention (CWC),[1] which bans chemical weapons (CW)
- the Biological and Toxin Weapons Convention (BTWC or BWC),[2] which bans biological weapons (BW)

Another recent treaty important to understand is UN Security Council Resolution 1540 (2004). This resolution requires countries to take active measures to close down the opportunities for non-state actors including terrorists to access materials and technology. National implementation of the requirements of the Resolution and the adoption of National Plans may be aided, on request, by the 1540 Committee of Security Council members, assisted by a Group of Experts, as a cooperation platform.

1 Full title: Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction.

2 Full title: Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction.

We here outline the responsibilities, advice, training and assistance activities under these three international instruments. A fourth instrument that is highly relevant to CBRN risk mitigation is the International Atomic Energy Agency (IAEA). The IAEA works worldwide in a multifaceted system to promote safe, secure and peaceful nuclear technologies and to inhibit military use. It is dealt with separately in **Chapter 11**.

UNSCR 1540. The 1540 Committee website describes responsibilities, reporting and assistance modalities for UN States. The Cooperation section of the website details Points of Contact in International, Regional and Sub-Regional Organisations, and in UN Bodies and Entities. The Transparency and Outreach section of the website provides an event calendar and related information. The 1540 Group of Experts facilitates technical assistance among countries and if requested help countries develop their own action plans to implement 1540 requirements. It is not, however, a project implementation system. Each state adopts its own implementation strategy for these requirements; the detail of national actions and the voluntary plan will vary. A CBRN CoE Partner Country's (PC) approach to 1540 may not fit with the formalised CoE self-assessment tools of the Needs Assessment Questionnaire (NAQ) and the National Action Plan (NAP). In 2016, the EU made a number of recommendations to improve the effectiveness of the 1540 Committee in providing advice and assistance to UN Member States. Suggestions were also made at an international seminar on UNSCR 1540 progress, held at Chatham House, London, on 5 November 2014.

The CWC. The Organisation for the Prohibition of Chemical Weapons (OPCW) provides outreach support to CWC State Parties (SPs) to assist them in capacity building with respect to three Articles of the CWC: implementation support, Article VII; assistance and protection, Article X; and peaceful uses of chemicals, Article XI. Outreach training includes protection against CW attack, so to help SPs meet the Article X requirement to adopt national protective measures that can also be offered to other SPs The Advisory Board on Education and Outreach (ABEO) is an important platform for chemicals safety and security. At the invitation of the UN Interregional Crime and Justice Research Institute (UNICRI), OPCW experts have provided briefings at CBRN CoE National Action Plan (NAP) workshops, to inform participants about CWC obligations and the related legally required capacity building in SPs – for a functioning CWC National Authority, legislation, preparedness and protection. Also provided are details of training already received by PC experts through OPCW outreach activities. The OPCW Technical Secretariat (TS) provides expert advice on the development of a SP's capacity to respond to an emergency in the event of the use of chemical weapons or the misuse of toxic chemicals, and has set up the Rapid Response and Assistance Mission (RRAM) to provide assistance upon request. There are TS initiatives on integrated chemicals management, the enhancement of laboratory capabilities (analytical chemistry courses and twinning of laboratories), and the promotion of chemical knowledge. An example was a regional basic training course on emergency response to chemical incidents for ASEAN countries, in May 2019. The EU has provided substantial funds, now totalling EUR 12,016 million, to support elements of this OPCW outreach, by means of European Council Joint Actions/Decisions.

The BWC. Although there is no sign of renewed progress towards a future verification Protocol (see Chapter 5), the establishment of the Implementation Support Unit (ISU) at the 2006 BWC Review Conference has facilitated treaty implementation including submission of the CBMs and general communication between SPs. However, by 2016 still less than half of SPs had submitted CBMs. The UN office in Geneva publishes an electronic guide to submission of CBMs: the first step suggested is to nominate a national contact point, and to inform the ISU. The ISU

produces a regular Newsletter.[3] A SP that requires support is recommended to explore the BWC Assistance and Cooperation Database, a secure web-based platform for SPs. It enables SPs to submit requests and offers for assistance and cooperation on a voluntary basis, individually or in collaboration with other states or international organisations. Financial support by the EU, channelled to specific projects, has been important. To date there have been five Council Joint Actions/Council Decisions, the latest from January 2019 brings the total contribution to EUR 9,337 million. These contributions aim to support the BWC and the work of ISU on international, regional and national levels.

Some details are provided in annexes:

- **Annex 1.** UN 1540 website: headings in the section on Frequently Asked Questions.
- **Annex 2.** Some key recommendations of the OPCW ABEO Report on the role of Education and Outreach in preventing the re-emergence of Chemical Weapons.
- **Annex 3.** Examples of OPCW seminars and workshops on offer from 2019 onwards.
- **Annex 4.** Article X of the BWC (that covers assistance and protection).

KEY TERMS

- **ABEO:** Advisory Board on Education and Outreach, a function within the Technical Secretariat of the CWC.
- **BWC (or BTWC):** Biological and Toxin Weapons Convention. The full title is Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction. The BWC was the first multilateral disarmament treaty banning an entire category of weapons. It opened for signature in 1972, entered into force in 1975, and enjoys almost universal membership today
- **CBMs:** Confidence Building Measures. Important for the exchange of information between BWC States Parties.
- **CWC:** Chemical Weapons Convention. The full title is Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction. Signed in 1993, it entered into force in 1997.
- **IAEA:** The International Atomic Energy Agency. A UN organization that seeks to promote the peaceful use of nuclear energy, and to inhibit its use for any military purpose, including nuclear weapons. Though established independently of the United Nations through its own international treaty, the IAEA Statute, the IAEA reports to both the UN General Assembly and Security Council.
- **ISU:** Implementation Support Unit of the BWC. Established by the sixth BWC review conference, in November 2006, to provide administrative support to the BWC and facilitate the CBMs and communication between State Parties.

3 UNOG. Newsletter on the the 'Latest Information' section of the UN Office at Geneva website. https://www.unog.ch/bwc/news.

- **NA:** National Authority, for example as explicitly required for each CWC State Party.
- **PC:** Partner Country, according to context in the EU-CBRN CoE initiative or under UNSCR 1540.
- **Protocol:** In international law, this is a treaty or international agreement that supplements an existing one. A protocol can amend the previous treaty, or add additional provisions.
- **RRAM:** Rapid Response and Assistance Mission, of the CWC TS.
- **TS:** Technical Secretariat, one of the principal organs of the OPCE, The others are the Conference of the States Parties and the Executive Council.[4]
- **UNSCR 1540:** United Nations Security Council 1540 (2004).
- **UNICRI:** UN Interregional Crime and Justice Research Institute.
- **Verification:** verification measures under an arms control treaty can include on-site inspections and exhibitions, data exchanges and notifications related to offensive arms and facilities covered by the treaty, and the use of technical means for treaty monitoring.
- **WMD:** Weapons of Mass Destruction. UN Security Council Resolution 1540 implicitly defines weapons of mass destruction as nuclear, chemical and biological weapons, including their means of delivery (missiles, rockets and other unmanned systems).

4 OPCW. The structure of the OPCW. Fact Sheet 3. https://www.opcw.org/sites/default/files/documents/Fact_Sheets/English/Fact_Sheet_3_-_OPCW_Structure.pdf.

A · UN SECURITY COUNCIL RESOLUTION 1540 (2004)

European Union (EU) outreach support to capacity building of export controls also directly supports the goal of United Nations (UN) Security Resolution 1540 (UNSCR 1540) implementation. In February 2016, the EU Outreach in Export Control programme was renamed to the EU P2P (Partner-to-Partner) Export Control Programme.[5] The current aim of the programme is to increase the effectiveness of export control systems in 34 countries from six regions and help them to comply with the obligations in UNSCR 1540. From 2017, training sessions have already included licensing and enforcement officials from Malaysia, Philippines, Laos, Myanmar. There was an initial visit to Malaysia on 28 Nov 2018.
The 1540 Committee website describes responsibilities, reporting and assistance modalities for UN States.[6] Helpfully, It starts with a 'Frequently asked Questions' format, the headings for which are listed in Annex 1 below. According to the website, 103 states have now provided national Points of Contact. There are details of how to request assistance and lists of the countries that have received assistance in the past or have requests pending. Requests by CoE SEA Region countries, with details of subjects covered, were:

Past:

- Brunei Darussalam. 26 December 2007
- Cambodia. 21 March 2005
- Philippines. 28 October 2004 and 28 October 2005
- Thailand. 5 November 2004
- Vietnam. 7 March 2008

Pending:

- Colombia. 7 January 2011

Visits can be used to discuss any matter related to the implementation of Resolution 1540, such as national implementation efforts, assistance needs, first report/additional information, national action plans, effective practices etc.[7]

The Cooperation section of the website details Points of Contact in International, Regional and Sub-Regional Organisations, and in UN Bodies and Entities. The Transparency and Outreach section provides an Event calendar and related information. The section on Comprehensive and Annual Reviews provides links to these documents, the most recent Comprehensive Review being dated 2016. The 2018 Annual Report[8] proposes *inter alia* that:

5 EU. P2P export control programme. https://export-control.jrc.ec.europa.eu/.

6 1540 Committee. Security Council Committee established pursuant to resolution 1540 (2004). https://www.un.org/en/sc/1540/faq.shtml#13.

7 UNSC 1540. Presentation to the 25th Asian Export Control Seminar, Tokyo, 27 February 2018. Gennady Lutay, Member, Group of Experts assisting the UNSCR 1540 Committee. https://supportoffice.jp/outreach/2017/asian_ec/pdf/21Mr.GennadyLutayUNSecurityCouncil1540(2004).pdf.

8 UNSC. Letter dated 28 December 2018 from the Chair of the Security Council Committee established pursuant to resolution 1540 (2004) addressed to the President of the Security Council. S/2018/1178. https://undocs.org/S/2018/1178.

- The training course for points of contact for Resolution 1540 continues to prove its worth as a useful tool in fostering regional networks of officials dedicated to facilitating the implementation of the resolution;
- The Committee should continue to engage with States that decided to invite them to assist them in developing voluntary national implementation action plans;
- The Committee will seek opportunities to hold meetings with relevant specialised international organisations to improve cooperation in assistance and the exchange of information on technical issues;
- The Committee should continue to increase efforts to raise awareness among parliamentarians and other high-level decision makers;
- The Committee should continue to support dialogue between States and industry, where appropriate, on the effective implementation of export controls.

It must be understood that the 1540 Committee with its Group of Experts is not a project implementation system – all it can do is facilitate technical assistance among countries and if requested help countries develop their own action plans to implement the 1540 requirements. Committee experts make this clear; for example, a 2018 presentation stated '*The 1540 Committee itself does not provide assistance but it has a clearing house and matchmaking role to facilitate assistance by others for implementation of the resolution*.[9]

In 2016, the EU made a number of detailed recommendations to improve the effectiveness of the 1540 Committee in providing advice and assistance to UN Member States.[10] The points made include:

- The Committee should be in a position to recommend voluntary visits to States (rather than waiting for requests). Such visits could be used to review a State's progress on implementation, provide updates on relevant legislation and measures adopted and identify possible assistance needs for capacity building;
- At present, international efforts against the proliferation of Weapons of Mass Destruction (WMD), especially to terrorist groups, are built on a plethora of programmes, legal instruments and initiatives linked by complex relationships and interactions. These include treaties and conventions, export control regimes, the security of nuclear materials, biosecurity, chemical safety and destruction of WMD. The 1540 Committee and its Group of Experts should fully assume its role in liaising with other relevant regimes and organisations, including the IAEA, Organisation for the Prohibition of Chemical Weapons (OPCW), The Implementation Support Unit set up under the Biological Weapons Convention (BWC-ISU) and the multilateral export control regimes, to coordinate and streamline actions and initiatives on UNSCR 1540. Enhanced coordination and exchange of information will promote synergies and avoid overlap;

9 UNSC 1540. At the 25th Asian Export Control Seminar, Tokyo, 27 February 2018. Gennady Lutay, Member, Group of Experts assisting the UNSCR 1540 Committee. https://supportoffice.jp/outreach/2017/asian_ec/pdf/21Mr.GennadyLutayUNSecurityCouncil1540(2004).pdf.

10 EU. Report by the European Union on EU support to the full and universal implementation of UN Security Council Resolution 1540(2004). Ref. Ares(2016)2646123 - 07/06/2016. https://eeas.europa.eu/sites/eeas/files/eu_support_to_1540.pdf.

- With its voluntary, bottom-up and regional approach, the EU-CBRN CoE initiative is providing an important contribution to UN Security Council Resolution 1540. Further mutual cooperation could be pursued on the following activities:
    - information sharing, at an agreed regularity, on networks of national and regional contact points and national teams, giving due consideration to maintaining confidentiality of sensitive information and partner countries' (PC) agreement;
    - coordination over the methodology to be applied to interaction and exchanging information with the regional and national contact points of such networks; coordination on the planning of events in selected countries including, where appropriate, mutual invitations for preparing and participating in such events; cooperation and effective partnership on technical matters in order to:
        - capitalise on overlaps and complementarities between programmes and objectives;
        - avoid duplication of efforts;
        - further develop capacities and communication between State authorities of the same region and information and best practices sharing between regions;
    - Adopt a synergic approach in line with the methodology and toolkits developed by the European Commission for performing needs assessments at national level and developing comprehensive CBRN national action plans.
- Using the EU-CBRN CoE's structure and identification methodology, the scope of CBRN will be progressively extended to other areas considered as emerging priorities or as regional priorities not well covered by the partner countries. These could include security of maritime borders and deep sea harbours in Africa, the fight against counterfeit medicines and the mining and transport of radioactive materials.

Observations from discussions with Committee experts, at an international seminar[11] on UNSCR 1540 progress, at Chatham House, London, on 5 November 2014 suggest the following:

- The Committee experts may tend to be unaware of the work done under the CBRN CoE with regard to export controls of dual use goods and border monitoring to prevent illicit trafficking – both activity areas that relate directly to the 1540 mandate;
- There is a mismatch between the regional approach adopted under the CoE system and the UN regional approach, leading to confusion and complications for CoE PCs;
- Each state makes its own choices for how to implement the requirements of UNSCR 1540. The detail of national actions and the voluntary plan depends on their policies on priorities and approach. The chosen PC approach for 1540 may not fit with the formalised CoE self-assessment tools of the Needs Assessment Questionnaire (NAQ) and the National Action Plan (NAP);

11 UNSCR 1540 Ten years on: challenges and opportunities. Meeting at International Security Department, Chatham House, London, 5 November 2014. https://www.chathamhouse.org/sites/default/files/field/field_document/UNSCR%201540-summary.pdf.

- This conceptual difference with the CoE initiative may make it difficult for the CoE PC to understand the relationship between the two processes, which at the national level can lead to disconnect and at the same time duplications, a multitude of Points of Contact, of entry points into national systems, and of action plans and activities;
- There are long recognised risks to smaller countries of "reporting fatigue" and overload with regard to their capacity to absorb technical assistance in this field and develop and apply additional action plans.

B · THE CHEMICAL WEAPONS CONVENTION (CWC)

The Organisation for the Prohibition of Chemical Weapons (OPCW) provides outreach support to CWC State Parties (SPs) to assist them in capacity building in respect of three Articles of the CWC: *implementation support*, re Article VII; *assistance and protection*, Article X; and *peaceful uses of chemicals,* Article XI. Support has largely focused on countries of Africa, Asia and Latin America.

The OPCW began education and outreach activities early on. In 2001, the "Ethics Project" was launched to guide the responsible practice of chemistry, producing The Hague Ethical Guidelines;[12] this subsequently inspired a new code of practice, The Global Chemists Code of Ethics, drafted in 2016 at a workshop in Kuala Lumpur.[13] Other OPCW resources that were early developed include the first "FIRES" films,[14] short videos to raise awareness about CW issues; and the "Multiple Uses of Chemicals" website, which was updated in 2013. This is an interactive website that allows educators, students, policy makers, and the public to explore the beneficial uses, misuses, and abuses of multi-use chemicals.[15] There is also an e-learning Website to provide National Authorities with guidance about declarations and their preparations to receive site inspections under the Verification Regime.[16]

Outreach action of the OPCW continues to expand. With regard to chemical safety and security, the Third Review Conference report[17] in 2013 "… *welcomed the role of the OPCW as a platform for voluntary consultations and cooperation among the States Parties and the relevant stakeholders, including the private sector and academia, to promote a global chemical safety and security culture.*" In 2015, following the recommendations of the Conference and the Scientific Advisory Board's Temporary Working Group on Education and Outreach, the Advisory Board on Education and Outreach (ABEO) was established. The ABEO provides specialised advice in areas of education and outreach relevant to the OPCW's mandate.[18] ABEO Members serve in a personal capacity (not as representatives of their countries); a current member is Professor Mohd Jamil Bin Maah of **Malaysia**. In 2017, the Board submitted its first report (ABEO-

12 OPCW. The Hague Ethical Guidelines. https://www.opcw.org/hague-ethical-guidelines.

13 OPCW Ethical Guidelines Inspire Global Chemists' Code. 8 June 2016. https://www.opcw.org/media-centre/news/2016/06/opcw-ethical-guidelines-inspire-global-chemists-code.

14 OPCW. Fires. The OPCW's Short Documentary Video Project. https://www.opcw.org/fires.

15 OPCW and IUPAC. Update educational materials for raising awareness of the multiple uses of chemicals and the Chemical Weapons Convention. 26 November 2013. https://www.opcw.org/media-centre/news/2013/11/opcw-and-iupac-update-educational-materials-raising-awareness-multiple.

16 OPCW E-Learning. https://www.opcw.org/opcw-e-learning.

17 In: Report of the Third Special Session of the Conference of the States Parties to Review the Operation of the Chemical Weapons Convention, 19 April 2013. paragraph 9.127.

18 OPCW. https://www.opcw.org/about-us/subsidiary-bodies/advisory-board-education-and-outreach.

5/1) on the role of education and outreach in preventing the re-emergence of chemical weapons.[19] This will form the basis for a user-friendly brochure on education and outreach for direct use in SPs. Key recommendations of this ABEO report are shown in **Annex 2** below.

Outreach training includes protection against CW attack, so as to help SPs meet the Article X requirement to adopt national protective measures that can also be offered to other SPs. In practice, this national response capacity also contributes to arrangements for dealing with industrial accidents. Although for many states the actual priority may be industrial safety, taking advantage of this OPCW training is expected to draw the state towards the other requirements of the CWC. The OPCW web site has recently been relaunched. It includes an interactive management system (Eventus) that lists upcoming courses and workshops in the three areas of Assistance and Protection, International Cooperation, and Implementation Support, describing the objectives, scope and target countries for each event.[20] More detail of proposed events is given in the Calendar page of the web site.[21] Annex 3 below lists some of the future events currently on the OPCW Calendar at February 2019, as an illustration of the typical range of events.

At the invitation of the UN Interregional Crime and Justice Research Institute (UNICRI), OPCW experts have provided briefings at CBRN CoE NAP workshops, to inform participants about CWC obligations and the related legally required capacity building in SPs – for a functioning CWC National Authority, legislation, preparedness and protection - and details of training already received by PC experts through the OPCW outreach activities. This was seen as a means to encourage coordination at PC and regional levels between skill building under the two mechanisms of OPCW support to the CWC NA and the EU CBRN CoE supported projects. As at 31 July 2017, 190 of the 193 SPs had established or designated their CWC National Authority; 153 SPs had adopted national implementing legislation, and 122 had legislation covering all the initial measures.[22]

In preparation for the CWC 4th Review Conference in 2018, The OPCW Technical Secretariat (TS) provided a note of OPCW activities since the third Conference in 2013.[23] In the interim, four countries had joined the Convention - Angola, Myanmar, the Syrian Arab Republic, and Somalia. To assist **national implementation,** country-to-country support had been encouraged: examples are the Mentorship/ Partnership Programme for NAs, and the Influential Visitors Programme through which key national decision makers are invited to attend briefings at OPCW Headquarters.

Under **assistance and protection** against the use or threat of use of chemical weapons, the TS continued to provide expert advice on the establishment or further development of SPs' capacity to respond to an emergency in the event of the use of chemical weapons or the misuse of toxic chemicals, and set up the

19 OPCW. Report on the Role of Education and Outreach in Preventing the Re-Emergence of Chemical Weapons. ABEO-5/1, 12 February 2018. https://www.opcw.org/sites/default/files/documents/ABEO/abeo-5-01_e.pdf.

20 OPCW. Eventus OPCW Management System. https://apps.opcw.org/eventus.

21 OPCW Calendar. https://www.opcw.org/calendar.

22 OPCW. Note by The Technical Secretariat. Review of the operation of the Chemical Weapons Convention since the Third Review Conference. WGRC-4/S/1 29 May 2018. Para 2.10. https://www.opcw.org/sites/default/files/documents/CSP/RC-4/en/wgrc4s01_e_.pdf.

23 OPCW. Note by the Technical Secretariat. Review of the operation of the Chemical Weapons Convention since the Third Review Conference. WGRC-4/S/1 29 May 2018. https://www.opcw.org/sites/default/files/documents/CSP/RC-4/en/wgrc4s01_e_.pdf.

Rapid Response and Assistance Mission (RRAM)[24] as a mechanism to provide assistance to affected SPs upon request. Under **International Cooperation,** the TS had launched new programmes and initiatives that focus on integrated chemicals management, the enhancement of laboratory capabilities (analytical chemistry courses and twinning of laboratories), and the promotion of chemical knowledge. An example for 2019 is a regional basic training course on emergency response to chemical incidents for SPs in Asia, in May 2019.[25] The TS organised 529 activities under Article 11, benefiting a total of 2,884 participants from various States Parties. Financial sponsorship was provided for 56 scientific fellowships and 70 international conferences. The TS donated and/or facilitated the transfer of 92 pieces of functional laboratory equipment.

EU funding support.

The 'core' OPCW budget cannot cover the full set of objectives for outreach and education, but the OPCW has been able to obtain significant funding support from the EU. The OPCW submits detailed proposals for specific projects to the EU Member State diplomatic forum in The Hague; proposals are refined jointly, and the OPCW has on occasion briefed CODUN[26] in Brussels. To date, the EU has acceded to requests on six occasions, by means of Council Joint Actions/Decisions. The latest funding instrument was Council Decision (CFSP) 2015/259, to run for 36 months; that contribution of EUR 2,528,069 brings the total to EUR 12,016 million. The project areas covered in this latest instrument are: National Implementation, Verification and Universality; International Cooperation; Science and Technology; Preparedness of State Parties to prevent and respond to attacks involving chemicals; Universality and outreach; Africa Programme. Full details of the total of 35 proposed activities to receive support under these headings are published in the Annex to the Decision.[27] To date, laboratory equipment has sometimes been included in the various projects proposed to the EU, but not Personal Protective Equipment.

The EU has also provided financial support to the other OPCW activities: for example, DG DEVCO contributed EUR 12m to the Trust Fund managed under OPCW IFS/2014/337084 – 'Contribution to the Organisation for the Prohibition of Chemical Weapons (OPCW) Special Trust Fund to finance the activities for the complete destruction of Syrian Chemical material stockpiles.

C · THE BIOLOGICAL WEAPONS CONVENTION (BWC)

Although there is no sign of renewed progress towards a future verification protocol, the establishment of the Implementation Support Unit (ISU) at the 2006 BWC Review Conference has facilitated treaty implementation including submission of the CBMs and general communication between SPs. The ISU reports that more than 100 BWC States Parties have provided a national point of contact – though there is no obligation to do this. The functions suggested by the conference for a national focal point were:

- Coordinating the national implementation of the Convention and communicating with other States Parties and relevant international organisations;

24 OPCW. Note by the Technical Secretariat. Establishment of a Rapid Response Assistance Team. S/1381/2016. 10 May 2016. https://www.opcw.org/sites/default/files/documents/S_series/2016/en/s-1381-2016_e_.pdf.

25 OPCW. Note by the Director General. Call for nominations for the Eighth Regional Basic Training Course on emergency response to chemical incidents for States Parties in Asia, Seoul, Republic of Korea. 13-17 May 2019. S/1706/2019, 22 January 2019. https://www.opcw.org/sites/default/files/documents/2019/01/s-1706-2019%28e%29.pdf.

26 CODUN is the EU Member States' Working Party on Global Disarmament and Arms Control (CODUN). https://www.consilium.europa.eu/en/council-eu/preparatory-bodies/working-party-global-disarmament-arms-control/.

27 European Council. COUNCIL DECISION (CFSP) 2015/259 of 17 February 2015. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015D0259&from=EN.

- Preparing the submission of confidence-building measures;
- Facilitating information exchange of universalisation efforts[28]

The BWC Assistance and Cooperation database, which includes offers of and requests for assistance by SPs, was established by the Seventh Review Conference in 2011 primarily to facilitate the implementation of Article X (see Annex 4 below). The 2016 Eighth Review Conference instructed the ISU to consult with SPs to improve the database and make it more user friendly. The new interactive database can be accessed at https://bwc-articlex.unog.ch/.

While there has been a steady increase in CBM submissions by SPs, from only 16 in the first year (1987), by 2016 still less than half of SPs had submitted CBMs.[29] The CBMs currently consist of a set of six measures (CBM D was deleted from the list at the Seventh Review Conference):

- CBM A. Research centres, laboratories and biological defence research and development programmes;
- CBM B. Exchange of information on outbreaks of infectious diseases and similar occurrences caused by toxins;
- CBM C. Encouragement of publication of results and promotion of use of knowledge;
- CBM E. Declaration of legislation, regulations and other measures;
- CBM F. Declaration of past activities in offensive and/or defensive biological research and development programmes;
- CBM G. Declaration of vaccine production facilities.

The UN office in Geneva publishes an electronic guide to participation in the annual round of CBMs.[30] The first step suggested is to nominate a national contact point, and inform the ISU. It can also be helpful to designate focal points having access to relevant information in government departments, agencies or other national bodies; these names need not be reported to the ISU. Some SPs have decided to re-use information already provided to other international organisations and treaties, such as The World Health Organisation (WHO); UNSCR 1540; The Food and Agriculture Organisation of the United Nations (FAO); The World Organisation for Animal Health (OIE).

There are forms for each CBM, and a cover page declaration, sometimes referred as “Form 0”. For each CBM form, there are any instructions on completion which were drafted at the Third and Seventh Review Conferences, together with extensive additional guidance developed since, and an example of a completed form.

28 The Biological Weapons Convention. An introduction. June 2017. UNODA. https://www.unog.ch/80256EDD006B8954/(httpAssets)/6D16C7B1933F0937C125815D00349763/$file/BWS%20brochure.pdf.

29 The Biological Weapons Convention. An introduction. June 2017. UNODA. https://www.unog.ch/80256EDD006B8954/(httpAssets)/6D16C7B1933F0937C125815D00349763/$file/BWS%20brochure.pdf.

30 UNODA. Guide to Participating in the Confidence-Building Measures of the Biological Weapons Convention. https://www.un.org/disarmament/publications/more/cbm-guide/.

A SP that requires support is recommended to explore the BWC Assistance and Cooperation Database,[31] a secure web-based platform for BWC SPs. It enables SPs to submit requests and offers for assistance and cooperation on a voluntary basis, individually or in collaboration with other states or international organisations. These exchanges can include requests and offers for equipment or information regarding the peaceful use of biological and toxin agents. The offers are openly accessible, but requests are password protected and are only available to SPs and the ISU.

The public part of the data base breaks down the numbers of offers and requests by category of topic, as at 16 February 2019 as follows:

- Biorisk Management, including Biosafety and Biosecurity. 6 offers, 16 requests.
- Capacity building. Training and Educations. 2 offers, 13 requests.
- CBMs related assistance. 4 offers, 3 requests.
- Disease surveillance and detection. 15 offers, 2 requests.
- Emergency response and assistance. 3 offers, 1 request.
- Legislative assistance. 4 offers, 7 requests.
- Scientific cooperation and joint research. 11 offers, 1 request.
- Outreach. No offers, 1 request.
- Transfer of materials, agents and technology. No offers, 1 request.

EU funding support

Pundits have suggested that the BWC faces significant challenges about funding. The ISU has no significant funding except for limited travel. SPs fund the ISU through annual assessed contributions, but some countries have tended to be in arrears.[32], [33] Financial support by the EU, channelled to specific projects, has therefore been important. To date there have been five Council Joint Actions/Council Decisions, the latest being Council Decision (CFSP) 2019/97 of 21 January 2019, running for 36 months and bringing the total contribution to EUR 9,336,856.[34], [35] These contributions aim to support the BWC and the work of ISU on the international, regional and national levels, this latest Decision through six major projects corresponding to measures of the EU Strategy against Proliferation of Weapons of Mass Destruction:

- Support for BWC universalisation;
- Capacity development in support of BWC national implementation;

31 BWC Article X. Assistance and Cooperation. https://bwc-articlex.unog.ch/.

32 Jenkins B. Order from Chaos. The Biological Weapons Convention at a crossroad. 6 September , 2017. Brookings. https://www.brookings.edu/blog/order-from-chaos/2017/09/06/the-biological-weapons-convention-at-a-crossroad/.

33 UN Secretariat. Summary status of contributions of BWC, CCW, CCM, OTW as at 01 January 2019. https://www.unog.ch/80256EDD006B8954/(httpAssets)/9B72B63B2F190F09C1258389004B2EA2/$file/Disarmament+Receivables+For+Website+01+January+2019+Annexes.pdf.

34 UNOG. European Union Support to the Biological Weapons Convention. https://www.unog.ch/80256EE600585943/(httpPages)/1ABD96932A955C6AC1257F9B0031C22E?OpenDocument.

35 European Council. Council Decision (CFSP) 2019/97 of 21 January 2019. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019D0097&qid=1548153556879&from=EN.

- Fostering biosecurity networks in the Global South;
- Supporting the inter-sessional programme and preparations for the Ninth Review Conference of the BWC;
- Preparedness of States Parties to prevent and respond to attacks involving biological agents;
- Enabling tools for outreach, education and engagement.

The ISU produces a regular Newsletter, available on the in the 'Latest Information' section of the UNOG website.[36] Among the many relevant symposia and workshops listed for 2017 and 2018, the following illustrate the types of events specifically organised by the ISU:

- Universalisation workshop for the Pacific Region in Nadi, Fiji, on 12 and 13 December 2018.
- A workshop on "The Importance of Disease Surveillance and Alert Mechanisms: Lessons for the BWC", in Geneva, on 20 November 2018.
- Norway/ISU workshop on Article X, on 22 June 2018.
- On 8 November 2017, the Geneva Centre for Security (GCSP) jointly co-organised with the BWC ISU a workshop in preparation for the Meeting of States Parties to the BWC.
- Regional Workshop for the Pacific Region. On 27-28 July 2017, a regional workshop on universalisation, hosted by Fiji, took place in Nadi. The workshop was organised in cooperation with the UNODA and the ISU, with the financial support of the EU.
- African Parliamentary Workshop on the BWC in Sierra Leone - on 27 March 2017, the Chief of the ISU participated via video-link in a Regional Africa parliamentary workshop to promote ratification and implementation of the BWC.

Other useful sources of information are:

- States Parties Article X implementation reports: https://www.unog.ch/80256EE600585943/(httpPages)/226CFDF7E6D66BE4C1257AC4004A1FF8?OpenDocument (includes reports from the Global Partnership activities too)
- The resource repository on the BWC website, which provides link to resources that can assist with national implementation: https://www.unog.ch/80256EE600585943/(httpPages)/0A20E57D9F8424B8C12581D8007EC32E?OpenDocument
- VERTIC's National Implementation Measures (NIM) Programme: http://www.vertic.org/pages/homepage/programmes/national-implementation-measures/biological-weapons-and-materials.php

36 UNOG website, https://www.unog.ch/bwc/news.

ANNEX 1

UN 1540 WEBSITE: HEADINGS IN THE SECTION ON FREQUENTLY ASKED QUESTIONS

Ref: 1540 Committee. *Frequently Asked Questions on Resolution 1540 (2004).* https://www.un.org/en/sc/1540/faq.shtml

- What is resolution 1540 (2004) and what is its significance?
- What does resolution 1540 (2004) require from States?
- Why is resolution 1540 (2004) relevant to States that do not possess weapons of mass destruction?
- What is the added value of UNSC resolution 1540 (2004) when most States have already undertaken international obligations in the non-proliferation areas, for example, through the Nuclear Non-proliferation Treaty, the Chemical Weapons Convention, and the Biological and Toxin Weapons Convention?
- How does resolution 1540 (2004) relate to counter-terrorism effort?
- What is the 1540 Committee and how do the Committee and its experts function?
- Is the 1540 Committee a sanctions committee? Does the 1540 Committee conduct any investigation or prosecution?
- What is the relationship between the 1540 Committee and the other Security Council Committees in the area of counter-terrorism?
- What role do international, regional and sub-regional organisations play in the implementation of the resolution, and how does the Committee liaise with them?
- How does the Committee encourage States to implement the resolution?
- What is the 1540 Committee matrix and what do the symbols “X” and “?” mean in the matrix?
- What are the control lists that we can refer to when implementing export controls?
- How often should States report to the Committee?
- What type of assistance is available?
- What is the mechanism of matching offers and assistance requests?
- What is the link between capacity building in the context of resolution1540 and development?

ANNEX 2

SOME KEY RECOMMENDATIONS OF THE OPCW ABEO REPORT ON THE ROLE OF EDUCATION AND OUTREACH IN PREVENTING THE RE-EMERGENCE OF CHEMICAL WEAPONS

Ref: ABEO-5/1, 12 February 2018. https://www.opcw.org/sites/default/files/documents/ABEO/abeo-5-01_e.pdf

- The OPCW should reach out to new stakeholder communities to raise awareness about their possible contributions to the "prevention of the re-emergence of chemical weapons"; and promote professional, scientific, and business cultures that aim to reduce the risks of inadvertently undermining the norm against chemical weapons.
- The OPCW should systematically develop more interactive approaches across the full range of its E&O activities. The design of activities should include greater emphasis on assessing the effectiveness of teaching or training. Courses and other activities therefore need to be designed with clear goals and measurable objectives.
- That the OPCW use its existing processes to support NAs, through assitance and training, to build their capacity to carry out E&O. In addition, existing E&O materials should be adapted for more effective use.
- To ensure a sense of common purpose among all E&O activities directed at different types of audiences in different parts of the world, the adoption of an overarching theme is recommended. The phrase "preventing the re-emergence of chemical weapons" reflects a primary goal of the OPCW and is sufficiently malleable that it can be adapted to many different E&O settings.

ANNEX 3

EXAMPLES OF OPCW SEMINARS AND WORKSHOPS ON OFFER FROM 2019 ONWARDS

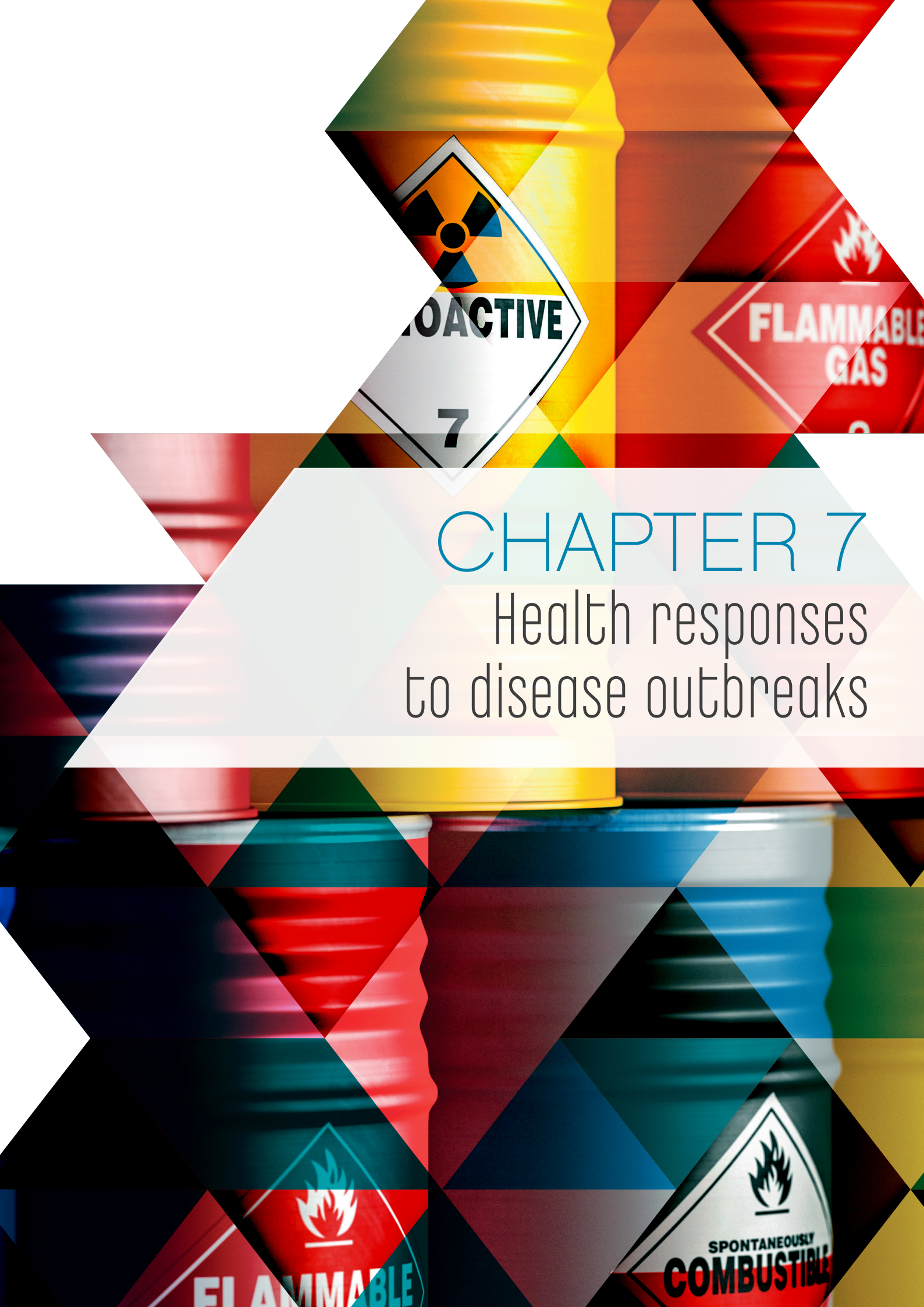
- General Training Course on the Chemical Weapons Convention for the Personnel of National Authorities and Relevant Stakeholders. At OPCW Headquarters, The Hague, The Netherlands, 25 February – 1 March 2019
- Seminar on the CWC and Chemical Safety and Security Management for Member States in the Asia Region. Doha Regional Centre for CBRN Training Doha, Qatar. 26–28 February 2019
- Internship Programme for Legal Drafters and National Authority Representatives. OPCW Headquarters, The Hague, the Netherlands. 4 March –22 November 2019

- Mentorship/Partnership Programme for National Authorities of States Parties to the CWC 2019. OPCW Headquarters, The Hague, The Netherlands 15 March 2019–31 December 2020
- Basic Course on Response to Chemical Attacks and Incidents with Toxic Industrial Chemicals for States Parties from the Latin America and Caribbean Region. Panama City, Panama. 11–15 March 2019
- Regional Training Course on Fulfilling Declarations and Inspections Obligations under Article VI of the Chemical Weapons Convention. Panama City, Panama. 25–29 MARCH 2019
- Analytical Chemistry Course (Africa Programme). Protechnik Laboratories, Pretoria, South Africa. 13–24 May 2019
- The Eighth Regional Basic Training Course on Emergency Response to Chemical Incidents for States Parties in Asia. Seoul, Republic of Korea. 13–17 May 2019
- Two Research Fellowships in Analytical Chemistry Skills Development. VERIFIN Laboratory, Finland. 1 September 2019
- Wuppertal Annual Courses on Loss Prevention and Safety Promotion in the Chemical Process Industries. University of Wuppertal, Wuppertal, Germany. 23–27 September 2019

ANNEX 4

ARTICLE X OF THE BWC

- The States Parties to this Convention undertake to facilitate, and have the right to participate in, the fullest possible exchange of equipment, materials and scientific and technological information for the use of bacteriological (biological) agents and toxins for peaceful purposes. Parties to the Convention in a position to do so shall also co-operate in contributing individually or together with other States or international organisations to the further development and application of scientific discoveries in the field of bacteriology (biology) for the prevention of disease, or for other peaceful purposes.
- This Convention shall be implemented in a manner designed to avoid hampering the economic or technological development of States Parties to the Convention or international co-operation in the field of peaceful bacteriological (biological) activities, including the international exchange of bacteriological (biological) agents and toxins and equipment for the processing, use or production of bacteriological (biological) agents and toxins for peaceful purposes in accordance with the provisions of the Convention.



CHAPTER 7
Health responses to disease outbreaks

CHAPTER 7

HEALTH RESPONSES TO DISEASE OUTBREAKS

Chapter 7 considers health arrangements for events of infectious disease, poisoning and harm from exposure to radioisotopes – i.e. variously involving CBRN materials as the causative agent. Human health is normally dealt with in public health infrastructures; there are separate infrastructures for animal or veterinary health, and phytosanitary infrastructures to deal with plant pests and diseases. We do not cover ancillary aspects such as food safety and the regulation of medicines and vaccines.

Three principal international bodies within the UN system regulate, monitor, advise and coordinate assistance to the health systems of individual countries on disease prevention and response, with the objective of improving health worldwide:

- The World Health Organisation (WHO), for human health.
- The World Organisation for Animal Health (OIE), for animal health.
- The Food and Agricultural Organisation (FAO), mandated to defeat hunger by defeating disease of human, animals and plants.

WHO rules for countries were extended significantly in the International Health Regulations of 2005, to require notification of **any disease event (infectious or non-infectious)** which may constitute a public health emergency of international concern.
Each country will have particular frameworks at national and district/local level to identify events of infectious disease or poisoning, with arrangements differing also between regions for historic, cultural and economic reasons and reflecting the prevailing diseases. We pay special attention to the situation in the countries of the SEA region The EU has provided significant support to capacity building on health preparedness and response in partner countries through its EU-CBRN CoE initiative. The European Centre for Disease Prevention and Control (ECDC) has provided scientific advice and leadership to some EU-CBRN CoE projects, and it can support national and international field response through missions.

SYNOPSIS

In this chapter we deal with health arrangements for events of infectious disease, poisoning or harm from exposure to radioisotopes – i.e. involving CBRN materials as the causative agent. Health arrangements for humans are usually called public health; those for animals are animal or veterinary health, those for plant pests and diseases are sometimes labelled as phytosanitary. We do not cover ancillary aspects such as food safety and the regulation of medicines and vaccines.
Each country will have particular frameworks at national and district/local level to identify new events of infectious disease or poisoning, with patterns differing also between regions because surveillance and response systems will have evolved differently as a reflection of a country's historic, cultural and economic contexts and the prevailing diseases. Disease reporting is likely to include 'alert' triggers, requiring '**notification**' to health authorities of disease capable of

causing human epidemics or impacts on economically important livestock. In practice, the efficiency of all this may vary from country to country.

Surveillance is the collection, collation, analysis and distribution of information relevant to the control of **human, animal or plant disease** and its prevention. Data may be formal or informal, from sources such as clinicians, hospitals, laboratories, veterinarians, pharmacies, farmers, abattoirs, morgues, wildlife rangers, the media and the public. Ongoing disease surveillance provides local baseline data to allow the **early detection** of new, emerging or re-emerging endemic, or non-endemic,[1] transmittable diseases that have the potential to escalate into epidemics which threaten the wellbeing of local populations and seriously disrupt trade, travel and food security.

The new global challenges. Since infectious disease does not stop at national borders, the movement of people, animals and plants also brings pressures to share information with other countries about local disease outbreaks. The notion that such international liaison is in the interests of all parties is not new: for instance, the cholera epidemics in Europe between 1830 and 1847 stimulated new cooperative efforts which culminated in the first International Sanitary Conference in 1851.[2]

Experience of the Severe Acute Respiratory Syndrome (SARS) outbreak that began in China in 2002 showed that the entire world is increasingly vulnerable to an epidemic from a single source. International air traffic is a very fast vector for international contagion, so a few unexpected cases can quickly affect economies, trade, and the service sector of tourism. For SARS, there were views that China did not have its detection and diagnosis system in order; and that it took far too long for quarantine regulations and work protocols to be put in place. In the next six months it spread to more than two dozen countries in North America, South America, Europe, and Asia before it was stopped in July 2003.[3] If anything, the human infections with the avian 'flu virus that began early in 2004 in Vietnamese poultry farms and soon spread to other countries in SEA were even more worrying. Other returning and emerging diseases that caused large outbreaks include:

- cholera spreading through countries in Latin America in the early 1990s;
- West Nile virus in North America from 1999 onwards, causing high mortality in horses;[4]
- polio in West Africa, the Middle East and Asia;[5]

1 An endemic pathogen is one that has been in a particular locality for a long period of time. The Non-endemic or exotic diseases for a locality are those that are not normally present. For example, Foot and Mouth Disease FMD is now exotic in the UK but was once endemic, and still is endemic in many parts of the world.

2 ThoughtCo. The Cholera Epidemic of 1832. https://www.thoughtco.com/the-cholera-epidemic-1773767.

3 CDC. SARS Response timeline. Severe Acute Respiratory Syndrome (SARS) was first discovered in Asia in February 2003. https://www.cdc.gov/about/history/sars/timeline.htm.

4 Healio. West Nile virus: The US epidemic. Infectious Disease News, May 2017. https://www.healio.com/infectious-disease/emerging-diseases/news/print/infectious-disease-news/%7B587ca228-067b-41dd-af5a-958d208554cf%7D/west-nile-virus-the-us-epidemic.

5 Mach O, et al. Outbreaks of Paralytic Poliomyelitis during 1996–2012: The Changing Epidemiology of a Disease in the Final Stages of Eradication. Journal of Infectious Diseases, Volume 210, 1 November 2014. https://academic.oup.com/jid/article/210/suppl_1/S275/2193460.

- the Ebola disease outbreak which started in December 2013, being the largest to date with more than 28,000 cases and 1,100 deaths in West Africa;[6]
- ongoing outbreaks of African Swine Fever (ASF), which is highly contagious and often lethal to domestic and wild pigs and devastates swine production in Eastern Europe and parts of Africa and Asia.[7]

The conditions allowing further international episodes on this scale will remain if individual countries are not technically able to identify an emerging disease problem or have a default reluctance to make official statements. (See **Chapter 4**).

The international impact of such outbreaks underlines the importance of quick and effective responses by the Intergovernmental Organisations (IGOs) tasked with **coordinating national** efforts to combat human, animal and plant disease. Their inter-linked international health surveillance framework can be triggered to determine the source of an outbreak, the properties of the disease and the potential countermeasures; without such actions in the cases above, a new pandemic[8] could have erupted. The three principal IGOs are:

- The World Health Organisation (WHO). The directing and coordinating authority for human health within the UN system.
- The World Organisation for Animal Health (OIE).[9] The OIE is the IGO responsible for improving animal health worldwide.
- The UN Food and Agricultural Organisation (FAO). The FAO mandate is to lead international efforts to defeat hunger including by defeating disease of human, animals and plant

In 1951, WHO Member States adopted the International Sanitary Regulations, renamed as the **International Health Regulations (IHR)** in 1969. These were primarily intended require countries to monitor and control six serious infectious diseases: cholera, plague, yellow fever, smallpox, relapsing fever and typhus, but only cholera, plague and yellow fever were notifiable to the WHO. In 2005 major revision of the scope of the IHR put major new legally binding obligations on countries in respect of surveillance and reporting – IHR (2005). This provided the global community with a new framework to detect disease events and to respond to major health risks and emergencies that can have devastating impacts on economies. The changes from IHR (1969) brought many organisational and cost implications for countries, the foremost of which was that countries must notify the WHO of **any disease event (infectious or non-infectious) which may constitute a public health emergency** of international concern – i.e. not only the three diseases previously notifiable.

6 CDC. Ebola (Ebola Virus Disease). Cost of the Ebola Epidemic. 8 Aug 2016. CDC. https://www.cdc.gov/vhf/ebola/history/2014-2016-outbreak/cost-of-ebola.html.

7 Food and Agriculture Organisation. ASF situation in Asia update. Emergency Prevention System for Animal Health (EMPRES-AH). Aas at 05 March 2020, 08:00 hours, Rome. http://www.fao.org/ag/againfo/programmes/en/empres/ASF/situation_update.html.

8 The distinction between the uses of the terms outbreak, epidemic, pandemic are not exact, but there is an implication of increasing scale and geographic scope with a pandemic being global.

9 Originally established as 'Office International des Epizooties' in 1924. In May 2003 the Office became the World Organisation for Animal Health but kept its historical acronym OIE.

The improvements in disease alerting provided through the Global Outbreak Alert and Response Network (GOARN), the Joint FAO–OIE–WHO Global Early Warning System (GLEWS) and the implementation of IHR 2005 together increase the ability of the WHO/OIE/FAO to recognise disease outbreaks.

Following the 2001 events of 9/11 and the anthrax letters in the US, several countries agreed to share information and coordinate their efforts to improve global health security, as an addition to existing forums and networks. This led to the formation of the Global Health Security Action Group (GHSAG), mandated to implement concrete actions and to be a network for rapid communication and reaction in the event of a crisis.

The EU's Instrument for Stability (IfS) ensured close coordination with the EU-CBRN CoE initiative by *inter alia* providing support to health preparedness and response capacities from 2010 onwards. Most subsequent projects were implemented through the EU-CBRN CoE initiative, starting with project 32. To date, none has yet targeted the health needs of SEA countries. CoE health related projects to date are listed in **Annex 4**.

Within the EU, health surveillance actions are specified by a number of European Directives. The Commission, through several functions, coordinates epidemiological surveillance on disease outbreaks between the Member States. These Commission functions include the European Centre for Disease Prevention and Control (ECDC), an EU agency set up in 2005 to strengthen Europe's defences against infectious diseases. ECDC actions in epidemic intelligence and outbreak response can involve supporting national and international field response through missions. ECDC provides scientific advice and leadership to some CoE projects.

Association of Southeast Asian Nations (ASEAN) health cooperation comes under the ASEAN Socio-Cultural Community pillar. The ASEAN Post-2015 Health Development Agenda (APHDA) encapsulates the shared goals, strategies, priorities and programmes of the health sectors between 2016 and 2020. The Agenda focuses resources onto 20 Health Priorities. The Asia Pacific Strategy for Emerging Diseases and Public Health Emergencies (APSED III) is the common framework to address shared threats as required by the 2005 IHR. The WHO Regional Director and other WHO arrangements work in the WHO SEA Region to support countries in integrating their preparedness against biological weapons in their national disaster preparedness plans and in strengthening their core competences.

This Chapter has these annexes:

Annex 1. The three principal IGOs for health matters

- **Annex 2.** WHO vision: 'Emergencies preparedness, response
- **Annex 3.** Constraints in implementing Thai national strategies for animal health and disease control
- **Annex 4.** EU-CBRN CoE Projects supporting public health measures

KEY TERMS

- ASEAN: Association of Southeast Asian Nations
- ECDC: European Centre for Disease Prevention and Control
- FAO: Food and Agriculture Organisation
- GHSAG: Global Health Security Action Group, of the WHO
- GLEWS: Joint FAO–OIE–WHO Global Early Warning System
- GOARN: the Global Outbreak Alert and Response Network
- IfS: Instrument for Stability of the EU.
- IHR: International Health Regulations, of the WHO. The current is IHR (2005)
- IGO: Intergovernmental Organisation. An IGO is an organization composed primarily of sovereign states, or of other intergovernmental organizations. IGOs are established by treaty or other agreement that acts as a charter creating the group. Examples include the United Nations, the World Bank, or the European Union.[10]
- OIE: World Organisation for Animal Health
- Phytosanitary: relating to measures for the control of plant diseases especially in agricultural crops
- SARS: Severe Acute Respiratory Syndrome.
- WHO: World Health Organisation

10 Union of International Associations. What is an intergovernmental organization (IGO)? https://uia.org/faq/yb3.

A · THE IMPORTANCE OF DISEASE SURVEILLANCE AT NATIONAL AND INTERNATIONAL LEVELS

In 1948, the WHO Constitution entered into force and in 1951 WHO Member States adopted the International Sanitary Regulations, renamed as the **International Health Regulations (IHR)** in 1969. These were primarily intended to monitor and control six serious infectious diseases: cholera, plague, yellow fever, smallpox, relapsing fever and typhus, but only cholera, plague and yellow fever were notifiable to the WHO.

Laboratories. To help countries in identifying an outbreak, national laboratories dealing with unusual specimens[11] are able to send samples to WHO, OIE or FAO Reference Laboratories or Collaborating Centres for confirmation and more detailed analysis such as genotyping . Reference Laboratories are designated for a particular disease, functioning as a centre of expertise and standardisation of diagnostic techniques. For example, the WHO Global Influenza Surveillance and Response System (GISRS) in 2004 was augmented by the WHO H5 Reference Laboratory Network to boost the global public health capacity and pandemic preparedness for avian influenza A(H5N1) infection in humans. One of the H5 Reference laboratories is the Institute Pasteur in Phnom Penh, **Cambodia**.[12] The OIE has a global network of 267 Reference Laboratories covering 118 diseases/topics in 38 countries.[13] The Veterinary Research Institute in **Ipoh, Malaysia** is a FAO Collaborating Centre covering emergency preparedness for transboundary animal diseases in SEA. Some national laboratories have sufficient resources to provide advice and assistance to other nations and to the international agencies. The prime example is the Centers for Disease Control and Prevention (CDC) in the US.[14] The Center for Global Health (CGH) strengthens CDC's global health programs that focus on the leading causes of mortality, morbidity and disability, including chronic disease and injuries.

Response networks. The WHO began improving its global emergency response capacity (see Annex 2) by instituting the **Global Outbreak Alert and Response Network (GOARN)** in year 2000.[15] This was made possible by the financing dialogue that WHO started in 2016 to ensure that it could meet 21st Century challenges and the Sustainable Development Goals (see **Chapter 14**).[16] GOARN is a collaboration of existing institutions and networks having human and technical resources, that the WHO can draw in to respond quickly for rapid identification, confirmation and response to outbreaks of international importance. As many diseases of animal origin can transmit to humans (so called zoonotic diseases), a supplementary initiative was launched in 2006 to strengthen the interface between the FAO, OIE and WHO. This initiative was GLEWS, **the '***Joint FAO–OIE–WHO Global Early Warning System for health threats and emerging risks at the human–animal–ecosystems interface'*; it was uprated as

11 The concept of what is unusual will vary from laboratory to laboratory depending on the normal disease pattern for that area of the country and region.

12 WHO. The WHO H5 Reference Laboratories. https://www.who.int/influenza/gisrs_laboratory/h5_reflabs/en/.

13 OIE. Reference Laboratories. http://www.rr-asia.oie.int/about-us/oie-reference-centres/reference-laboratories/.

14 The Centers for Disease Control and Prevention (CDC). Center for Global Health. https://www.cdc.gov/globalhealth/resources/reports/annual/2017/about-center-for-global-health.html.

15 WHO. Strengthening health security by implementing the International Health Regulations (2005). Global Outbreak Alert and Response Network (GOARN). https://www.who.int/ihr/alert_and_response/outbreak-network/en/.

16 WHO's Financing Dialogue 2016. About WHO. https://www.who.int/about/finances-accountability/funding/financing-dialogue/en/.

GLEWS+.[17] It facilitates information sharing, epidemiological analysis and joint field missions to assess and control outbreaks in animals and humans. The GLEWS website includes December 2018 posts on ongoing Ebola virus disease in the Democratic Republic of the Congo; and posts on the eradication in 2011 of the disease rinderpest, which had caused the death of millions of cattle, buffalo, yak and wild animals. Rinderpest was the first animal disease to be eliminated.[18]

Regional coordination. For its work with health authorities in each country, the WHO operates through six regions, with a number of offices in each region. **The WHO regions do not however match with the CBRN CoE regions.** The WHO South-East Asia Region was the first to be established, in 1948. It has 11 Member States, including three EU-CBRN CoE SEA region members Indonesia, Myanmar and Thailand; its headquarters is in New Delhi, India.[19] The Western Pacific Region, with its headquarters in Manila, has 37 members including the other countries of the EU-CBRN CoE SEA region.[20] Both these WHO regions represent approximately a quarter of the world's population.

Association of Southeast Asian Nations (ASEAN) health cooperation comes under the ASEAN Socio-Cultural Community pillar.[21] All ten partner countries of the EU-CBRN Coe SEA region are member states of the ASEAN. The ASEAN Post-2015 Health Development Agenda (APHDA) encapsulates the shared goals, strategies, priorities and programmes of the health sectors between 2016 and 2020. The Agenda focuses resources onto 20 Health Priorities overseen by four Health Clusters; Health Cluster 2 covers a range of activities under 'Responding to All Hazards and Emerging Threats'.[22] An example of ASEAN regional cooperation and integration is the network 'Communicable Diseases and Pandemic Preparedness and Response'.[23] A key foundation is the commitment to ASEAN unity in health emergencies, made at the 8th ASEAN Health Ministers meeting in June 2006.[24] In the region, the Asia Pacific Strategy for Emerging Diseases and Public Health Emergencies (APSED III) is the common framework to address shared threats as required by the IHR. The framework provides an important collaborative platform for Member States, WHO and partners to work together to strengthen preparedness and response to outbreaks and public health emergencies.

Improving national surveillance and response. International arrangements to collate disease data and coordinate responses are only as effective as the national inputs that feed into them. The annual World Health Assembly (WHA), the decision making body of the WHO, has continued to press for

17 OIE. Launch of global early warning system for animal diseases transmissible to humans. http://www.oie.int/for-the-media/press-releases/detail/article/launch-of-global-early-warning-system-for-animal-diseases-transmissible-to-humans/.

18 GLEWS+. The Joint FAO–OIE–WHO Global Early Warning System for health threats and emerging risks at the human–animal–ecosystems interface. http://www.glews.net/.

19 WHO Regional office for South East Asia. http://www.searo.who.int/en/.

20 WHO Regional Office for Western Pacific. https://www.who.int/westernpacific/about/where-we-work.

21 ASEAN. Overview. Working together to address complex health challenges. https://asean.org/asean-socio-cultural/asean-health-ministers-meeting-ahmm/overview-2/.

22 ASEAN Health Cluster 2 Work Programme for 2016 to 2020. https://asean.org/ https://asean.org/asean-socio-cultural/asean-health-ministers-meeting-ahmm/overview-2/wp-content/uploads/2017/02/Responding-to-All-Hazards-and-Emerging-Threats.pdf.

23 ASEAN Regional Cooperation in Communicable Diseases and Pandemic Preparedness and Response. https://www.asef.org/images/docs/1156-Presentation_4__ASEAN_Regional_Cooperation_in_Communicable_Diseases_and_Pandemic_Preparedness_and_Response_Dr_Bounpheng_Philavong.pdf.

24 ASEAN. Declaration of the 8th ASEAN Health Ministers Meeting, ASEAN Unity in Health Emergencies. 21 June 2006, Yangon. https://www.asean.org/wp-content/uploads/images/archive/18494.pdf.

improvements **both to national and international capacities**. The 2002 WHA[25] **urged its MS** to:

- ensure they have in place national disease-surveillance plans which are complementary to regional and global disease-surveillance mechanisms, and to collaborate in the rapid analysis and sharing of surveillance data of international humanitarian concern;
- collaborate and provide mutual support in order to enhance national capacity in field epidemiology, laboratory diagnoses, toxicology and case management;
- **treat any deliberate use, including local, of biological and chemical agents and radio nuclear attack to cause harm also as a global public health threat,** and to respond to such a threat in other countries by sharing expertise, supplies and resources in order rapidly to contain the event and mitigate its effects.

For the international measures, **it requested the WHO Director General** to:

- continue, in consultation with relevant intergovernmental agencies and other international organisations, to strengthen global surveillance of infectious diseases, water quality, and food safety, and related activities such as revision of the International Health Regulations and development of the WHO's food safety strategy;
- provide tools and support for Member States, particularly developing countries, in strengthening their national health systems, notably with regard to emergency preparedness and response plans, including disease surveillance and toxicology, risk communication, and psychosocial consequences of emergencies;
- continue to issue international guidance and technical information on recommended public health measures to deal with the **deliberate use** of biological and chemical agents to cause harm, and to make this information available on the WHO's web site;
- examine the possible development of new tools, within the mandate of the WHO, including modelling of possible scenarios of natural occurrence, accidental release or deliberate use of biological, chemical agents and radio nuclear material that affect health

This decision for the WHO mandate to explicitly include disease resulting from deliberate use of CB agents was a **considerable advance** from its historic position. More recently, the FAO has issued guidance to national veterinary services for the investigation of suspicious biological events.[26]
The **2005 WHA** agreed a revision of the IHR[27] which put major new legally binding obligations on countries in respect of surveillance and reporting – **IHR (2005)**. This was lauded as a public health landmark, providing the global community with a new framework to detect disease events and to respond to major health risks and emergencies that can have devastating impacts on economies. There

25 55th World Health Assembly. Resolution WHA55.16. 18 May 2002. Global public health response to natural occurrence, accidental release or deliberate use of biological and chemical agents or radionuclear material that affect health. http://apps.who.int/gb/archive/pdf_files/WHA55/ewha5516.pdf.

26 OIE. Guidelines for investigation of suspicious biological events. (Guidelines for national veterinary Services). http://www.oie.int/fileadmin/Home/eng/Our_scientific_expertise/docs/pdf/Guidelines_Investigation_Suspicious_Biological_Events.pdf.

27 WHO. International Health Regulations (2005). Second edition. https://apps.who.int/iris/bitstream/handle/10665/43883/9789241580410_eng.pdf;jsessionid=31244D469E79AF0BDD544F3849768E24?sequence=1.

were a number of radical changes[28] from IHR (1969), many with **significant organisational and cost implications for countries**:

- MS must notify the WHO of **any** disease event (infectious or non-infectious) which may constitute a public health emergency of international concern – i.e. not only the three diseases previously notifiable. A decision tree was provided to facilitate reporting;
- The time scale to develop core national surveillance capabilities was tight, by June 2012, though extensions have since been granted. Core elements include national plans e.g. for influenza pandemic preparedness, and sanitary and health services and facilities at designated international airports, ports and ground crossings. Notifications and information are communicated by a National IHR Focal Point to a designated WHO IHR Contact Point;
- The WHO is obliged to request verification of events that it detects through its surveillance activities with the countries concerned, who must respond to such requests in a timely manner. MS must also inform the WHO of significant evidence of public health risks outside their territory that may cause international disease spread;
- The WHO Director General (DG) is empowered to make the final decision as to whether a disease event constitutes a 'public health emergency of international concern'. The DG may then issue temporary recommendations for health measures to prevent the international spread of disease and to avoid interference with international traffic;
- The WHO may take account of surveillance **data from non-state sources** - an important example has become the posts by professionals on the non-profit Internet organisation PROMED.[29] **ProMED-SoAs** focuses on disease reports from South Asia. This change was important because the old IHR limited the WHO to information provided by MS, and in practice states were often slow to admit to outbreaks in their territories which could negatively impact on their trade or tourism. (For the changes in IHR 2005 see WHO website[30]).

B · INTERNATIONAL AND NATIONAL HEALTH MEASURES TO COMBAT MALICIOUS OUTBREAKS

Early health detection of terrorist attacks. The improvements in disease alerting expected through GOARN, GLEWS and the IHR 2005 together increase the ability of the WHO/OIE/FAO to recognise disease outbreaks. National and international surveillance algorithms put in place to detect *natural* disease could can easily be re-configured to include symptomatic, timing and spatial indicators of *intentional release*. Without knowing the precise causative agent – and probably initially being unsure about the broad category of agent, i.e. whether an infectious agent, toxin, other chemical or radiological agent – it is inherently difficult to arrive at a diagnosis and thus trigger appropriate medical and security countermeasures. This has led some countries to develop alert triggers based on syndromic surveillance.[31]

28 WHO. International Health Regulations (IHR). https://www.who.int/ihr/about/faq/en/#faq17.

29 ProMED, an Internet based set of regional networks with 60,000 members worldwide. It invites report relating to infectious diseases and acute exposures to toxins that affect human health, animals and plants grown for food or animal feed. ProMED-SoAs focuses on disease reports from SEA.

30 WHO. International Health Regulations (IHR). https://www.who.int/ihr/about/faq/en/#faq17.

31 Syndromic surveillance uses individual and population health indicators that are discernible before confirmed clinical diagnoses are available.

Following the 2001 events of 9/11 and the anthrax letters in the US, several countries agreed to share information and coordinate their efforts to improve global health security, as an addition to existing forums and networks. On 7 November 2001, a first meeting of the Global Health Security Initiative (GHSI) took place between Health Ministers of the G7 countries[32] plus Mexico and senior representatives of the European Commission and the WHO. This led to the Global Health Security Action Group (GHSAG), mandated to develop and implement concrete actions to improve global health security, and to be a network for rapid communication/reaction in the event of a crisis. GHSI Working Groups are:

- Risk Management and Communications
- Global Laboratory Network
- Pandemic Influenza
- Chemical Events
- Radio-Nuclear Threats
- There are also specific GHSI projects: early alerting and reporting; research collaboration; support to the WHO in the implementation of the IHR.[33]

The Biological and Toxin Weapons Convention BWC

Since 1986, BWC States Parties have agreed the voluntary exchange of information under a number of Confidence Building Measures (CBMs), one of which covers disease outbreaks: *CBM B Exchange of information on outbreaks of infectious diseases and similar occurrences caused by toxins*. CBM B submissions may conveniently include data for human diseases already submitted to the WHO, OIE or FAO.[34] However the commitment to CBMs has been poor, with less than half of BWC State Parties (SPs) ever having submitted one. (See Chapter 6).

Under Article X of the 1972 BWC Convention, BWC SPs agree *inter alia* to assist in the application of technologies for peaceful purposes specifically including **the prevention of disease**. Having failed in 2001 to agree a BWC Protocol for mandatory declarations and inspections (see **Chapter 5**), the SPs decided on an initial three year follow up programme of discussion, including a meeting in July 2004 to:

- discuss, and promote common understanding and effective action on mechanisms for the surveillance, detection, diagnosis and combating of infectious diseases affecting humans, animals, and plants; as well as
- capabilities for responding to, investigating and mitigating the effects of cases of alleged use of biological or toxin weapons or suspicious outbreaks of disease.

Discussion of these issues in expert forums of the BWC SPs continues[35]; this has become important because it further encourages countries to work actively together to promote health capacity building

32 Canada, France, Germany, Italy, Japan, the UK, and the US.

33 GHSI. GHSI Background. http://www.ghsi.ca/english/background.asp.

34 UNODA. Guide to participating in the Confidence-Building Measures of the biological Weapons Convention. Revised Edition (2013). https://www.unog.ch/80256EDD006B8954/(httpAssets)/5316814CF65D0E10C1257B2B0039E156/$file/CBM%20guide%202013.pdf.

35 For example, see UN Chairs report of 2018 meeting, https://undocs.org/BWC/MSP/2018/MX.1/3.

according to BWC Article X.[36] The meetings of the BWC SPs are configured for the members of the three regional/political alignments to coordinate and prepare their views before plenary[37] discussion, and thus ensure that the particular features, difficulties and needs of their country or region are heard. The countries of the EU-CBRN CoE SEA region are in the Group of the Non-Aligned Movement and Other States, the 'NAM'.

The two-week expert meeting in 2004 was attended by 87 States Parties: from the EU-CBRN CoE SEA Region Indonesia, Malaysia, the Philippines, Thailand, Vietnam. Four BWC Signatory States present included Myanmar. The WHO, OIE, FAO and the International Committee of the Red Cross (ICRC) were allowed observer status. Nearly 100 papers were presented.[38] These ranged from papers on national arrangements for human, animal and plant health diagnosis, protection and response to events including suspicious outbreaks; on food safety; on use of non-licensed drugs and vaccines in emergencies; on recent epidemics of SARS, Avian 'Flu and BSE etc. Several countries described the upgrading of diagnostic and medical systems and disaster management for emergency response both at national and local levels. At one extreme, as in the United Kingdom (UK), this had even involved a major reorganisation of public health resources. In the UK, in 2003 the Health Protection Agency was formed in 2003 to combine laboratory services, surveillance and health emergency planning for infectious disease and chemical and radiological hazards into a new integrated approach with one of the explicit concerns being the need to react to terrorist acts. The new coordination also allowed an improved focus on TB, HIV and other sexually transmitted diseases and on the increasing resistance of bacteria and viruses to drug therapy.[39]

Since 1986, BWC States Parties have agreed to the voluntary exchange of information under a number of Confidence Building Measures (CBMs), one of which covers disease outbreaks: *CBM B Exchange of information on outbreaks of infectious diseases and similar occurrences caused by toxins*. CBM B submissions may conveniently include data for human diseases already submitted to the WHO, OIE or FAO.[40] However the commitment to CBMs has been poor, with less than half of BWC State Parties (SPs) ever having submitted one. (See **Chapter 6**).

The BWC-ISU. The BWC-Implementation and Support Unit (BWC-ISU) was created in 2006 and is under the umbrella of the UN Office for Disarmament Affairs (UNODA). It is funded by the States Parties to the BWC and supports efforts in the implementation of BWC and promotes the peaceful uses of biology. The tasks of BWC-ISU include:[41]:

36 For example, the Seventh and Eighth Review Conferences agreed "on the value of working together to promote capacity building in the fields of vaccine and drug production, disease surveillance, detection, diagnosis, and containment of infectious diseases as well as biological risk management". https://undocs.org/bwc/msp/2018/mx.1/2.

37 Plenary means meetings of all States Parties normally with simultaneous interpretation into the six official UN languages Arabic, Chinese, English, French, Russian and Spanish.

38 UNOG. (BWC) 2003-2005 Intersessional Process. Meeting of Experts in 2004. https://www.unog.ch/__80256ee600585943.nsf/(httpPages)/da292636ae31f1cbc125718600361e55?OpenDocument&ExpandSection=4#_Section4.

39 United Kingdom. BWC/MSP/2004/MX/WP.21, 20 July 2004. United Kingdom paper submitted to the BWC Meeting of Experts Geneva, 19-30 July 2004. Prevention, Investigation and Control of Human Infectious Disease. https://documents-dds-ny.un.org/doc/UNDOC/GEN/G04/623/85/PDF/G0462385.pdf?OpenElement.

40 UNODA. Guide to participating in the Confidence-Building Measures of the biological Weapons Convention. Revised Edition (2013). https://www.unog.ch/80256EDD006B8954/(httpAssets)/5316814CF65D0E10C1257B2B0039E156/$file/CBM%20guide%202013.pdf.

41 UN. Role of BWC-ISU https://www.unog.ch/80256EE600585943/(httpPages)/F8521A510F455706C12573A6003F49F2?OpenDocument.

- Administrative support and assistance
- National implementation support and assistance
- Support and assistance for Confidence-Building Measures
- Support and assistance in obtaining universality
- Administers the database for assistance requests and offers and facilitated associated exchanges of information
- Supports States Parties efforts to implement the decisions and recommendations of the review conference

BWC-ISU has worked closely with other international organisations and partners to strengthen national and international efforts to prevent, detect, mitigate and recover from disease incidents, irrespective of how they started.

Information from the SEA Region. A paper from Thailand at the 2004 meeting gave insights into an animal health situation in the EU-CBRN CoE SEA region.[42] The constraints Thailand faces in implementing animal disease control strategies are shown below in **Annex 3**. Thailand is stated as the world leader in poultry production, mostly as export to Japan and European Union (EU) markets. Livestock farming in Thailand divides into two: large commercial scale high throughput process, and home rearing type of farming. Chicken production predominates, but cattle, pig and buffalo are livestock are also important. Surveillance effectiveness in Thailand was being helped by a number of developments:

- improved awareness by politicians and the public about the impact of animal diseases on human health, and economic and social impacts;
- experience gained from the outbreaks of avian influenza;
- close cooperation between countries e.g. Australia (the Asian regional reference laboratory for FMD, proficiency tests of leptospirosis and brucellosis) and the US (training and strengthening programs);
- support by the FAO, OIE and the Japan International Cooperation Agency (JICA).

Strengthening the UNSGM. The UNSGM is the UN Secretary General's Mechanism for investigating the alleged use of biological weapons.[43] The 1989 UN Report of Qualified Experts laid down technical guidelines and procedures for the investigation of reports of alleged use of chemical and bacteriological (biological) or toxin weapons. However, details such as investigation equipment, laboratory specialisations and sampling procedures had not been reviewed since 1989, and at the 2004 BWC SP Experts meeting there were proposals that UNSGM procedures should be brought up to date to reflect new technology developments, and that regular exercises should be instituted to test designated experts and

42 BWC. BWC/MSP/2004/MX/WP.65. 27 July 2004. Thailand paper submitted to the BWC Meeting of Experts Geneva, 19-30 July 2004. Animal disease surveillance and response in Thailand. https://undocs.org/pdf?symbol=en/BWC/MSP/2004/MX/WP.65.

43 UNODA. Secretary-General's Mechanism for Investigation of Alleged Use of Chemical and Biological Weapons. https://www.un.org/disarmament/wmd/secretary-general-mechanism/.

laboratories.[44] Since then, some countries have held training courses to develop the skills of experts on the UNSGM roster.[45] The UN has a Memorandum of Understanding (MOU) with the WHO; if asked by the UN Secretary General, the WHO would '*provide technical support in assessing the public health, clinical and event-specific health aspects of an alleged use*'.[46] The UN has similar MOUs with the Organisation for the Prohibition of Chemical Weapons (OPCW) (in respect of chemicals) and with the OIE, FAO and Interpol. All of these organisations have been involved in the efforts to strengthen the UNSGM.

C · EU HEALTH MEASURES AND PROGRAMMES

Intra-EU health activities

EU MS are responsible for organising and delivering their own health services and medical care. National policies are complemented by the EU health policy, under which strategic health issues are discussed by representatives of national authorities and the European Commission at a senior level. The Commission's Directorate for Health and Food Safety (DG SANTE – formerly DG SANCO) supports the efforts of EU countries to protect and improve the health of their citizens and to ensure the accessibility, effectiveness and resilience of their health systems. (DG SANTE links to DG DEVCO over the outreach health projects - see below).

Surveillance actions are specified by a number of European Directives which are updated according to need. In the health areas for CBR related disease, these make rules on priority diseases, notifications, case definitions, development of surveillance schemes and networks. Directives aim to be realistic for implementation under the varying socio-economic conditions existing among this large group of countries. The foundation Directives were:

- For human health, Decision 2119/98/EC of 1998[47]established a network of epidemiological surveillance and control of communicable diseases, with a list of diseases;
- For animal health, Directive 82/894/EEC of 1982 established a list of diseases affecting intra Community trading in bovine animals, pigs and poultry meat and meat products. There is a list of diseases for notification, for some types of outbreak on a weekly basis. Since 2016 one single, comprehensive EU animal health law (AHL: EU2016/429) supports the livestock sector with early detection and control of animal diseases, including emerging diseases linked to climate change. The Regulation lays down general and specific rules for the prevention and control of transmissible animal diseases (with a risk based approach) and ensures a harmonised approach to animal health across the Union. Diseases targeted are: • Foot and mouth disease; Classical swine fever; African swine fever; Highly pathogenic avian influenza; African horse sickness - among around forty diseases listed in its Annex II.

44 BWC. BWC/MSP/2004/MX/WP.56. 23 July 2004. UK paper submitted to the BWC Meeting of Experts Geneva, 19-30 July 2004. Enhancing International Capabilities for Responding to, Investigating and Mitigating the Effects of Cases of Alleged Use of Biological or Toxin Weapons or Suspicious Outbreaks of Disease.

45 Side event of the 2018 meeting of BWC SPs. Strengthening the UNSGM: From Trusted Laboratories to Trained Experts. https://www.unog.ch/80256EDD006B8954/(httpAssets)/DE31718321595D35C125835F003B2EE3/$file/BWC+MSP+Side+Event+UNSGM_06.12.2018.pdf.

46 UNODA. Memorandum of Understanding between the World Health Organisation and the United Nations. https://unoda-web.s3-accelerate.amazonaws.com/wp-content/uploads/assets/WMD/Secretary-General_Mechanism/UN_WHO_MOU_2011.pdf.

47 European Parliament and Council Decision 2119/98/EC. https://publications.europa.eu/en/publication-detail/-/publication/13a83657-97b6-4a80-aa32-3b335bdf80be/language-en.

- For plant protection, Directive 94/3/EC of 1994 established a procedure for intercepting a plant consignment or a harmful organism from third countries. Later directives added movements between EU MS, and inspections outside the EU and even in the source country.
- For radiological harm, Directive 89/618/Euratom informed the public about health protection measures and action to be taken in the event of an emergency. Directive 3954.87 controls extra-EU trade of food and animal feed following an emergency causing radioactive contamination.

The Commission **coordinates** epidemiological surveillance on disease outbreaks between the MS, but it is not, however, responsible for the **operational surveillance** and management of disease outbreaks and crises. Key elements of Commission coordination activities are:

- The EU Health Security Committee was set up in 2001 at the request of EU Health Ministers as an informal advisory group on health security at European level. In 2013, Decision 1082/2013/EU strengthened its role. The Committee is mandated to reinforce the coordination and sharing of best practice and information on national preparedness activities.[48]
- The European Centre for Disease Prevention and Control (ECDC), an EU agency set up in 2005 to strengthen Europe's defences against infectious diseases. Core functions cover a wide spectrum of activities: surveillance, epidemic intelligence, response, scientific advice, microbiology, preparedness, public health training, international relations, health communication.[49] Key objectives include supporting the European Commission and the MS in addressing the **Sustainable Development Goals** in the area of HIV, TB and hepatitis; and supporting the Commission and the MS in strengthening the preparedness for **cross-border health threats**. ECDC actions in epidemic intelligence and outbreak response can involve supporting national and international field response through missions.[50] ECDC provides scientific advice and leadership to some CoE projects e.g. Project 74 MEDIPIET;[51]
- The Early Warning and Response System (EWRS). A web-based platform linking the Commission, ECDC and public health authorities in EU/European Economic Area (EEA) countries responsible for measures to control serious cross-border threats to health, covering communicable disease outbreaks, food, feed, animals and plants and the Civil Protection mechanism;
- The RAS-BICHAT alert system for bio-terrorism and chemo-terrorism, a secure 24/7 rapid alert system, operational since June 2002. It links with alert systems on risks related to the EWRS, and with permanent contact points in all the MS. ECURIE, a radiological emergency preparedness network, is part of RAS-BICAT;

48 European Commission. Health Security Committee members. https://ec.europa.eu/health/preparedness_response/risk_management/hsc/members_en.

49 European Centre for Disease Prevention and Control. https://ecdc.europa.eu/en/about-ecdc.

50 European Centre for Disease Prevention and Control. https://ecdc.europa.eu/en/about-uswhat-we-do/ecdc-activities-epidemic-intelligence-and-outbreak-response.

51 MediPIET – Mediterranean Programme for Intervention Epidemiology Training. https://www.cordsnetwork.org/wp-content/uploads/2018/03/Mediterranean-Programme-for-Intervention-Epidemiology-Training-as-an-approach-to-addressing-international-health-risks-in-the-Meditteranean-region-2.pdf.

- The MediSys system which scans publications and news websites to provide advance warning of an outbreak;
- Projects for cooperation in surveillance, laboratory collaboration (Containment level 4 labs and other pathogen labs), vaccine and other public health medicines development strategies, anti-microbiological resistance, field epidemiological training (EPIET) and publications (EUROSURVEIILANCE).

D · EU OUTREACH FOR CBRN RELATED HEALTH CAPACITIES

The EU's Instrument for Stability (IfS) Multi-annual Indicative Programme 2009-2011 - *Support for the Objectives of the EU Non-proliferation of Weapons of Mass Destruction Strategy* - included as one of the six project areas under Priority 1 the support for bio-safety and bio-security. To ensure close coordination with the EU-CBRN CoEs established under Project area 1, particular attention was to be paid to **health preparedness and response capacities**.[52]

Health preparedness cooperation support under IfS began in 2010, as IfS/2010/238-194. This contributed funding to the follow-up of *EpiSouth,* which had started in 2006 as a framework for collaboration for communicable diseases surveillance and training in the EU neighbourhood of the Mediterranean Region and South-East Europe (10 EU + 17 non EU countries).[53] This project developed a generic preparedness planning tool, under EpiSouth Plus (IfS/2010/238-194).[54] EU-CBRN CoE Project 37 builds on these results.

Most subsequent projects were implemented through the CBRN CoE initiative, starting with project 32. To date, none has yet targeted the immediate needs of SEA countries. For a list of CoE health related projects see Annex 4.

Cooperation for Sub-Saharan Africa. This region is where most of the world's outbreaks caused by Risk Group 3 and 4 pathogens occur, being an endemic zone for arboviruses such as Ebola, Marburg, Lassa, Crimean Congo Hemorrhagic Fever, Yellow Fever, Rift Valley fever and Chikungunya. Increasing mobility of the human populations was creating conditions for the rapid spread of these highly infectious, high lethality diseases. The severity of the Ebola disease outbreak which started in December 2013 shows what happens when an outbreak in impoverished post-conflict countries becomes embedded in congested urban areas and then spreads transnationally. (See Chapter 9 for an explanation of Risk Group and Containment/Biosafety Level).

In 2009 and 2010, exploratory missions in African countries were carried out by EU experts under IfS ESF[55] arrangements. This highlighted the need for a project to procure mobile laboratories that could be deployed to any new outbreaks in Africa, to reduce the delays in testing for Risk Group 4 infectious disease

52 The Instrument for Stability - Multi-annual Indicative Programme 2009-2011. Brussels, 8.4.2009. C(2009)2641 page 27. https://reliefweb.int/sites/reliefweb.int/files/resources/F66EDF39EEAABA8E492575F2000ECA23-Full_Report.pdf.

53 Episouth. Network for the Control of Public Health Threats in the Mediterranean Region and South East Europe. http://www.episouthnetwork.org/.

54 The EpiSouth Plus Project. Tool for supporting countries on generic emergency preparedness planning in the health sector. http://gesdoc.isciii.es/gesdoccontroller?action=download&id=23/11/2015-3905fb6680.

55 Expert Support Facility, a funding and administrative framework for organising Ad Hoc exploratory missions.

agents. In 2011, under the IfS rubric, the Commission set up the collaborative project *Establishment of Mobile Laboratories up to Risk Group 4 in combination with CBRN Capacity Building in sub-Saharan Africa* (EMLab project, 2012-2015), to be implemented by a consortium of several EU Biosafety level 4 laboratories. As well as developing three mobile laboratory units, the project aimed to establish a collaborative network of the European and African institutions able to operate these units in the field. From the beginning, ECDC and GOARN and Medicines Sans Frontieres were part of the project and attended workshops and training sessions.[56]

To increase the centralised EU response to the growing Ebola crises, in September 2014 a new mobile laboratory project was initiated, this time under the EU-CBRN CoE initiative as Project 45 (EUWAM- lab). This new laboratory is truck-based. It was deployed in Guinea in March 2015. This would provide yet more training capacity for African and EU specialists, and being truck-based the laboratory unit would be more suitable than EMLab for use in extremes of ambient temperature. The European Union (EU) has handed this lab to the Institut Pasteur in Dakar in May 2018. It will be used especially for training people under Project 72, MediLabSecure.

Other EU funding streams have provided outreach support to health preparedness. An example is the European & Developing Countries Clinical Trials Partnership (EDCTP), a public–public partnership between 14 European and 16 African countries. EDCTP's vision is to reduce the individual, social and economic burden of poverty-related infectious diseases affecting sub-Saharan Africa. It is supported under **Horizon 2020**, the EU's Framework Programme for Research and Innovation.[57] The EU also is one of the contributors to the One Health Network in SEA. (See **Chapter 9**)

E · OTHER INTERNATIONAL HEALTH SUPPORT IN ASEAN

The WHO Regional Director works in the WHO SEA Region to support countries in integrating preparedness against biological weapons in their national disaster preparedness plans and in strengthening their core competences in relevant areas: response, public health and case management infrastructure, mechanisms for risk communication and collaborations with other national agencies namely intelligence, defence sector and police.[58] The region is home to over a quarter of the world's population.[59] The WHO Western Pacific Region includes 37 countries and areas. Influenza surveillance is based on data from sentinel surveillance systems, that include outpatient and inpatient sites. It has an interactive, web-based platform that provides seasonal and avian influenza surveillance updates from the region.[60]

56 EU Mobile Labs. Addressing the Ebola outbreak. Establishment of the EU Mobile Lab Project - December 2011. https://europa.eu/capacity4dev/emlabproject-ebola/document/establishment-eu-mobile-lab-project-december-2011.

57 EDCTP. Tackling infectious disease in sub Saharan Africa. https://ec.europa.eu/research/health/pdf/edctp_funded_clinical_studies_2018.pdf.

58 Strategies of Preparedness against the threat of Biological Warfare and Bioterrorism in South-East Asia. Lianbangchang S. Asian Biotechnology and Development Review vol. 8 No.1, pp 77-98. 2005. http://ris.org.in/images/RIS_images/pdf/article3_v8n1.pdf.

59 WHO. About WHO South-East Asia. https://www.who.int/southeastasia/about.

60 Influenza situation update. Where is the WHO Western Pacific Region? WHO. https://extranet.wpro.who.int/influenzaupdate/.

Other major outreach systems provide outreach support to mitigate the potential for acute, destabilising outbreaks of pathogens of potential security concern. ASEAN countries have been included in support under the US Cooperative Biological engagement Program (CBEP) Research Strategic Plan mission of the US Defense Threat Reduction Agency. The CBEP has been active since 2011 in Cambodia, India, Laos, Malaysia, Philippines, Thailand, and Vietnam. Project support areas include sustainable disease surveillance, detection, diagnosis, and reporting systems; and support research projects focusing on improved recognition and understanding of endemic pathogens of concern. As an example, in FY 2015, CBEP furthered these efforts by developing plans for a melioidosis[61] Research Coordinated Network, to foster multidisciplinary research and melioidosis surveillance in SEA and facilitate a better understanding of the impacts and spread of this disease in the region.[62] (See also **Chapter 9**)

61 Meliodosis is an infectious disease that can infect humans or animals. The disease is caused by the bacterium Burkholderia pseudomallei.

62 DTRA. Cooperative Biological Engagement Program. Annual accomplishments FY 2015. page 31 et seq. https://www.dtra.mil/Portals/61/Documents/Missions/CBEP%20FY15%20Annual%20Accomplishments.pdf?ver=2016-09-16-150152-690.

ANNEX 1

THE THREE PRINCIPAL IGOS FOR HEALTH MATTERS

The World Health Organisation WHO. The WHO is responsible for providing leadership on global health matters, shaping the health research agenda, setting norms and standards, articulating evidence-based policy options, providing technical support to its 178 member countries and monitoring and assessing health trends. The WHO's Health Security Interface coordinates interactions with bodies such as international organisations, civil defense, military doctors, law enforcement and armed forces.[63] WHO programmes include biorisk reduction to cover biosafety and laboratory biosecurity, and the operation of the GOARN. Advisory functions and research is carried out in a network of nationally funded institutions in all regions that have achieved designation as WHO Collaborating Centres and Reference Laboratories. Some of these centres are linked jointly to the WHO and the Pan American Health Organisation (PAHO).[64] The WHO 'One Health' is an approach to designing and implementing programmes, policies, legislation and research in which multiple sectors communicate and work together to achieve better public health outcomes. The areas of work in which it is particularly relevant include food safety, the control of zoonoses, and combatting antibiotic resistance.[65]

The World Organisation for Animal Health (OIE). The need to fight animal diseases at global level led to the creation of the Office Internationale des Epizooties through the international Agreement signed on January 25th 1924. In May 2003, the Office became the World Organisation for Animal Health but kept its historical acronym OIE. It is recognised as a reference organisation by the World Trade Organisation (WTO). The OIE collects and analyses the latest scientific information on animal disease control, including diseases transmissible to humans. It offers expertise to the poorest countries to help them control animal diseases that cause livestock losses, present a risk to public health and threaten any of the other 182 member countries. Advisory functions and research is carried out in a network of institutions in all regions that have achieved OIE Collaborating Centre or Reference Laboratory status. It has official procedures for the recognition of animal disease status for African horse sickness (AHS), bovine spongiform encephalopathy (BSE) risks, classical swine fever (CSF), contagious bovine pleuropneumonia (CBPP), foot and mouth disease (FMD), peste des petits ruminants and rinderpest.[66]

The UN Food and Agriculture Organisation (FAO). Founded in 1945 to help address the urgent food problems after World War 2, it **s**erves both developed and developing countries to be a neutral forum where all nations can negotiate agreements and debate policy. With over 194 members, the FAO works in over 130 countries worldwide. With special attention to rural areas, it helps developing countries and countries in transition to modernise and improve agriculture, forestry and fisheries practices and ensure good nutrition for all and the safety of trade in plants. The FAO works in partnership with others on food security, natural resource management, forestry and fisheries, early warning of food emergencies,

63 WHO. Health Security. https://www.who.int/health-security/en/.
64 WHO. https://www.who.int/about/what-we-do.
65 WHO. One Health. September 2017. https://www.who.int/features/qa/one-health/en/.
66 OIE. Animal Health in the World – Overview. http://www.oie.int/animal-health-in-the-world/.

disaster recovery, food safety, bioenergy and other areas. For example, in April 2019, the FAO adopted new international measures to prevent six plant pests from crossing borders and spreading.[67] FAO is responsible for the implementation of the International Plant Protection Convention (IPPC)[68] The FAO has instituted new standards to curb the spread of plant pests and diseases.[69]

ANNEX 2

WHO VISION: 'EMERGENCIES PREPAREDNESS, RESPONSE'

From: https://www.who.int/csr/en/

WHO vision

An integrated global alert and response system for epidemics and other public health emergencies based on strong national public health systems and capacity and an effective international system for coordinated response.

Core functions

- Support Member States for the implementation of national capacities for epidemic preparedness and response in the context of the IHR(2005), including laboratory capacities and early warning alert and response systems;
- Support national and international training programmes for epidemic preparedness and response;
- Coordinate and support Member States for pandemic and seasonal influenza preparedness and response;
- Develop standardised approaches for readiness and response to major epidemic-prone diseases (e.g. meningitis, yellow fever, plague);
- Strengthen biosafety, biosecurity and readiness for outbreaks of dangerous and emerging pathogens outbreaks (e.g. SARS, viral haemorrhagic fevers); maintain and further develop a global operational platform to support outbreak response and support regional offices in implementation at regional level.

67 FAO. New standards to curb the global spread of plant pests and diseases. http://www.fao.org/news/story/en/item/1187738/icode/.

68 International Plant Protection Convention. Convention text. https://www.ippc.int/en/core-activities/governance/convention-text/.

69 FAO. New standards to curb the global spread of plant pests and diseases. http://www.fao.org/news/story/en/item/1187738/icode/.

ANNEX 3

CONSTRAINTS IN IMPLEMENTING THAI NATIONAL STRATEGIES FOR ANIMAL HEALTH AND DISEASE CONTROL

From: BWC/MSP/2004/MX/WP.65 27 July 2004. Thailand paper submitted to the BWC Meeting of Experts Geneva, 19-30 July 2004. *Animal disease surveillance and response in Thailand. https://undocs.org/pdf?symbol=en/BWC/MSP/2004/MX/WP.65*

There are constraints in implementing the national animal disease prevention strategies:

- Immunisation (vaccination) is still controversial in respect of vaccine efficacy and costs.
- Control of movement of poultry is onerous, needing legal enforcement and support by other organisations such as police, military.
- Destruction of infected or exposed animal causes enormous financial loss in the short term.
- Epidemiological surveillance is hampered by difficulties in identifying sources of pathogens and details of numbers, locations and incidence (rate of new cases).
- Varying degrees of public support participation make it difficult to implement disease control strategies.

ANNEX 4

EU-CBRN COE PROJECTS SUPPORTING PUBLIC HEALTH MEASURES

To date, none of these projects has included countries in the SEA Region.

PROJECT 32 (IFS): Establishment of a Mediterranean Programme for Intervention Epidemiology Training (MediPIET). 01/01/2013 for 24 months. EUR 440,000.

- **COUNTRIES:** Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, former Yugoslav Republic of Macedonia, Israel, Jordan, Kosovo*, Lebanon, Libya, Montenegro, Morocco, Palestine**, Serbia, Tunisia, Turkey**.**
- **OBJECTIVES:** To start-up a regional training programme aimed at creating a public health work force with necessary skills in field/intervention epidemiology to meet present and future national and cross-border challenges of communicable diseases. To create a regional network of field epidemiologists sharing experiences and best practices and easily mobilised in case of cross-border outbreaks and other health threats. To transfer knowledge and experiences through the European Programme for Intervention Epidemiology Training (EPIET) and more recently also in Public Health Microbiology training (EUPHEM). To provide a virtual library of up-to-date bilingual (English and

Arabic) training material, accessible to the network through a collaborative electronic workspace.

- **KEYWORD(S):** Public health mitigation; intervention epidemiology; network; communicable diseases

PROJECT 36 (IFS): Further development and consolidation of the Mediterranean Programme for Intervention Epidemiology Training (MediPIET). 01/01/2014 for 51 months**. EUR 6,400,000.**

- **COUNTRIES:** Albania, Algeria, Armenia, Bosnia and Herzegovina, Egypt, Georgia, Jordan, Kosovo, Lebanon, Libya, Moldova, Montenegro, Morocco, Palestine, Serbia, The former Yugoslav Republic of Macedonia, Tunisia, Ukraine.
- **OBJECTIVES:** To consolidate a competent public health workforce in field epidemiology capable of facing national and cross- border emergencies posed by communicable diseases. To supports the creation of regional networks of training infrastructures and of field epidemiologists easily mobilised in case of cross-border outbreaks and other health threats.
- **KEYWORD(S):** Public health mitigation; intervention epidemiology; network; communicable diseases

PROJECT 37 (IFS): MEDILABSECURE - Establishment of networks of human and animal virology laboratories and of medical entomology. 06/01/2014 for 60 months. EUR 3,626,410.

- **COUNTRIES:** Albania, Algeria, Armenia, Bosnia and Herzegovina, Burkina Faso, Egypt, Georgia, Jordan, Kosovo, Lebanon, Libya, Mali, Mauritania, Moldova, Montenegro, Morocco, Niger, Palestine, Senegal, Serbia, former Yugoslav Republic of Macedonia, Tunisia, Turkey, Ukraine.
- **OBJECTIVES:** The project is aimed at creating a framework for collaboration on reference laboratories issues to to improve communicable diseases surveillance and communication and provide training for public health experts in the participating countries. It will build-up on the results of the ending EpiSouth-Plus project (IFS/2010/238-194).
- **KEYWORD(S):** Public health impact mitigation.

PROJECT 39: Strengthening health security at ports, airports and ground crossings. 2013, for 28 months. EUR 1,500,000.

- **COUNTRIES:** Algeria, Iran, Iraq, Pakistan, Uzbekistan, Yemen.
- **OBJECTIVES:** The overall objective is to increase health security within travel and transport, in a multi-sectorial approach, to minimize risks in association with natural or deliberate released hazards. Specific objectives of the project are: • Foster collaboration, information and knowledge sharing in disease detections at points of entry; • Support health surveillance and public health emergency preparedness.

PROJECT 40: Strengthening health laboratories to minimize potential biological risks. 2014, for 54 months. EUR 4,500,000.

- **COUNTRIES:** Armenia, Azerbaijan, Egypt, Iran, Jordan, Kyrgyzstan, Moldova, Morocco, Oman, Pakistan, Somalia, Sudan, Tajikistan, Tunisia, Turkmenistan, United Arab Emirates, Uzbekistan, Yemen.

- **OBJECTIVES:** Support institutional and individual capacity building efforts through implementation of appropriate tools, methodologies and training activities • Enhance the ability of partner countries to safely and rapidly detect and respond to natural or deliberate events of national and international concern; • Support the development of nationally-owned laboratory policies, strategies norms and regulations; • Engage institutional and individual capacity building efforts through implementation of appropriate tools, methodologies and training activities; • Enhance the ability of Member States to safely and rapidly detect and respond to natural or deliberate events of national and international concern according to the IHR through support to laboratory networks; • Support national, regional and global laboratory networks aiming at detecting potential biological or other threats, such as emerging and dangerous pathogens.

PROJECT 45 (IFS): Establishment of a mobile laboratory for in situ interventions on VHF outbreak sites in combination with CBRN capacity building in West Africa (EUWAM-Lab). 18/09/2014 for 43 months. EUR 2,579,854.

- **COUNTRIES:** Côte d'Ivoire, Guinea, Liberia, Senegal, Sierra Leone.
- **OBJECTIVES:** To strengthen the capacity of the countries affected by the 2014 Ebola Virus Disease outbreak to detect and identify infectious diseases caused by risk group 4 viruses. To strengthen cooperation and reinforce the capacity of West Africa partner countries to fight against biological threats.
- **KEYWORD(S):** Public health impact mitigation; crisis management; first response; international cooperation.

PROJECT 48: Improved regional management of outbreaks in the EU-CBRN Centres of Excellence Partner Countries of the African Atlantic Façade. 01/01/2016 for 36 months. EUR 3,499,600.

- **COUNTRIES:** Benin, Côte d'Ivoire, Gabon, Liberia, Mauritania, Morocco, Senegal and Togo.
- **OBJECTIVES:** The overall objective of the project is to improve the regional level of preparedness and response to outbreaks crisis (biological risk mitigation) in the CBRN CoE partner countries belonging to the African Atlantic Façade Region and neighbouring countries.
- **KEYWORD(S):** Public health mitigation; safety and security.

PROJECT 49 (IFS): One Health Project in Pakistan. 05/01/2015 for 42 months. EUR 927,608.

- **COUNTRY:** Pakistan.
- **OBJECTIVES:** The overall objective of this project is to support the development of a structured, integrated and sustainable collaboration between the Ministry of Health and Ministry of Agriculture in Pakistan for improved risk assessments and detection, prevention and control of the spread of emerging zoonotic diseases.
- **KEYWORD(S):** Detection, prevention and control of the spread of emerging zoonotic diseases.

PROJECT 54: **Capacity building for medical preparedness and response to CBRN incidents.** 01/09/2016 for 54 months. EUR 3,000,000**.**

- **COUNTRIES:** Iraq, Jordan, Lebanon.
- **OBJECTIVES:** The objectives of the project are: to increase the preparedness and response capacity to the CBRN incidents of the medical responders; to enhance national long-term training system on urgent medical assistance; to develop training guidelines on a disaster medical/medicine management in case of CBRN incidents.
- **KEYWORD(S):** Medical assistance; first response; crisis management; public health impact mitigation;

PROJECT 74: **Mediterranean and Black Sea field epidemiology training programme network to increase security in the EU neighbourhood (MEDIPIET).** 13/12/2018 for 31 months. EUR 1,859,800.

- **COUNTRIES:** Albania, Algeria, Armenia, Bosnia and Herzegovina, Egypt, former Yugoslav Republic of Macedonia, Georgia, Jordan, Kosovo, Lebanon, Libya, Moldova, Montenegro, Morocco, Palestine, Serbia, Tunisia, Ukraine.
- **OBJECTIVES:** Enhancing health security in the Mediterranean and Black Sea regions by supporting capacity-building for prevention and control of biological, natural, or man-made health threats through the further roll-out of a sustainable training program in intervention epidemiology. Extension of the field epidemiology training programme (FETP) and other training activities in Mediterranean and black sea countries:
    - To train a regional cadre of field epidemiologists competent in intervention epidemiology to carry out essential public health functions for prevention and control of communicable diseases and capable of disseminating their knowledge, skills and attitudes and nurture a regional network of field epidemiologists;
    - To train national trainers and supervisors in field epidemiology from the participating public health institutions, to provide support to cascade trainings down to regional and local levels and to nurture a regional network of trainers/ supervisors;
    - Disseminate experience, knowledge and skills on methodologies related to “”on-the-job training”” between non-EU countries, EU partners and other key actors in the field, during national and regional field epidemiology training programs, workshops or events as well as during relevant European activities such as the EPiet and EUPhem programs;
    - Foster country commitment, ownership and regional networking to share practices and experiences as essential conditions for building-in sustainability of the FETP programs.

PROJECT 75: **Preventing biological risks increased by environmental and climate change in the Mediterranean, Black Sea and Sahel regions by strengthening institutional capacities in the context of One Health (MEDILABSECURE).** 15/01/2019 for 42 months. EUR 5,555,255.

- COUNTRIES: Albania, Algeria, Armenia, Bosnia and Herzegovina, Burkina Faso, Egypt, former Yugoslav Republic of Macedonia, Georgia, Jordan, Kosovo , Lebanon, Libya, Mali, Mauritania, Montenegro, Morocco, Niger, Palestine, Senegal, Serbia, Tunisia, Turkey.
- OBJECTIVES: Through the strengthening of the network of laboratories and public health institutions previously created by MediLabSecure, providing capacity building and networking activities, the purpose of this contract is to:
    - strengthen and harmonise preparedness and response capacities on health threats related to (arbo)zoonotic viruses and their vectors in the target regions (O.1);
    - enhance awareness of the added value of integrated surveillance, risk assessment and early warning to prevent and control epidemics and epizootics (O.2).

PROJECT 76: **Preventing biological risks increased by environmental and climate change by strengthening Public Health Laboratories – (STRONGLABS).** 01/02/2019 for 36 months. EUR 2,500,000.

- COUNTRIES: **No entry.**
- OBJECTIVES: Minimise potential biological risks related to climate change by improving the detection of, response to, and recovery from outbreaks and health emergencies. The project intends to strengthen preparedness to common health threats and biosafety risks at national and regional levels, as described in the Action Document for Climate Change and Security- ANNEX IV of the Commission Implementing Decision on the Annual Action Programme 2018 for Article 5 of the Instrument contributing to Stability and Peace (IcSP).

PROJECT 81: **Enhanced Biosecurity in South East Asia (BIOSEC).** 27/11/2019 for 42 months. EUR 3,799,850.

- COUNTRIES: Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam.
- OBJECTIVES: To provide a set of recommendations for improving biosecurity management system in South East Asia with effective tools to enhance capabilities to respond to highly communicable diseases or global catastrophic biological events, such as pandemics.

PROJECT 85: **Strengthening Laboratory Capacities in Africa against CoVID-19 and other epidemics: From set up in Senegal to scale up in Africa (LABPLUS AFRICA).** 15/07/2020 for 36 months. EUR 10,000,000.

- COUNTRIES: Senegal and other countries to be identified.
- OBJECTIVES: to reinforce preparedness and response to CoVID-19 in Africa as well as to implement an innovative approach to address unmet needs of diagnostics and health services through mobile platforms delivering laboratory and health services to detect, respond, control and prevent epidemics in Africa focusing on access driven business models, local capacities and sustainability.

CHAPTER 8
Transport of dangerous goods

CHAPTER 8
TRANSPORT OF DANGEROUS GOODS

Peaceful uses of chemicals and other CBRN agents are a key part of economic development, and these uses sometimes involve multi-step transfers. Throughout these transfer chains, inattention to safety issues including administrative oversight and permission, packing and labelling, could lead to accidents causing major harm and long lasting reputational damage. Careful oversight and training is also needed to mitigate the potential of misappropriation by criminals or terrorists, a risk now explicitly built into internationally recognised regulations. These regulations are complex and their implementation is anyway costly for governments and the organisations in a transfer chain but especially so when High Consequence Dangerous Goods are involved. Effective implementation should be one of the main pillars of CBRN risk mitigation strategy. This chapter outlines these regulations, and shows how the EU is supporting CBRN CoE risk mitigation partners in preventing illicit trafficking of nuclear and other materials.

SYNOPSIS

Dangerous goods, in particular fuels, industrial gases and chemicals, play a key role in economic development, and an intrinsic activity is often that these goods are transported long distances nationally and internationally. Chemicals are widely used in any modern society, and this usually involves transfers from the production or importation source to the ultimate end user, often cascading down from initial transfers that were in multi-tonne amounts. For CBRN agents as a whole, inattention to safety issues during transfers including administrative oversight and permission, packaging and labelling, could lead to accidents causing major harm and long-lasting reputational damage. Additionally, every storage and transfer activity in a sequence must be designed to minimise the potential for misappropriation by criminals or terrorists. The risks of illicit trafficking in nuclear and other radioactive substances received increased public attention after the breakup of the Soviet Union; the focus on this by the International Atomic Energy Agency (IAEA) is covered in **Chapter 11**.

Ensuring that dangerous goods are transported safety and securely has significant cost implications for governments, for international regulatory authorities such as involved with air travel, and for each organisation involved in a particular transfer. Regulations and procedures (for containers, packaging, labelling, documentation etc.) are necessarily detailed and technically complex in the case of dangerous goods in our CBRN context; this requires significant competence levels throughout the supply chain and for officials in government inspectorates, customs and border organisations, which can only be achieved by training and awareness raising.

International concern about the potential for terrorists to obtain CBRN agents at any one of the points within a transport chain led in 2002 to significant modification of the very detailed UN Model Regulations which cover all modes of transport - road, rail, air, sea etc. The ADR are the derivative regulations used by EU Member States and others for the road mode. These changes have administrative and cost implications for transfers of the highest risk materials, High Consequence Dangerous Goods (HCDGs), imposing additional training and tracking requirements throughout the stages of a transfer. For the first time, there was a list of biological agents that require enhanced measures, thus a move away from the previous reliance on the Biosafety Risk Group that had been assigned for a laboratory setting. (For Risk Groups, see **Chapter 9**). Government regulation

and implementation measures such as inspection are needed to ensure that all organisations involved, even the smallest, understand these new rules and can demonstrate that they adhere to them. This is costly for government as well as for each element involved in transfer chains, but it should be an essential part of national CBRN risk mitigation strategies.

Historically, a source for confusion in the transport of dangerous chemicals including internationally is that in any country chemicals may also be subject to other kinds of national regulation that are not internationally harmonised, such as for workplace safety, consumer protection, storage, including protection of wildlife and the environment. These regulatory systems may contain provisions for classification and labelling which differ from those in transport regulations. The implementation of the UN action plan Agenda 21 has made progress in addressing such discrepancies, by establishing the Globally Harmonised System of Classification and Labelling of Chemicals (GHS).

EU outreach assistance in developing capacity to combat illicit trafficking of nuclear and radioactive material was one of the CBRN risk mitigation priority areas of the Instrument for Stability (IfS). From 2008, geographic expansion of this illicit trafficking support began, continuing the emphasis on equipment for borders and customs. The first project that included ASEAN countries was in 2009, supporting the preparation of border management activities. Four early CoE projects covered illicit trafficking to some extent; two of these projects involved all ten CoE SEA Partner Countries. The most recent CoE projects are widening the focus from equipment to legal frameworks, training, traffic planning and response to accidents in Partner Countries in African regions.

Annexes included:

- **Annex 1.** The derivative dangerous goods transport regulations
- **Annex 2.** The ADR 2017 List of High Consequence Dangerous Goods HCDGs
- **Annex 3.** EU-CBRN CoE projects focused on transport of dangerous goods and illicit

KEY TERMS

- **ADR:** The European Agreement of 30 September 1957 concerning the International Carriage of Dangerous Goods by Road (from a title in French)
- **Agenda 21:** A non-binding action plan of the United Nations with regard to sustainable development. It is a product of the Earth Summit (UN Conference on Environment and Development) held in Rio de Janeiro, Brazil, in 1992
- **ASEAN:** Association of Southeast Asian Nations
- **Dangerous goods:** Goods containing substances and articles, which have been identified as hazardous for transport and present a risk to people, property and the environment, and subject to regulation.
- **GHS:** Globally Harmonised System of Classification and Labelling of Chemicals
- **Hazmat:** hazardous material, a noun or adjective particularly used in the US
- **HCDGs:** High Consequence Dangerous Goods
- **IAEA:** International Atomic Energy Agency
- **IfS:** Instrument for Stability, of the EU
- **Model Regulations:** the UN Recommendations on the Transport of Dangerous Goods, also known as the “Orange Book”, when reformatted in 1994
- **Risk Group:** Biosafety Risk Groups 1-4. Used in many countries to categorise biological agents according to their risk.
- **TIC:** Toxic Industrial Chemical
- **UNECE or OSCE:** UN Economic Commission for Europe

A · THE RISKS. THE PROBLEM OF ACHIEVING SAFETY AND SECURITY IN TRANSPORTING DANGEROUS GOODS.

Dangerous goods, in particular fuels and petroleum products, industrial gases and bulk chemicals including active pharmaceutical ingredients, play a key role in economic development and an essential part of this is being transported nationally and internationally. Chemicals are widely used in any modern society, and this usually involves transfers from the production or importation source to the ultimate end user, often cascading down from initial transfers that were in multi-tonne amounts. Criminals may attempt to take control of chemicals that are being legitimately transferred and divert these for their own purposes. These include bulk chemicals with low value but bearing relatively high taxes, e.g. gasoline; and/or high-value specialty chemicals that are rare and expensive, for example, active pharmaceutical ingredients used in the manufacture of drugs for the treatment of rare diseases. Terrorism scenarios include the theft of shipments of chemicals that are precursors for explosives[1]; or theft of radioactive materials, infectious biological material or toxic industrial chemicals; or attack of bulk shipping containers to cause release of flammable, toxic or caustic chemicals or radioisotopes and thus local harm to people and the environment. Another problem area is illicit trafficking, that is the illegal trading, selling or dealing in specified goods such as the opiate drug heroin. In the CBRN field, the risks of illicit trafficking are dealt with through a number of regulatory instruments, most obviously under the International Atomic Energy Agency (IAEA) regulation to combat trafficking in nuclear and other radioactive substances[2], a risk which attracted increased public attention after the breakup of the Soviet Union.

Bulk transfers of Toxic Industrial Chemicals (TICs) are made routinely in several industry sectors including bulk TIC manufacture and distribution, fine chemical or pharmaceutical or pesticide manufacture, water treatment and waste treatment. Many TICs have a potential for serious harm if they escape in large quantity, and released in so-called “vulnerable zones”. The published US official information of the ‘vulnerable zones’ from accidental or malicious escape of chemicals from facilities or 90 tonne rail tank cars, leaves no doubt about the potential scale of the hazard. Two chemicals commonly shipped by rail in the US are chlorine and anhydrous ammonia, and rail crashes of multi-tank trains have released thousands of gallons and caused sometimes hundreds of casualties from inhalation.[3] The US Central Intelligence Agency website ‘*Terrorist CBRN*’ draws attention to the risks involved if containers of chlorine or phosgene being transported in multi-tonne shipments by road and rail were to be deliberately ruptured. [4] The number of facilities with large amounts of toxic industrial chemicals needing to be transferred could be large. For example, in the US the Department for Homeland Security in 2005 testified that approximately 3,400 chemical facilities were considered high risk, having the ability to harm 1,000 or more people.[5]

1 The EU Action Plan on Enhancing the Security of Explosives defines the top 11 precursors for Improvised explosive devices IEDs.

2 IAEA. Combating Illicit Trafficking in Nuclear and Other Radioactive Material. Technical Guidance Reference Manual no 6. https://www.iaea.org/publications/7806/combating-illicit-trafficking-in-nuclear-and-other-radioactive-material.

3 US National Transportation Safety Board. Railroad Accident Report NTSB/RAR-05/04 (PB2005-916304). Collision of Norfolk Southern Freight Train 192 with standing NS Local train P22 with subsequent hazardous materials release at Graniteville, South Carolina. 6 January 2005. https://www.ntsb.gov/investigations/AccidentReports/Reports/RAR0504.pdf.

4 US Central Intelligence Agency. Terrorist CBRN: Materials and Effects. https://www.cia.gov/library/reports/general-reports-1/terrorist_cbrn/terrorist_CBRN.htm.

5 US Department of Homeland Security. Chemical Facility Security: Regulation and Issues for Congress. CRS Report for Congress. Updated 10 January 2008. Ref 19. https://fas.org/sgp/crs/homesec/RL33847.pdf.

On a lesser scale, there will be many transfers of chemicals in small amounts for local applications such as the chlorination of drinking water supplies and swimming pools, and for use in research institutes; and huge numbers of clinical samples containing infectious biological material are transported between laboratories as part of disease diagnosis and control.

The 2007 insurgent attacks in Iraq in which cylinders of chlorine were exploded, even if ineffective in toxicity terms, generated new waves of concern in the West about the susceptibility of TIC transfers to terrorist attack. For instance, in March 2007 the UK's Guardian newspaper reported that police were monitoring the movement of industrial chlorine across Britain amid fears that terrorists planned to hijack lorries (trucks).[6] In the US, attempts at new legislation to reduce the risk of attacks on TICs during transit had begun in 2004; by 16 April 2008 an interim 'Hazmat' Rule passed into law, requiring carriers of hazardous materials to assess risks to population safety from accidents and to make appropriate routing decisions; and also to consider security issues related to *en route* storage and delays in transit.[7]

B · NEW INTERNATIONAL APPROACHES TO REGULATING THE TRANSPORT OF DANGEROUS GOODS

A real complication in practice is that if countries have different safety regulations, the international trade of chemicals and dangerous products can be seriously impeded. As so many transfers involve part journeys by two or more methods - road, rail, air, maritime (sea), inland waterways – regulations for each so called 'transport mode' need to be compatible to allow goods to pass along the transport chain safely and without confusion or delays which could be detrimental to some materials.

In 1953, the United Nations (UN) had started to address this need for **internationally harmonised regulation of dangerous goods transport** in the several modes, by creating the UN Committee of Experts on the Transport of Dangerous Goods. In 1999, the Committee's mandate was extended to provide a mechanism for a global harmonisation of systems of classification and labelling of chemicals.[8] The Sub-Committee of Experts on the Transport of Dangerous Goods (TDG Sub-Committee) comprises country experts from all parts of the world, with other states able to attend as observers. On a biennial basis it updates the UN Recommendations on the Transport of Dangerous Goods, also known as the "Orange Book"; this was reformatted in 1994 as the "**Model Regulations**". These are addressed to:

- UN Member States, for the development of their national requirements for **domestic** traffic of dangerous goods. In the European Union (EU) context, transportation regulations based on this model are developed by the UNECE or OSCE, the UN Economic Commission for Europe[9], a 56 member group of countries: EU Member States, non-EU Western and Eastern Europe, South East Europe, FSU[10] and North America;

6 Townsend M. Police track chlorine lorries in terror alert. 4 March, 2007. The Guardian. https://www.theguardian.com/uk/2007/mar/04/theobserver.uknews.

7 U.S. Government. Interim Final Rule 49 CFR parts 172 and 174. Hazardous Materials: Enhancing rail safety and security for hazardous materials shipments. April 16, 2008. Federal Register. A Rule by the Pipeline and Hazardous Materials Safety Administration on 04/16/2008. https://www.federalregister.gov/documents/2008/04/16/E8-8185/hazardous-materials-enhancing-rail-transportation-safety-and-security-for-hazardous-materials.

8 See also the objectives of Chapter 19 of Agenda 21 by the United Nations Conference on Environment and Development (UNCED) (Rio de Janeiro, 3-12 June 1992).

9 All interested UN MS may participate in the work of UNECE. Over 70 international professional organisations and other non-governmental organisations take part.

10 States of the Former Soviet Union. Also known as the Commonwealth of Independent States CIS.

- international organisations such as the International Maritime Organisation (IMO), the International Civil Aviation Organisation (ICAO) and regional commissions such as UNECE for regulations and international/regional agreements or conventions governing the **international** transport of dangerous goods by the different modes. Each **modal regulation** is to be based on the latest edition of the Model Regulation and thus compatible with one another.

The Model Regulations cover the following main areas in a detail that provides an unambiguous framework:

- List of dangerous goods most commonly carried and their identification and classification. Consignment procedures: labelling, marking, and transport documents;
- Standards for packaging and Intermediate bulk containers; test procedures and certification;
- Standards for multimodal tank-containers (portable tanks) and bulk containers; test procedures, certification and service requirements;
- A national Competent Authority (CA), empowered and trained to carry out spot checks anywhere in the transport chain. Each organisation in the chain must have a Safety Adviser holding a training certificate from the CA.

The World Health Organisation (WHO) biosecurity guidance for Valuable Biological Material includes headline advice on transfers and refers to the Model Regulations.[11] (See **Chapter 9**).

For radioactive material, the IAEA issues detailed requirements in the "IAEA Regulations for the Safe Transport of Radioactive Material". (See **Chapter 11**). These **IAEA requirements are also incorporated in the UN Model Regulations**. A radiation protection programme must be set up to ensure containment of the radioactive contents, control of external radiation levels, prevention of criticality[12], prevention of damage caused by heat. Radiation dose rate monitoring and contamination monitoring of packages vehicles etc. may be required. The IAEA Transport Safety Appraisal Service (TranSAS) reviews the implementation of transport regulations in IAEA MS and provides recommendations for improvement.[13] Readable summaries of the evolution of the Model Regulations appear in periodic reviews[14] by the UN Economic Commission for Europe OSCE/UNECE. OSCE tasks include advising on changes to the Model Regulations and guiding the process of harmonising and simplifying border crossing procedures for the various modes of inland transport.

Agenda 21 and the Globally Harmonised System of Classification and Labelling of Chemicals. The Model Regulations are of course only implemented through transport regulations. However, dangerous chemicals are also subject to other kinds of regulation that are not internationally harmonised, such

11 WHO. Biorisk management. Laboratory biosecurity guidance. September 2006. WHO/CDS/EPR/2006.6. page 22. https://www.who.int/csr/resources/publications/biosafety/WHO_CDS_EPR_2006_6.pdf.

12 A self-sustaining nuclear chain reaction.

13 IAEA. Transport Safety Appraisal Services (TranSAS). https://www.iaea.org/services/review-missions/transas.

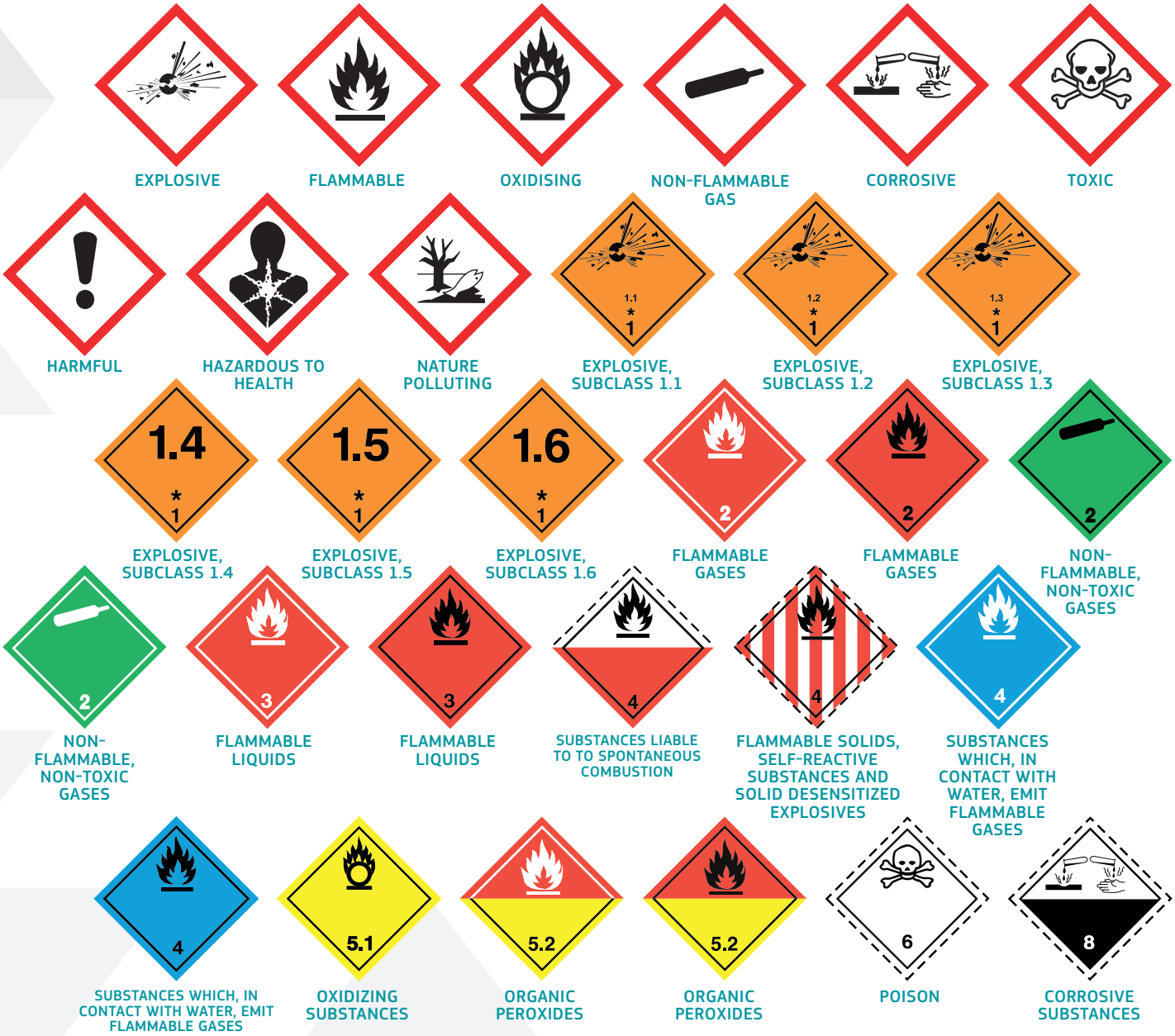
14 OSCE. Review of the implementation of OSCE commitments in the economic and environmental dimension. Transport of Dangerous Goods. Sixteenth OSCE Economic and Environmental Forum, 19-21 May 2008 Prague, Czech Republic. https://www.osce.org/eea/31854?download=true.

UN RECOMMENDATIONS ON THE TRANSPORTATION OF DANGEROUS GOODS

High consequence dangerous goods.

Refer to the UN recommendations on the Transport of DG- Model Regulations- 18th revised edition:
http://www.unece.org/trans/danger/publi/unrec/rev18/18files_e.html

GLOBALLY HARMONIZED SYSTEM (GHS) OF CLASSIFICATION AND LABELLING OF CHEMICALS



as for workplace safety, consumer protection, wildlife and environmental concerns and storage. These regulatory systems also contain provisions concerning classification and labelling which may differ from those in transport regulations. Progress to reduce the scope for confusion started. In June 1992, when the UN Conference on Environment and Development (UNCED) adopted "Agenda 21" as the programme of action for the future.[15] Its Chapter 19 addressed the environmentally sound management of toxic chemicals including prevention of illegal international traffic in toxic and dangerous products. Chapter 19 outlines six programme areas for action:

- expanding and accelerating international assessment of chemical risks;
- harmonization of classification and labelling of chemicals;
- information exchange on toxic chemicals and chemical risks;
- establishment of risk reduction programmes;
- strengthening of national capabilities and capacities for management of chemicals;
- prevention of illegal international traffic in toxic and dangerous products.

After coordination between several international agencies, significant progress was made towards this second Agenda 21 objective by establishing the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), adopted in December 2002 and revised in 2007. The GHS makes recommendations about hazard classification and hazard communication (including labelling and safety data sheets) for materials including compressed gases, flammable gases, toxic gases, corrosive gases and oxidizing gases. As of June 2011, 67 countries had implemented the GHS into their national frameworks for chemical labelling and classification, while others were revising their national guidelines.[16]

C · ADDITIONAL TRANSPORT SECURITY MEASURES ADOPTED IN 2002

Two events in 2001 - the mailing of letters containing anthrax spores in the US, and the 9/11 attacks in New York – led to an increasing realisation that terrorist actions could be *unpredictable* and could include a CBRN attack. One of the responses of governments was to propose the addition of specific **security requirements to the UN Model Regulations**. The 2003 edition, which entered into force in most transport modes in 2005, included new security provisions for all dangerous goods as well as more rigorous provisions for a new grouping of goods, **High Consequence Dangerous Goods** (HCDGs), explicitly defined as "*those which have the potential for misuse in a terrorist incident and which may, as a result, produce serious consequences such as mass casualties, mass destruction, or, particularly for Class 7, mass socio-economic disruption.*"[17] (Class 7 covers **radioactive and fissile materials)**. The new security provisions were published in Chapter 1.4 of the UN Model Regulations. They appeared in Chapter 1.10 of ADR and RID for mandatory application to international (and domestic in EU countries)

15 UNCED. Agenda 21. 1992, UN Sustainable Goals Knowledge Platform. https://sustainabledevelopment.un.org/outcomedocuments/agenda21.

16 UN. Review of implementation of Agenda 21. Sustainable Development in the 21st century (SD21). Study prepared by the Stakeholder Forum for a Sustainable Future, January 2012. Chapter 19, pp129-133. https://sustainabledevelopment.un.org/content/documents/1126SD21%20Agenda21_new.pdf.

17 ADR 1.10.3.1.3. https://adrbook.com/en/2017/ADR/1.10.3.1.3.

transport by road and rail as from 1 July 2005, and similarly in the codes for maritime transport and for air transport. (The derivative codes ADR and RID are described in **Annex 1** below).

In the ADR, the derivative regulations used by EU MS and others for the road mode, the security General Provisions for all dangerous goods cover:

- the consignment of the goods;
- the security of sites for temporary storage during transfer;
- means of identification of carrier staff;
- that safety inspections must include appropriate security aspects;
- valid training certificates of drivers, which must be registered with the national Competent Authority;
- the security training of persons involved.

In this way, all aspects of the transfer are addressed, involving 'consignors', 'loaders', 'carriers', and 'unloaders'.

There are additional security provisions for HCDGs. HCDGs also require a security plan to prevent theft of vehicles and cargoes, to include allocation of responsibilities, records and tracking of goods and vehicles. Arrangements between consignors, carriers and any other participants in the transport operation must adopt and comply with the plan.[18]

Achieving a balance. The regulators recognised that they would need to strike a balance between safe practices, security, and commercial realities. To determine views on whether this had been achieved, a comprehensive review of the effects of changes to the international legislation since 2001 was carried out on behalf of the European Commission during 2007-2008. The consultants concluded that the new security additions had provided the right level of protection to the public while allowing that trade and other movements of dangerous goods must continue with the minimum of restriction.[19]

18 ADR Chapter 1.10. Security Provisions. https://adrbook.com/en/2017/ADR/1.10.

19 Pira Consulting Report. Final Report HCDG Study. Prepared for European Commission by Pira International. 13 October 2008. EU Ref: TREN/07/ST/S07.76239 Pira Ref: S.004183. https://ec.europa.eu/transport/sites/transport/files/themes/security/studies/doc/2008_10_hcdg_study.pdf.

Chemical HCDGs. The list of HCDG categories and their packing requirements that appear in the 2017 ADR is reproduced in Annex 2 below. Designation of a shipment as HCDGs, with the additional restrictions for security, is determined by *the risk from the combined factors of the type of the material and the amount being transferred.* As examples: hydrogen fluoride is to be treated as HCDGs of Class 8, (Corrosive substances ….) when shipped in amounts above 3000 litres; chlorine, anhydrous ammonia, phosgene and sulphur dioxide appear in Class 2.2 (Toxic gases…), in all cases regardless of the amount being shipped.

Infectious substances as HCDGs. Up to 2002, the Model Regulations had used Biosafety Risk Group to determine the procedures for transporting infectious material through the modes. (For explanation of Risk Group see Chapter 9). In a laboratory setting, Risk Groups are an accepted device to define the level of hazard when biological material is being handled, but experts in the TDG Sub-Committee argued that the hazard would always be much reduced during transfer of specimens that are properly packed, labelled etc. according to the transport regulations. Thus, applying 'Risk Group' during transit often led to a designation of a particular package that was **disproportionate to the actual risk,** adding unnecessary complications, cost and often delays that would affect the provision of healthcare, diagnostic analysis and the swift treatment of new and emerging diseases.

Accordingly, from January 2005 risk groups would no longer be used in the UN transport regulations. Instead, Infectious substances would be placed in one of two Categories based on the scientific risk during transport, each category subject to different packing criteria.[20] The WHO published new guidance to reflect these changes.[21] The two defining Categories are:

- **Category A**: an infectious substance which is transported in a form that, when exposure to it occurs, is capable of causing permanent disability, life-threatening or fatal disease to humans or animals. And any other infectious substance when shipped as a culture (laboratory stocks) i.e. the result of a process by which pathogens are amplified or propagated in order to generate high concentrations.

- **Category B:** An infectious substance that does not meet the criteria for inclusion in Category A, unless shipped in a cultured (laboratory stocks) form. This category includes cultures intended for diagnostic and clinical purposes, and human or animal material being transported for research, diagnosis, investigational activities, disease treatment or prevention etc.

An indicative list of microorganisms assigned to Category A was provided. Because the list is not exhaustive, new or emerging pathogens which do not appear in the list but which meet the same criteria must be transported as a Category A infectious substance. Also, in case of doubt, a pathogen must be transported as a Category A. The list comprises 49 human pathogens humans (UN 2814) and 12 animal pathogens (UN 2900).

Because of the high administrative, training and cost burdens of HCDG security for a carrier dealing with

20 Sub-Committee of Experts on the Transport of Dangerous Goods Twenty-fifth session Geneva, 5-14 July 2004. Infectious substances Guidance Note from the Joint Aviation Authorities (JAA) Dangerous Goods Study Group. Transmitted by the expert from the United Kingdom. http://www.unece.org/fileadmin/DAM/trans/doc/2004/ac10c3/UN-SCETDG-25-INF43e.pdf.

21 WHO. Guidance on regulations for the Transport of Infectious Substances 2007– 2008. Applicable as from 1 January 2007. WHO/CDS/EPR/2007.2. https://www.who.int/csr/resources/publications/biosafety/WHO_CDS_EPR_2007_2cc.pdf.

Category A infectious substances, few carriers may be able to offer this service and even if so it will be expensive. Postal services, convenient for these typically small packages, may decide not to offer to carry Category A material. It is therefore **important that the transfer of diagnostic and clinical specimens,** common when local hospital laboratories need quickly to send samples to large specialist or 'reference' laboratories for further testing, can be handled by carriers operating under the reduced security provisions and costs of Category B dangerous goods.

Drones as a means of transporting dangerous goods. Drones are dual-use technology: the military, criminals and terrorists alike have used drones for spying and carrying out attacks; and the latter two have also employed drones to transport drugs and other supplies for their operations. Drones or unmanned aircraft vehicles (UAV) are now being used to deliver commercial goods, as well as the much needed medicines, donated organs and other life-saving materials when no time can be wasted and/or in dangerous or inaccessible places. Recently, drones have found a wide-range of uses in both the negative and positive sides: non-state actors use drones to attack military, civilian and industrial establishments on one-hand; and on the other hand, law enforcement and first responders employ drones in apprehending criminals and in rescue operations during natural disasters. Drones are also used in sports and entertainment industry, as well as in research on wild-life conservation (mapping and tracking of wild animals in large areas). Clearly, with the many possibilities of using drones for commercial purposes (legitimate or otherwise), including as a means of transporting/delivering controlled or regulated substances as well as other possible dangerous goods, international and national regulations on their use had to be developed and implemented. The literature includes those published by private companies[22] as well as free-access databases for national regulations associated with the use of drones.[23]

D · THE IMPLEMENTATION OF THE UN MODEL REGULATIONS.

Universal application of these standards is intended to lead to safe and effective methods for transport, handling and control, thus reducing time consuming formalities at the interchanges and facilitating trade. It also allows a coherent approach to emergency response. Governments are recommended to develop national regulations that implement these provisions by following the actual structure of the model, with any supplements necessary for legal reasons or because of additional requirements specific to a mode of transport, like drones There is no doubt that international transport of dangerous goods has been facilitated by two factors: the centralised practical experience at government and industry expert level that is fed into the Model Regulations; and the harmonisation of the major international conventions or agreements with the Model Regulations, with coordinated updating. Nevertheless, the fact that national regulations for inland transport are not always brought into line simultaneously, or completely, will continue to cause problems in international trade, in particular in the case of transfers involving several modes.

Association of Southeast Asian Nations (ASEAN) countries. The Economic and Social Commission for Asia and the Pacific (UNESCAP) published, in 1997, Guidelines for the Establishment of National and Regional Systems for Inland Transportation of Dangerous Goods, recommending the implementation of the UN Recommendations on the Transport of Dangerous Goods. On 20 September 2002, the Transport

22 Rand Corporation. International Commercial Drone Regulation and Delivery Services by Therese Jones. 2017: https://www.rand.org/pubs/research_reports/RR1718z3.html.

23 Global Drone Regulations Database: https://www.droneregulations.info/.

Ministers of the Association of Southeast Asian Nations (ASEAN) signed Protocol No. 9 to the ASEAN Framework Agreement on the Facilitation of Goods in Transit. This Protocol provides for the simplification of procedures and requirements for the transport of dangerous goods in ASEAN, using the Model Regulations and ADR. UNECE/OSCE (see above), the UN body that considers *inter alia* transport regulation, has no members from the CoE SEA region, but one of its four counterpart regional commissions is the Economic and Social Commission for Asia and the Pacific ESCAP.[24] ASEAN uses Regional Forum workshops to improve connectivity and intelligence-sharing on illicit transfers and to focus on capacity building, technical support and information exchange.[25]

E · EU OUTREACH TO PARTNER COUNTRIES

Outreach assistance in developing capacity to combat illicit trafficking was one of the CBRN risk mitigation priority areas of the Instrument for Stability (IfS)[26], as an objective for "*Strengthening the capacity of the competent civilian authorities involved in the development and enforcement of effective control of illicit trafficking in chemical, biological, radiological and nuclear materials or agents (including the equipment for their production or delivery), including through the installation of modern logistical evaluation and control equipment".* These IfS outreach actions reflect EU strategy against the proliferation of weapons of mass destruction[27], and are also in line with UN Security Council Resolution 1540 (2004).[28]

The IAEA-EU Joint Action EUJA partnership was established in 2005.[29] (See **Chapter 11**). Shortcomings to be addressed included nuclear security measures for material in use, storage and *transport.* The total budget for EUJA projects was nearly EUR 32 million, providing support to 82 countries between 2005 and 2013. The decision to support the combating of illicit trafficking measures in six FSU countries (Ukraine, Armenia, Georgia, Russia, Moldova and Azerbaijan) was a logical transition from the TACIS programme.[30] The nuclear heritage of FSU countries left risks that needed to be addressed, and TACIS and now IfS support was able to contribute to this objective. The first contract was IfS/2008/145-156, running from 11/07/2008 to 12/04/2103, to supply equipment for **detection of nuclear and radioactive materials NRM** at border check points in the FSU. The programme was extended in 2008 to include Belarus, which has common borders with countries of the EU. The choice of the European

24 See UNECE. https://www.unece.org/mission.html.

25 ASEAN Regional Forum (ARF) Workshop: Countering Illicit Trafficking of Chemical, Biological, Radiological and Nuclear Materials – Interagency awareness building. 20-21 November, 2013, Manila, Philippines. https://www.un.org/en/sc/1540/documents/Information%20Note%20Manila%20ARF%20CBRN%20WS%202013-78.pdf.

26 Set out in Regulation (EC) No 1717/2006 of 15 November 2006 establishing an Instrument for Stability., Article 4, paragraph 2(d). https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02006R1717-20061214&from=ET.

27 Annex to document 15656/03 submitted by the European Council to PECS, CODUN, CONOP and COARM on 10 December 2003 (see in particular paragraphs 30.A5 and A.6). http://register.consilium.europa.eu/pdf/en/03/st15/st15708.en03.pdf.

28 UNSCR 1540 (2004) emphasises inter alia the need for measures to account for and secure materials related to CBRN weapons during ... transport; and measures to detect, deter, prevent and combat the illicit trafficking and brokering of such items. This implies controls on transit and trans-shipment.

29 IAEA – EU Joint Action, Partnership in Improving Nuclear Security, IAEA, Vienna (2013). https://www.iaea.org/sites/default/files/nseu0613.pdf.

30 TACIS (Technical Assistance to the Commonwealth of Independent States and Georgia) was the European Community's effort to support the economic reform and development in the ten Former Soviet Republics and Georgia. It started in 1991.

Commission's JRC[31] as the main contractor capitalised on its experience of working closely in the Border Monitoring Working Group with the IAEA and the US National Nuclear Security Administration, both of which have extensive contacts in priority countries.

The IfS Multi-Annual Indicative Programme for 2009-2011 includes Project area 2 *Fighting illicit CBRN trafficking and deceptive financial practices*, with an objective to **s**trengthen the authorities involved in the developing and enforcing effective controls.[32] Coordination was foreseen with groups like the UN Counter Terrorism Implementation Task Force (CTITF) composed of the UNICRI, IAEA, OPCW, WHO, Interpol and the 1540 Committee, to ensure exchange of illicit trafficking data. As a geographic expansion, priority would be given to the Middle East (including Egypt, Jordan, and UAE); Morocco; Central Asia and the Southern Caucasus; and South and South-East Asia (including India, Indonesia, Malaysia, Singapore and Thailand). Among the indicators would be the number of borders equipped and the percentage of equipment supplied still working after two years.

From 2008, the potential for geographic expansion of the **illicit trafficking support** began to be explored. The first project that included ASEAN countries was IfS/2009/219-636, entitled *Combating illicit trafficking of nuclear and radioactive materials in selected FSU and Mediterranean Basin countries and preparation of border management activities in the ASEAN region*. The contract was to run from 2/12/2009 to 1/12/2014, with an indicative budget of EUR 6.7 million. From 2012-2015 there were three projects to supply radiation detection equipment to border guards and customs entities in Thailand, Cambodia, Laos and the Philippines.[33] Four early CoE projects covered illicit trafficking to some extent; two of them included all the CoE SEA countries. (See **Annex 3** below for list of relevant CoE projects).

Following the outreach emphasis on equipment for borders and customs that goes back almost two decades, CoE support specifically directed at **transport controls** has now begun, with Project 71 and 72 in preparation, variously focusing on legal frameworks, training, traffic planning and response to accidents in countries in African regions.

F · HAZARDS FROM CBRN MATERIALS BEING TRANSPORTED IN ASEAN COUNTRIES

In **Chapter 4** we have already described two incidents where harm resulted from radioactive material being transported without authorisation. One was an incident in Samut Prakan, Thailand, in 2000, involved several teletherapy heads which were stolen and taken to a scrap yard. Ten people received high doses of radiation and three of them died. Under the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, the Thai authorities requested advice from the IAEA on the medical

31 The Joint Research Centre is the Commission's science and knowledge service. It employs scientists to carry out research in order to provide independent scientific advice and support to EU policy. https://ec.europa.eu/info/departments/joint-research-centre_en.

32 EU. The Instrument for Stability- Multi-Annual Indicative Programme 2009-2011. Brussels, 8.4.2009 C(2009)2641 pp24-26. https://reliefweb.int/sites/reliefweb.int/files/resources/F66EDF39EEAABA8E492575F2000ECA23-Full_Report.pdf.

33 Council of the EU. Annex to the 2016 Annual Progress Report on the Implementation of the European Union Strategy against the Proliferation of Weapons of Mass Destruction. Annex II. Overview of Instrument for Stability, Priority 1, "Risk mitigation and preparedness relating to Chemical, Biological, Radiological and Nuclear Materials or Agents". Brussels, 17 January 2017. 5361/17 ADD 2. http://data.consilium.europa.eu/doc/document/ST-5361-2017-ADD-2/en/pdf.

treatment of the exposed people.[34] A more recent example was that a moisture density gauge containing radiosotopes that went missing from Norzagaray town, Bulacan in the Philippines in August 2018.[35]

Case histories in Malaysia.[36] According to records from the Malaysian Atomic Energy Licensing Board, since the 1990's there have been 17 cases involving theft or loss of radioactive materials. The last reported case in August 2018 indicated the loss of an industrial device as it was being transported 30 miles from the town of Seremban to Shah Alam on the outskirts of the capital, Kuala Lumpur. The device was an industrial radiography unit with an iridium 192 isotope used for non-destructive testing; it was considered to be very dangerous, though only if the metal discs containing the radioactive isotope were to be taken out of the shielding container.

The incident caused concerns at the highest levels of the government. The Special Branch's Counter-Terrorism Division assistant principal director reported that this was not a case linked to terrorism, but was a criminal investigation. Because the possibility of malicious intent and insider threat could not actually be ruled out, the Malaysian government in late August 2018 set up a special task force of the Atomic Energy Licensing Board and local police to continue investigating the incident. The neighbouring country Singapore stepped up its border checks after the report of the missing device.

The missing radioactive device in Malaysia was said to have raised concerns on the **regional level**, for a variety of reasons. First, Malaysia is in a strategic location for shipping routes as it shares a border with Singapore—one of the world's busiest ports. With a high volume of cross-border transfer of goods into and out of Singapore, a perpetrator could smuggle a radioactive source to a country with porous borders. Fortunately, Singapore has a robust Radiation Portal Monitor (RPM) infrastructure to prevent the smuggling of radioactive material.

While Malaysia has developed a strong export control regime for the sophisticated dual-use technologies being manufactured in the country, unfortunately in the past it has been a target and platform for nuclear smuggling. In the early 2000's, the A.Q. Kahn network used Malaysia as a starting point to produce and export materials to Libya that later would be used in its clandestine nuclear weapons program. It was suggested that the 2018 incident of the missing radioactive device could raise questions about the effectiveness of Malaysia's nuclear legal framework that regulates the security of radioactive materials. As part of its efforts to adhere to its nuclear security regime, Malaysia has programmes to detect radiation sources at scrap yards and conduct a follow-up forensic investigation. Furthermore, with the objective of having broader regulatory control over radioactive sources, the licensing board, in cooperation with the Malaysia Remote Sensing Agency, in September 2017 launched a mobile phone app that allows the appropriate authorities to locate radioactive material throughout Malaysia.

34 IAEA. The Radiological accident in Samut Prakarn. 2002. https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1124_scr.pdf.

35 Kromek. Radioactive material missing in the Philippines. 27 September 2018. https://www.kromek.com/news/radioactive-material-missing-in-the-philippines/.

36 Parada F. et al. Radioactive material is still missing in Malaysia: Cause for concern? 14 September 2018. Bulletin of the Atomic Scientists. https://thebulletin.org/2018/09/radioactive-material-is-still-missing-in-malaysia-cause-for-concern/.

Case histories in Vietnam.[37] [38] In Vietnam since 2002 there have been seven reported incidents of radioactive sources going missing, including Ir-192, Cs-137 and Co-60. The last reported incident in 2016 was a Cs-137 source that disappeared from Bac Kan Cement Company in northern Vietnam. This container was found to be missing when the company was asked to move the radioactive material from its warehouse to a safer place, but the company did not know when the loss had occurred. Following the incident, the company was asked to suspend operations; authorities suspected that the missing radioactive material might be have been sold for scrap metal. According to the Viet Nam Agency for Radiation and Nuclear Safety (VARANS) data, only three of the radioactive sources missing over this period have been found.

However, Vietnam was able to report at the 2016 Nuclear Security Summit[39] that it had established a national database of radioactive sources and detailed administrative information on all facilities with radioactive sources. At the same time, a pilot project on radiation source location tracking system (RADLOT) has been implemented with cooperation between Viet Nam, the Republic of Korea and the IAEA. The project provides the infrastructure necessary for stricter control of these radioactive sources, making source tracking mandatory.

A case history in the Philippines.[40] [41] On June 21, 2008, M/V Princess of the Stars sank in the waters off Sibuyan Island in Romblon, the Philippines, caught by a tropical typhoon Frank (Fengshen) while sailing from Manila to Cebu City. The vessel was carrying 724 passengers and 141 crew, as well as dangerous goods: 402 barrels of the pesticide endosulfan (about 10,000 kilograms) imported from Israel, four other pesticides (carbofuran, propineb, metamidophos and niclosamide), and a large quantity of bunker fuel. The pesticides were from Bayer Philippines for delivery to the pineapple plantations of Del Monte Philippines, Inc. Planning for salvage operations was greatly complicated by the toxicity of the cargo. The United Nations responded to the Philippines call for assistance, and recommended extensive monitoring and protocols to avoid exposing salvage crews and the nearby islands and environment to risks. Many of the residents of the nearby San Fernando town were evacuated. The recovery operations for the endosulfan and other chemicals lasted three and a half months, until October, 2008. After siphoning off the fuel from the sunken vessel, the last phase was recovery of some 560 bodies which were decontaminated before being shipped to Manila for identification by relatives. DNA identification was conducted in Sarajevo. The Stockholm Treaty on Persistent Organic Pollutants, to which the Philippines has been a party since 2004, was amended in 2011 to include endosulfan in the list of pollutants.[42]

37 Viet Nam Net Bridge. Seven incidents of radioactive sources in Vietnam. Update 13 January 2016. https://english.vietnamnet.vn/fms/special-reports/149927/seven-incidents-of-radioactive-sources-in-vietnam.html.

38 Viet Nam News. Missing radioactive materials might be sold as scrap. Update 07 January, 2016.

39 National Progress Report: Vietnam. 31 March 2016. Nuclear Security Summit Washington 2016. http://www.nss2016.org/document-center-docs/2016/3/31/national-progress-report-vietnam.

40 ABS-CBN News. Salvors complete endosulfan recovery from 'Princess'. Posted 05 October 2008. https://news.abs-cbn.com/nation/10/05/08/salvors-complete-endosulfan-recovery-princess.

41 Howard C. Endosulfan threat still looms off Romblon. Posted 03 September, 2008. ABS CBN News. https://news.abs-cbn.com/anc/09/03/08/endosulfan-threat-still-looms-romblon.

42 PhilStar bans use of technical grade endosulfan. 26 January, 2015. https://www.philstar.com/business/2015/01/26/1416684/fpa-bans-use-technical-grade-endosulfan.

ANNEX 1

THE DERIVATIVE DANGEROUS GOODS TRANSPORT REGULATIONS

The implementation of the Model Regulations though derivative regulations is best considered under two headings**:**

A · IMPLEMENTATION THROUGH LEGAL MODAL INSTRUMENTS OF GLOBAL SCOPE.

Maritime transport. To implement the two international Conventions that apply, the International Maritime Organisation publishes the "International Maritime Dangerous Goods Code" (IMDG Code). The seven parts of the UN Model Regulations are supplemented with chapters dealing with stowage and segregation of dangerous goods and cargo transport units on board ships, marine pollution aspects, carriage of road tank vehicles on board ships, special provisions in the event of an incident and fire precautions, transport of dangerous goods in shipborne barges on barge-carrying ships, transport of wastes, etc.

Air transport. The underpinning convention is implemented by the International Civil Aviation Organisation (ICAO)'s "Technical Instructions for the Safe Transport of Dangerous Goods by Air". The 189 Contracting Parties to the Chicago Convention are required to implement these Technical Instructions or to notify ICAO of those cases where they have adopted provisions different from those contained in the Technical Instructions. The International Air Transport Association (IATA) also publishes "Dangerous Goods Regulations" based on the ICAO Technical Instructions. This manual incorporates additional operational requirements and is intended to provide a harmonised system of procedures for air transport operators to accept and transport dangerous goods safely and efficiently.

B · IMPLEMENTATION THROUGH INTERNATIONAL LEGAL INSTRUMENTS OF REGIONAL APPLICATION

ADR – European Agreement concerning the International Carriage of Dangerous Goods by Road. ADR was developed under the auspices of the UNECE Inland Transport Committee and was concluded in 1957. It entered into force in 1968. ADR is intended primarily to increase the safety of international transport by road, but it is also regarded as an important trade facilitation instrument. There are at present 51 Contracting Parties to ADR.

RID – Regulations concerning the International Transport of Dangerous Goods by Rail. RID is annexed to the Convention for international transport by rail (COTIF), and therefore it is applied by all Contracting Parties to the COTIF, i.e. 50 countries including all western and central European countries plus certain Middle East and North African countries.

ADN – European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways. It entered into force on 29 February 2008, with 8 Contracting Parties: Austria, France, Germany, Hungary, Luxembourg, Moldova, Netherlands and Russian Federation.

ASEAN countries. See main text.

ANNEX2

THE ADR 2017 LIST OF HIGH CONSEQUENCE DANGEROUS GOODS HCDGS

Ref: Table 1.10.3.1.2 from ADR 2007. https://adrbook.com/en/2017/ADR/1.10.3.1

CLASS	DIVISION	SUBSTANCE OR ARTICLE	QUANTITY		
			TANK (L) C	BULK (KG) D	PACKAGES (KG)
1	1.1	Explosives	a	a	0
	1.2	Explosives	a	a	0
	1.3	Compatibility group C explosives	a	a	0
	1.4	Explosives of UN Nos. 0104, 0237, 0255, 0267, 0289, 0361, 0365, 0366, 0440, 0441, 0455, 0456 and 0500	a	a	0
	1.5	Explosives	0	a	0
2		Flammable gases (classification codes including only the letter F)	3000	a	B
		Toxic gases (classification codes including letters T, TF, TC, TO, TFC or TOC) excluding aerosols	0	a	0
3		Flammable liquids of packing groups I and II	3000	a	B
		Desensitized explosives	0	a	0
4.1		Desensitized explosives	a	a	0
4.2		Packing group I substances	3000	a	B
4.3		Packing group I substances	3000	a	B
5.1		Oxidizing liquids of packing group I	3000	a	B
		Perchlorates, ammonium nitrate, ammonium nitrate fertilisers and ammonium nitrate emulsions or suspensions or gels	3000	3000	B
6.1		Toxic substances of packing group I	0	a	0
6.2		Infectious substances of Category A (UN Nos. 2814 and 2900, except for animal material)	a	0	0
8		Corrosive substances of packing group I	3000	a	B

a Not relevant.

ANNEX 3

CBRN COE PROJECTS FOCUSED ON TRANSPORT OF DANGEROUS GOODS AND ILLICIT TRAFFICKING

Ref: CBRN Centres of Excellence. Addressing regional CBRN risk mitigation needs. http://www.cbrn-coe.eu/Projects.aspx

A · IN THE SEA REGION

PROJECT 21: **Building regional border control capacity to identify and detect CRN materials.** 21/12/2012 for 24 months. EUR 700,000.

- **COUNTRIES:** Brunei Darussalam, Cambodia, Gabon, Indonesia, Lao PDR, Malaysia, Mauritania, Morocco, Myanmar, the Philippines, Senegal, Singapore, Thailand, Vietnam.
- **OBJECTIVES:** To develop and strengthen national border control capacity by improving the understanding of Chemical, Radiological and Nuclear (CRN) materials and raising awareness of the risk posed by such materials if they are not properly managed and handled by national authorities at borders (land, sea and air). To foster regional inter-agency cooperation and promote synergies between national border control authorities.
- **KEYWORD(S):** Border control; detection and identification; inter-agency cooperation; regional cooperation.

PROJECT 28: **Supporting development of an integrated national security system for nuclear and radioactive material.** 21/12/2012 for 24 months. EUR 700,000.

- **COUNTRIES:** Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Vietnam.
- **OBJECTIVES:** To enhance national capacity in the radiological and nuclear safety and security field. To contribute to the development of a national strategy to combat illicit trafficking of radiological and nuclear material. To contribute to the elaboration of a national response plan for potential radiological or nuclear incidents**.**
- **KEYWORD(S):** Illicit trafficking; national response plan; radiological and nuclear safety; radiological and nuclear security

B · IN OTHER COE REGIONS.

PROJECT 01: **Identification and strengthening forensic capacities in the area of prevention of organised crime and illicit trafficking of chemical agents.** 01/01/2013 for 24 months. EUR 64000**.**

- **COUNTRIES:** Bosnia and Herzegovina, Croatia, Serbia.
- **OBJECTIVES:** To increase capabilities in monitoring and reporting of import/export activities of chemical substances through the providing of equipment and improvement of fast identification of chemical substances at border crossings.
- **KEYWORD(S):** Chemical detection; border security; customs control; illicit trafficking; import/export.

PROJECT 16: **Supporting development of an integrated national nuclear security system.** 01/01/2013 for 24 months. EUR 183,000.

- **COUNTRIES:** Libya, Morocco, Tunisia.

- **OBJECTIVES:** The project aim is the elaboration of a National Response Plan for potential radiological and nuclear incidents, the developing of a national strategy to combat illicit trafficking of radiological and nuclear materials.
- **KEYWORD(S):** Illicit trafficking: safety and security; nuclear; radiological.

PROJECT 70: **Provision of specialized equipment to manage transport accidents with dangerous goods aimed for first responders**. 02/02/2018 for 24 months. EUR 2,249,717.

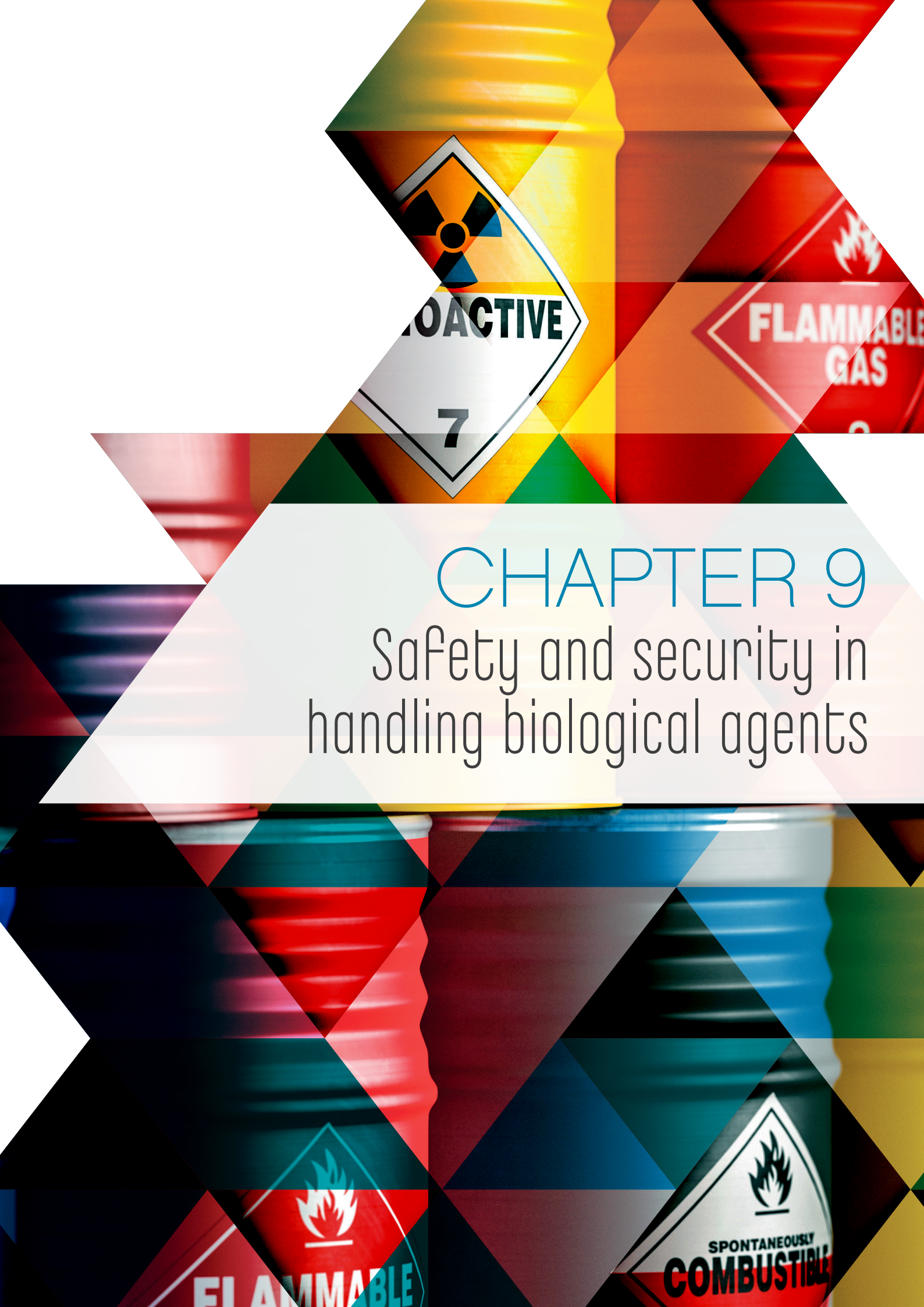
- **COUNTRIES:** African Atlantic Façade, North Africa and Sahel.
- **OBJECTIVES:** Provision of specialized equipment to manage transport accidents with dangerous goods aimed for first responders in the African Atlantic Façade and North Africa and Sahel region (AAF: Benin, Cameroon, Côte d'Ivoire, Gabon, Liberia, Mauritania, Morocco, Senegal, Sierra Leone and Togo; NAS: Algeria, Burkina Faso, Mali, Niger, Tunisia).

PROJECT 71: **Safer and more secure transportation of dangerous goods by road and rail in the AAF region (SECTRANS AAF).** 07/12/2018 for 36 months. EUR 2,249,250**.**

- **COUNTRIES:** Benin, Cameroon, Côte d'Ivoire, Gabon, Liberia, Mauritania, Morocco, Senegal, Sierra Leone, Togo.
- **OBJECTIVES:** Improving safety and security regulations for TDG; Improving awareness and skills of transportation entities and their staff; Improving capacities to respond to TDG accidents.

PROJECT 72: **Developing and strengthening the capacities for the management of risks associated with the land transport of chemical and biological materials (SECTRANS NAS).** 17/12/2018 for 36 months. EUR 2,249,600.

- **COUNTRIES:** Algeria, Burkina Faso, Mali, Morocco, Niger, Tunisia.
- **OBJECTIVES:** 1. Strengthen the legal framework by supporting partner countries to enhance the legislative and regulatory framework; 2. Develop a model traffic circulation plan focusing on TDM; 3. Improve prevention, preparedness and response by developing practical guidelines and providing training, specific workshops and exercises. Very detailed specific objectives could be developed which can be summarized as follows:
  - Improving safety and security regulations for TDG;
  - Improving TDG logistics and traffic planning;
  - Improving prevention, preparedness and response to TDG accidents by increasing the awareness and skills of transportation entities, first responders and security services.



CHAPTER 9
Safety and security in handling biological agents

CHAPTER 9

SAFETY AND SECURITY IN HANDLING BIOLOGICAL AGENTS

A key part of the EU's support to partner countries for capacity building in CBRN risk mitigation has been to improve safety and security practices in civilian facilities where CBRN agents are found. From the start of the EU-CBRN CoE initiative in 2010, improving laboratory biosafety and biosecurity has been a key objective. There have already been eleven EU-CBRN CoE projects on these issues, many of them in the SEA region. Apart from minimising health risks, measures to prevent the use of legitimate facilities by criminals or terrorists have become important. This is an essential objective for CBRN risk mitigation because of the legal obligations under UN Security Council Resolution 1540 and the 2005 WHO International Health Regulations (IHR) to implement effective measures. Chapter 9 explains the complex terminology and concepts, and demonstrate how the design of biosafety facilities more suitable for developing countries is being discussed.

SYNOPSIS

EU determination to support partner countries in their safety practices in civilian facilities where CBRN agents are found has been apparent throughout the CBRN risk mitigation outreach programme. Up to 2007, the main objective of this aspect of external support was to reduce CBRN illicit trafficking and to secure nuclear and chemical materials in Former Soviet Union countries. The EU-CBRN CoE saw a broadening into new areas of safety, accompanied by a geographic expansion. In view of the importance of this EU-CBRN CoE support, this Chapter considers it in some detail. One of the two pilot projects of the EU-CBRN CoE initiative was the 'Reinforcement of legislation and regulations in the field of biosafety, biosecurity and laboratory management systems', carried out in the SEA region in 2011 and 2012. Since then, eight EU-CBRN CoE projects focusing on biosafety and biosecurity have targeted countries in the SEA Region, with three other projects solely for countries outside SEA. In parallel, Association of Southeast Asian Nations (ASEAN) countries have received support from other organisations on these topics. It is not a matter of choice for a country to address the safety and security of legitimate activities on its territory involving biological agents: there are legal obligations under UN Security Council Resolution 1540 and the 2005 WHO International Health Regulations (IHR) to implement effective measures.

The last two decades have seen much debate about how the two terms biosafety and biosecurity should be used, which has then complicated the national and international debates about what strategies and protocols should be addressed under each heading. We start therefore with a description of how the debates evolved and why there was increasing consensus that new regulation needed to be designed and widely implemented. A good summary of how the concept of laboratory biosafety led to a different understanding of laboratory biosecurity appears in the 2004 edition of the WHO Laboratory Biosafety Manual (LBM). Initially as a result of the implications of the SARS outbreak, the WHO experienced an increase in requests for biosafety guidance and support that in 2005 led to the adoption by the World Health Assembly of resolution WHA58.29 on Enhancement of laboratory biosafety.

BIOSAFETY AND BIOSECURITY

BIOSAFETY

Measuring assembly (containment principles, technologies and practices) that are implemented to prevent the unintentional exposure to pathogens and toxins, or their accidental release.

BIOSECURITY

Measuring assembly (access control, security procedures) to reduce the risk of transmission of infectious diseases and invasive alien species and to prevent the malicious use of dangerous pathogens, parts of them or toxins in direct or indirect act against humans, livestock or crops.

Understanding the basic practical features needed in laboratory biosafety is not helped by the fact that the terminology describing risk and containment can be confusing. The biological material is described item by item as falling into Risk Group 1-4 or Hazard Group 1-4, whereas the appropriate physical and procedural requirements are described as 'containment' levels – either as Biological Safety Level 1-4 or BSL 1-4 (ABSL for animal pathogens), but sometimes as 'Basic', 'Containment' and 'Maximum Containment' levels. The term biosecurity is also difficult to grasp. It does not have a standardised meaning across human, animal and plant health fields; indeed in other fields such as arms control and security it can refer to a whole panoply of national measures to prevent the harmful use of biological material by state or terrorist actors. To avoid confusion for readers, this chapter is restricted to the concept that was defined by the WHO in its 2004 LBM edition as 'laboratory biosecurity'.

Following the increasing global concerns about the potential for terrorist or criminal misuse of the assets of legitimate activities, a few countries have extended their laboratory biosafety oversight arrangements to cover biosecurity. Examples of two different strategies are described:

- The US Federal Select Agent Program, which oversees the possession, use and transfer of select (listed) biological agents and toxins considered to have the potential to pose a severe threat to public, animal or plant health or to animal or plant products.
- The UK 2001 Anti-Terrorism, Crime and Security Act, which controls the use of over 100 listed pathogens and toxins as well as any related generic material. This Act is criminal legislation separate from the implementation of biosafety regulation. Specially trained police officers ensure that the substances and the premises in which they are kept, stored, worked on and disposed of are secure and that access is authorised and controlled.

The 'insider' threat has been described as the highest risk; laboratories are therefore provided with detailed advice on how to conduct personnel checks and what to do if concerns arise.

The basic structure and equipment needed to operate containment facilities able to deal with the highest risk biological agents can be extremely expensive, and by the end of the last century even countries with highly developed economies in the West had only a handful of such laboratories. However, well organised discussions have taken place outside the CoE framework on what might be the best biosafety approach for countries that are less developed. There were views that the sometimes over-engineered solutions accepted by Western countries would often be unsuitable for emerging economies, and anyway can encourage a 'tick-box' approach that may undermine intelligent assessment of risk. To develop a more global approach, the European Biosafety Association (EBSA), the largest representation of biosafety professionals in Europe, works with more than 50 biosafety associations within the International Federation of Biosafety Associations to foster collaboration and networks. EBSA annual conferences host biosafety professionals, policy makers, and regulators from countries outside Europe. As another example, in May 2012 the Centre on Global Health Security and International Security at Chatham House, UK, convened an international conference on 'Safe and Secure Biomaterials; Matching Resources to Reality', bringing together representatives of governments and health protection agencies, medical experts, architects, engineers, and biosafety and biosecurity experts – from several regions. Key objectives were to:

- understand the needs of developing countries;
- consider innovative solutions; and

- explore whether and how practices can be improved with limited resources, while still meeting standards and not inhibiting essential diagnostic and surveillance activities.

A 2016 study attempted to translate biosafety containment concepts to the needs of low- and middle-income countries, carrying out case studies of regulations and standards in three G7 countries and seven others countries including Thailand. The study argued that apart from high cost other problems could be

- poor health infrastructure – such as a dearth of laboratories or the use of laboratory equipment ill-suited to the environment;
- lack of enforcement capacity that then restricts the impact of biosafety and biosecurity regulation;
- that risk mitigation concepts are not suited to all contexts. For instance, laboratory location conditions vary widely in temperature, elevation, remoteness and in the endemicity of supposedly restricted biological agents.

Annexes included:

- **Annex 1**. Organisations and groups that contribute to discussion of biosafety best practice
- **Annex 2.** Organisations and groups that contribute to discussion of biosecurity
- **Annex 3.** Protocols recommended by the WHO for laboratory biosecurity
- **Annex 4.** WHO conclusions for a laboratory biorisk system that addresses biosecurity
- **Annex 5.** CBRN CoE projects focused on biosafety and laboratory biosecurity

KEY TERMS

- **ASEAN:** Association of Southeast Asian Nations
- **EBSA:** European Biosafety Association
- **Handling:** any action involved in production, use, storage or transport of an item
- **IfS:** Instrument for Stability, of the EU
- **IHR:** 2005 WHO International Health Regulations
- **LBM:** WHO Laboratory Biosafety Manual
- **WHO:** World Health Organisation

A · UNDERSTANDING THE DEBATE ON 'BIOSAFETY' AND 'BIOSECURITY' AND THE NEED FOR ACTION

Biosafety and *Biosecurity* can have different meanings, so we start with an explanation of how they are used in this chapter to denote infections or other disease originating from laboratories or from potentially harmful samples.

The recognised international model for laboratory **biosafety** in handling pathogens that can cause human or animal disease is the practical guidance issued by the World Health Organisation (WHO) on techniques for use in laboratories. The 2004 WHO Laboratory Biosafety Manual (LBM),[1] first published in 1983, considers biosafety to be "*the containment principles, technologies and practices that are implemented to prevent unintentional exposure to pathogens and toxins, or their accidental release.*" In other words, there needs to be a separation between the exterior of a laboratory and the 'hot' or 'dirty' interior where work will be carried out under measures that protect personnel and prevent escape into the environment. The equipment and procedures used inside the laboratory to protect the workforce from the material will depend on whether the agents pose an immediate risk to humans, or not as in the case of many animal pathogens and most plant pathogens. Operating the inside of a laboratory unit under negative pressure to ensure that inward air flows, and filtering the exit air to prevent the release of pathogens into the environment, is also adopted for the highest risk situations.

The LBM contains expert guidance on how to implement the relevant principles and technologies into safe practices. By this, the WHO encourages all countries to accept the basic concepts it proposes for biological safety and to adopt them into national codes for safe work in laboratories. The principles of such concepts are consistent across public, animal and plant health sectors and close cooperation between the WHO, FAO[2] and OIE[3] has contributed to the development of realistic guidance and understandings. **Annex 1** lists the major international organisations and groups that contribute to the discussion and promulgation of best practice advice for laboratory biosafety.

However, the terminology to describe risk and containment can be confusing. The biological material is described usually item by item as falling into Risk Group 1-4 or Hazard Group 1-4, whereas the appropriate physical and procedural requirements are described as 'containment' levels. Nor is the terminology about containment standardised: sometimes levels are differentiated as Biological Safety Level 1-4 or BSL 1-4 (ABSL for animal pathogens), but sometimes as 'Basic', 'Containment' and 'Maximum Containment'. Furthermore, international guidance such as from the WHO is not wholly prescriptive as to the methods for achieving containment. For instance, for the most hazardous material, two different approaches are used around the world:

- containing the material in 'glove boxes' or cabinets that prevent escape. Nevertheless, where there is deemed to be an unacceptable risk of an unforeseen accidental release into the laboratory then there may be an additional precaution for workers to showering on exit;
- or accepting that the chosen procedures will allow some of the agents into the room, and therefore protecting workers in positive pressure 'space suits'. The term **biosecurity** is difficult to grasp. It does not have a standardised meaning across human, animal and plant health or

1 World Health Organization. Laboratory biosafety manual. Third edition. Geneva, World Health Organization, 2004. https://www.who.int/csr/resources/publications/biosafety/Biosafety7.pdf?ua=1.

2 The Food and Agriculture Organisation of the United Nations. http://www.fao.org/home/en/.

3 The World Organisation for Animal Health. http://www.oie.int/animal-health-in-the-world/.

indeed in other fields. In the veterinary[4] field, biosecurity targets mainly pathogens, by including all procedures to reduce the risk and consequence of infection with a disease-causing agent. In agriculture[5] and allied activities the term denotes protecting biological resources from foreign or invasive species. Furthermore, in arms control and security fields it can refer to a whole panoply of national measures to prevent the harmful use of biological material by state or terrorist actors. For the public health context, the foreword to the 2004 edition of the LBM defined biosecurity as "*the protection of microbiological assets from theft, loss or diversion, which could lead to the inappropriate use of these agents to cause public health harm*". In 2006, when the WHO published its first guidance on biosecurity in order to extend the LBM guidance on biosafety, it further clarified the concept by developing the term into '**laboratory biosecurity'**, defined as "*the protection, control and accountability for valuable biological materials within laboratories, in order to prevent their unauthorised access, loss, theft, misuse, diversion or intentional release*." As technology had moved on, the scope of the 1983 LBM was thereby expanded from pathogens and toxins to include all '*valuable biological materials'* (VBM), illustrated as non-pathogenic organisms, vaccine strains, foods, genetically modified organisms, cell components, genetic elements, and extra-terrestrial samples.[6] (The term 'extra-terrestrial' is used without explanation in the WHO definition of VBMs; it appears that it would apply for example to material contaminating space probes that return to earth). The third edition of the LBM added new chapters on risk assessment, safe use of recombinant DNA technology and transport of infectious materials. It also introduces biosecurity concepts – the protection of microbiological assets from theft, loss or diversion, which could lead to the inappropriate use of these agents to cause public health harm. It includes safety information from the 1997 WHO publication Safety in health-care laboratories.

In the Biological Weapons Convention (BWC) setting where negotiations focus on non-proliferation and terrorism, working definitions for biosafety and biosecurity evolved that were similar to these WHO definitions, but not without initial confusion because some languages cannot differentiate between the two words.[7] The definitions in the Rolling text of the failed BWC Protocol were based on expert contributions from the WHO and from expert advisers to individual national delegations who were able to reflect a broad range of governmental regulation and national practice. The BWC ISU[8] set a baseline for discussions on biosafety and biosecurity in preparation for a 2008 meeting of BWC experts in Geneva.[9] **Annex 2** lists some of the organisations and groups that contribute to discussions on biosecurity.

4 For example, the glossary of the FAO Basic Laboratory Manual for the Small-Scale Production and Testing of I-2 Newcastle Disease Vaccine considers biosecurity to be "precautions taken to minimize the risk of introducing an infectious agent into a population".

5 For example, the glossary of the New Zealand Parliamentary Commissioner for the Environment considers biosecurity to be "The exclusion, eradication and effective management of pests and unwanted organisms into New Zealand." http://www.pce.govt.nz/reports/pce_reports_glossary.shtml.

6 WHO, Biorisk Management: Laboratory Biosecurity Guidance, September 2006. http://www.who.int/csr/resources/publications/biosafety/WHO_CDS_EPR_2006_6.pdf.

7 The Biological and Toxin Weapons Convention (BTWC) Database. Procedural report and rolling text. Ad Hoc Group 9th session. Annexes, A. Declarations. https://www.brad.ac.uk/acad/sbtwc/ahg39/annexa-c.htm.

8 BWC Implementation Support Unit.

9 Paper submitted by the Implementation Support Unit. Biosafety and Biosecurity. BWC/MSP/2008/MX/INF.1 24 June 2008. https://documents-dds-ny.un.org/doc/UNDOC/GEN/G08/618/92/PDF/G0861892.pdf?OpenElement.

The risks from accidental release from laboratories

Although there is widespread agreement that governments should take measures to prevent the *deliberate* misuse of biological material, the daily risk from *accidental* release from laboratory samples is hugely greater. In a single country there may be hundreds of clinical laboratories handling potentially infectious specimens from patients, and also research institutions under a variety of ownerships. There will be laboratories handling specimens from infected animals, some of them of great importance to societal wellbeing and a country's economy. There will be laboratories handling infected plant material.

It has long been known that some diseases in nature that occur primarily in animals can also infect man - anthrax being an example. However, there is increasing evidence of genetic changes that can allow a pathogen that previously only affected animals to **cross the species barrier** from an animal reservoir and cause serious human infections, with the ultimate spectre of human to human transmission and the potential to cause a massive pandemic. Examples of one of the known recent events is the thousands of human cases from Severe Acute Respiratory Syndrome (SARS), caused by the SARS corona virus in Singapore, Taipei and Beijing in 2002-2004 and probably originating from bats; and the human cases of H7N9 'bird flu' between 2013 and 2017. Population movement greatly increases the risk of widespread national and global effects from transmissible disease, as was seen in these outbreaks, the Ebola outbreaks in West Africa from 2013 onwards – the latter a case of **(re)emerging disease**, and now in the on-going Covid19 pandemic caused by SARS-CoV-2 virus The MERS-CoV coronavirus first identified in 2012 in Saudi Arabia which causes Middle East Respiratory Syndrome (MERS), is a zoonotic virus believed to have originated from bats and transmitted to camels and made the jump to humans. (See **Chapter 4** for more detail of such health events). Almost certainly as a result of the implications of the SARS outbreak, the WHO experienced an increase in requests for biosafety guidance and support that in 2005 led to the adoption by the World Health Assembly of resolution WHA58.29 on Enhancement of laboratory biosafety.[10]

The need for comprehensive governmental initiatives on biosafety.

Alarm about the global spread of these major disease outbreaks, as well as the anthrax letters and 9/11 terrorist episodes in 2001, has led to an increase in the number of costly 'high containment' laboratories handling particularly dangerous pathogens, with objectives such as improving national diagnostic capabilities and even developing new medical countermeasures. However, there is evidence that governments also recognised that without rigorous governmental strategies and mechanisms to **enforce** safety standards nationwide, an increase in the number of high containment laboratories could increase the risk of accidents resulting in infections of personnel or animals. An example of a government publicly advocating the consequent need for national oversight strategies is a 2009 United States (US) government GAO report. This focused largely on the gaps created when local regulation is not integrated into a country wide 'federal' system. The report pointed to three non-malicious incidents variously resulting from failures in laboratory administration, planning for power cuts and an actual breach of containment. Two events were in the US, and one in the United Kingdom (UK).[11] The UK incident took place in August 2007 when an accidental release of foot and mouth disease virus from the effluent waste system of laboratories at Pirbright was first discovered when animals in neighbouring farms became sick. (See **Chapter 4**). Though quickly dealt with, it was a reminder of the potentially significant economic cost when highly transmissible disease affects agricultural production and trade: an earlier foot and mouth outbreak in the UK cost over £3 billion.[12]

10 WHO Biorisk management Laboratory biosecurity guidance September 2006. WHO/CDS/EPR/2006.6. https://www.who.int/csr/resources/publications/biosafety/WHO_CDS_EPR_2006_6.pdf.

11 GAO Report to Congressional Requesters. High containment laboratories. National strategy for oversight is needed. GAO-09-574, September 2009. https://www.gao.gov/new.items/d09574.pdf.

12 National Audit Office. Foot and mouth disease: Applying the lessons. Department for Environment, Food and Rural Affairs. London. February 2, 2005.

The relationship between biosafety and laboratory biosecurity practices

The 2006 WHO 'Laboratory Biosecurity Guidance'[13] provides a comprehensive yet readable discussion of both concepts. It proposes an overarching philosophy of '*biorisk management*', to comprise '*biosafety, laboratory biosecurity and an ethical components*'. Biosafety and laboratory biosecurity are complementary: the implementation of specific biosafety activities to prevent loss or escape of material by poor management and accountability partly addresses some of the biosecurity objective of preventing theft or misuse. The WHO recommendation for objectives to minimise the biorisk are:

- reducing the risk of unintentional exposure to pathogens and toxins or their accidental release (biosafety), and reducing the risk of unauthorised access, loss, theft, misuse, diversion or intentional release of VBM to tolerable, acceptable levels (laboratory biosecurity);
- providing assurance, internally and externally (facility, local area, government, global community, etc.), that suitable measures have been adopted and effectively implemented;
- providing a framework for continuous awareness-raising for biosafety, laboratory biosecurity and ethical code of conduct, and training within the facility.

Accountability for the biological material, and measures to deal with breaches, becomes crucial for effective biosecurity. WHO recommendations are shown in **Annex 3**. There are however some potential conflicts between the needs for safety and security. Controls that reduce unauthorised access might also hinder an emergency response by fire or rescue personnel, and also access by such personnel must not impact on security based protocols. Staff members must be able to quickly and safely exit a laboratory during an emergency without at the same time allowing unrestricted access to outsiders. Signage may need to be modified: while earlier recommendations were that biohazard signs on laboratory doors should identify the biological agents present in the laboratory, as a safety measure, the WHO changed its recommendation to more limited signage information to reduce the potential compromise to security. The overall conclusions for a laboratory biorisk system that addresses biosecurity are reproduced below in **Annex 4**.

Obligations on countries

As has been pointed out by the WHO, widely regarded as the prime international voice on the ethical and practical implications of laboratory-acquired infections, such events *should no longer be considered acceptable,* and no infection or disease should be the result of a breach in biosafety or biosecurity resulting from unsafe or insecure laboratory work practices.[14] The WHO guidance referred to above is examined in more detail below. It is important to be clear that this guidance has no legal basis, and it does not attempt to provide prescriptive guidance or set standards. It sets out recommendations and performance expectations, emphasising the responsibility on national authorities and facility managers to ensure that appropriate risk minimisation procedures have been designed and will be implemented, i.e. appropriate to each local and wider situation and resource. However**, it is not a matter of choice for a country to make efforts to address the safety and security of legitimate activities on its territory involving biological agents, because of the legal obligations** under UN Security Council Resolution 1540, the BWC and the 2005 WHO International Health Regulations (IHR)[15] to implement effective measures.

13 WHO Biorisk management Laboratory biosecurity guidance September 2006. WHO/CDS/EPR/2006.6. https://www.who.int/csr/resources/publications/biosafety/WHO_CDS_EPR_2006_6.pdf.

14 WHO. Biorisk Management: Laboratory Biosecurity Guidance, September 2006. Page 12. http://www.who.int/csr/resources/publications/biosafety/WHO_CDS_EPR_2006_6.pdf.

15 WHO. International Health Regulations (2005). Third Edition. https://apps.who.int/iris/bitstream/handle/10665/246107/9789241580496-eng.pdf.

B · EXAMPLES FROM EU MEMBER STATES AND THE US.

Regulation in EU Member States for protection from biological agents in the workplace.

Historic *national regulations* covering laboratory biosafety risks from human, animal, and plant pathogens have in most remained in force after joining the European Union, but in 1989 the EU MS adopted *common controls* for workplaces such as laboratories that handle biological agents causing human disease, now under Directive 2000/54/EC,[16] complemented by a Directive[17] on the contained use of genetically modified micro-organisms. 2000/54/EC lays down minimum requirements for the health and safety of workers. Biological agents are classified into four risk groups according to their level of risk of infection, with the Competent Authority to be notified prior to the first use of agents in Groups 2-4. Measures to keep employees safe are elaborated in terms of personal protection and physical containment, keeping risks proportionate to the objectives of the work, lists of workers, training, record keeping etc. Similar concepts of containment and risk groups are applied to laboratories handling animal pathogens, and there are controls for plant diseases and pests. The concept of 'laboratory' covers whatever physical spaces are used, such as growth-rooms, animal units, glasshouses. For a EU MS, a number of common EU directives covering other aspects of safety and health at work, for example exposure to chemical agents and chemical safety (see **Chapter 10**).[18] In general, for a country to have a range of regulations with separate but linked inspectorates makes sense because of the range of contexts that must be covered: public, occupational, animal and plant health; environmental protection; genetic modification; and transport of dangerous goods.

National strategies in implementing laboratory biosecurity.

Most countries recognising the advantages of imposing standards of *biosafety* consistent with internationally recognised best practice, will decide to establish legally based inspectorates with rights of entry and powers to require operations to be changed or ceased. Following the increasing global concerns about the potential for terrorist or criminal misuse of the assets of legitimate activities, a few countries have extended their biosafety oversight arrangements to cover *biosecurity*. An example is the US, where the Federal Select Agent Program oversees the possession, use and transfer of select (listed) biological agents and toxins considered to have the potential to pose a severe threat to public, animal or plant health or to animal or plant products.[19] The linkage of the *biosafety* administration of this system with *security oversight* in the US was clear for example from collaborations between the Assistant to the President for Homeland Security and Counterterrorism and the Director of the Office of Science and Technology Policy, in planning to enhance biosafety and biosecurity at thousands of Federal infectious disease laboratories.[20], [21]

16 EU Directive 2000/54/EC of 18 September 2000. On the protections of workers from risks related to exposure of biological agents at work. https://osha.europa.eu/en/legislation/directives/exposure-to-biological-agents/77.

17 Council Directive 90/219/EEC of 23 April 1990 on the contained use of genetically modified micro-organisms. Amended by Council Directive 98/81/EC of 26 October 1998. https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1998:330:0013:0031:EN:PDF.

18 European Agency for Safety and Health at Work. European directives on safety and health at work. https://osha.europa.eu/en/safety-and-health-legislation/european-directives.

19 CDC Federal Select Agent Program. https://www.selectagents.gov/.

20 USG. FACT SHEET: Biosafety and Biosecurity in the United States. 16 December 2014. https://www.cdc.gov/labs/pdf/EXTERNAL-USG-Wide-Fact-Sheet_BSAT-Safety-Stand-Down-and-Summary-Table_FINAL_12-16-2014.pdf.

21 US White House. A National Biosafety and Biosecurity System in the United States. 29 October, 2015. https://obamawhitehouse.archives.gov/blog/2015/10/29/national-biosafety-and-biosecurity-system-united-states.

The UK is an example of a different approach, where biosecurity of laboratory work with pathogens and toxins is now regulated under criminal legislation separate from the implementation of biosafety regulation. The official record of this new biosecurity system is worth examining, and it illustrates the additional costs and burdens both for government and institutions.[22]
This UK law is the 2001 Anti-Terrorism, Crime and Security Act (ATCSA). The inspectorate are specially trained police officers. The Act controls the use of over 100 listed pathogens and toxins as well as any related generic material. These substances and the premises in which they are kept, stored, worked on and disposed of, must be secure and access must be authorised and controlled. University and hospital laboratories must register, but there are exemptions for work with clinical specimens and for some medicinal and immunological products. The scope has been amended from time to time to reflect concerns about additional pathogens and toxins, and animal pathogens. As at 2008, of the approximately 450 laboratories registered under the Act, only two sites had presented any problems, in both cases due to shortage of funds to improve security measures at a facility within an educational establishment.

Laboratories are inspected under the Act at least annually, where possible in joint visits with the Health and Safety Inspectors so as to minimise the disruption on a laboratory. Most of the advice given has focused on personnel and procedures. **The 'insider' threat** is considered to be the highest risk (see also US GAO report referred to above); laboratories are therefore provided with detailed advice on how to conduct personnel checks and what to do if concerns arise.

The need for robust physical security is stressed under this law according to a so called "3D principle" – **Deter, Detect and Delay**:

- **Deter –** the overt physical and electronic security measures that may provide a serious deterrent to a would-be intruder;
- **Detect –** alarm systems and cameras to detect the presence of an intruder; and,
- **Delay –** physical security measures that delay the intruder for a sufficient period to allow a response force to attend.

This UK scheme was regarded a success because it generated new awareness in registered laboratories about the potential for the misuse of dangerous pathogens and toxins, and provided a fast track new mechanism for taking security advice from a local police officer trained to understand the technical environment.

C · EU OUTREACH TO PARTNER COUNTRIES

Up to 2007, the main objective for EU external support in the CBRN field was to reduce CBRN illicit trafficking and to secure nuclear and chemical materials in Former Soviet Union countries. The Commission's Instrument for Stability (IfS) Strategy paper 2007-2011 broadened this *thematically* into new areas including safety practices at civilian facilities where sensitive CBRN materials are

22 Implementation of the UK Anti-Terrorism, Crime and Security Act (ATCSA) 2001; Biosecurity aspects. UK paper to BWC Meeting of Experts Geneva, 18-22 August 2008. BWC/MSP/2008/MX/WP.6 30 July 2008. https://documents-dds-ny.un.org/doc/UNDOC/GEN/G08/625/40/PDF/G0862540.pdf?OpenElement.

found; and broadened it *geographically* with additional focus on the Middle East (e.g. Egypt, Jordan, and the UAE); Morocco; South and South-East Asia (e.g. India, Indonesia, Malaysia, Singapore and Thailand). The IfS Multi-annual Indicative Programme Statement for 2009-2011 set out the objectives for Project area 3, 'Support for biosafety and biosecurity', as to:

- reduce the threat and risk posed to public health, safety and security by the handling, storage and transportation of dangerous biological agents;
- promote a culture of bio-safety and biosecurity among relevant governmental authorities, industry and the scientific community through best practice and the adoption of relevant legislation and regulations;
- develop and enforce standards to clarify boundaries of biological R&D activities.[23]

A multi-stranded approach would be adopted: assessing the effectiveness of the regulatory framework in selected countries; identifying the facilities and institutions carrying out biomedical research or other activities with the potential for risk; appraising major risk aspects such as the design, operation, and physical protection of high risk facilities, to identify preventive and crisis response measures; and designing pilot projects in a limited number of national laboratories to ensure adequate levels of bio-safety and security. The feasibility of pilot projects would be determined through prior missions by experts of EU MS through Expert Support Facility (ESF) arrangements. The indicative budget was EUR 14-18 million for 2009-2011.

As an example of how the programme continued, for the period 2013 and 2015 the **United Nations Interregional Crime and Justice Research Institute (UNICRI**) was tasked with the overall coordination, provision of technical assistance and monitoring of nine projects in South Caucasus (Armenia, Azerbaijan and Georgia) and Central Asian countries (Tajikistan and Uzbekistan) in the field of bio-safety and bio-security, mostly concentrating on laboratory issues.[24]

The start of the EU-CBRN CoE initiative.

European Commission management of CBRN cooperative support projects through the EU-CBRN CoE initiative was launched in May 2010, to address two recognised limitations: insufficient institutional capacity of several countries to mitigate the CBRN risk; and the need for new Commission structural measures to reduce vulnerabilities at national and regional level to CBRN events in the reciprocal interest of regions and the EU security.[25] The CoE initiative began with **two pilot projects in SEA**, Pilot 2 being the '*Reinforcement of legislation and regulations in the field of biosafety, biosecurity and laboratory management systems*', carried out in the SEA region between January 2011 and October 2012. Since then, eight CoE projects focusing on biosafety and biosecurity have targeted countries in the SEA Region, and another three projects have solely targeted partner countries outside SEA. (See **Annex 5** below).

23 EU. The Instrument for Stability- Multi-Annual Indicative Programme 2009-2011. Brussels, 8.4.2009 C(2009)2641 pp26-28. https://reliefweb.int/sites/reliefweb.int/files/resources/F66EDF39EEAABA8E492575F2000ECA23-Full_Report.pdf.

24 UNICRI. Strengthening Biosafety and Biosecurity Capabilities in South Caucasus and Central Asian Countries. http://www.unicri.it/topics/cbrn/biosecurity/se_europe_and_caucasus/.

25 EU Council. Six-monthly Progress Report on the implementation of the EU Strategy against the Proliferation of Weapons of Mass Destruction (2012/I). (2012/C 237/01). Section 5. https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2012:237:0001:0020:EN:PDF.

D · OTHER INTERNATIONAL SUPPORT FOR BIOSAFETY AND BIOSECURITY IN ASEAN

Association of Southeast Asian Nations (ASEAN) countries have received support on health related issues under the Cooperative Biological Engagement Program (CBEP) Research Strategic Plan of the US Defence Threat Reduction Agency. Project areas include improving biorisk management practices from the field to the laboratory, and encouraging adoption of international biosafety and biosecurity best practices and standards. Projects have included installing Pathogen Asset Control System (PACS) at a number of institutions, and supporting biosafety and biosecurity assessments at hospital laboratories.[26] (See also Chapter 7). The programmes are reviewed regularly with partner organisations: the 2019 meeting held in Hanoi on 12 March 2019 saw attendance from the Vietnamese Government and partners in the human health and animal health sectors, as well as US Government Agencies such as the United States Agency for International Development (USAID) and the Centers for Disease Control and Prevention (CDC). The meeting reviewed 2018 achievements, and introduced activities in biosafety, biosecurity, bio-surveillance, science & research planned for 2019.[27] USAID/Vietnam Mission staff also interact with other health initiatives in SEA, such as the '**One Health'** initiative. This provides a coordinated approach to counter emerging infectious disease risks at the interface of animal, human and environment health. In it, universities play a key role by bringing together disciplines such as medicine, veterinary medicine, public health, and environmental and ecosystem health to more effectively address emerging zoonotic infectious disease challenges. The Southeast Asia One Health University Network (SEAOHUN) held its 2018 International Conference at Hanoi Medical University, attended by more than 300 participants from 12 countries - an illustration of the scale of the initiative.[28]

E · CONSIDERATIONS OF REGIONAL DIFFERENCES

The basic structure and equipment needed for containment facilities able deal with the highest risk biological agents can be extremely expensive and manpower intensive to operate, and by the end of the last century even countries with highly developed economies in the West did not had more than a handful of such laboratories. However, biomedical professionals in Western countries have been energetic in discussions of what design of facilities and procedures would best translate to the realities of countries in other regions. A leading light has been the European Biosafety Association (EBSA), as the largest representation of biosafety professionals in Europe. EBSA works with more than 50 biosafety associations within the International Federation of Biosafety Associations to foster collaboration and networks. EBSA annual conferences host biosafety professionals, policy makers, and regulators from countries outside Europe.[29]

26 Cooperative Biological Engagement Program. Annual accomplishments FY 2015. page 31 et seq. https://www.dtra.mil/Portals/61/Documents/Missions/CBEP%20FY15%20Annual%20Accomplishments.pdf?ver=2016-09-16-150152-690.

27 Vietnam One Health Unversity Network. News. Ensuring sustainable and effective biological risk management for health security systems. http://vohun.org/en/news-events/ensuring-sustainable-and-effective-biological-risk-management-for-health-security-systems/.

28 USAID. USAID helps improve the next generation workforce implementing "One Health". 23 November 2018. https://www.usaid.gov/vietnam/program-updates/nov-2018-usaid-helps-improve-next-generation-workforce-implementing-one-health.

29 EBSA. http://ebsaweb.eu/about-ebsa.

Well organised discussions have taken place outside the CoE framework on what might be the best biosafety fit for countries outside the West. For example, on 17 May 2012, the Centre on Global Health Security and International Security at Chatham House, UK, convened an international conference on '**Safe and Secure Biomaterials; Matching Resources to Reality**', bringing together representatives of governments and health protection agencies, medical experts, architects, engineers, and biosafety and biosecurity experts – from several regions. Key objectives were to

- understand the needs of developing countries;
- consider innovative solutions; and
- explore whether and how practices can be improved with limited resources, while still meeting standards and not inhibiting essential diagnostic and surveillance activities.

There was a strong feeling that the sometimes over-engineered solutions accepted by Western countries are often unsuitable for emerging economies, and anyway can encourage a 'tick-box' approach that may undermine intelligent assessment of risk. A good system should:

- be simple;
- be straightforward to introduce, run and maintain;
- achieve a safer (as opposed to 'safe') state focused on protecting people and preventing further infection; and
- use locally available and sustainable resources.[30]

An in depth study which evolved from this meeting, reported in 2016,[31] carried out case studies of regulations and standards in three G7 countries and seven "low- and middle-income countries" (Nigeria, Sudan, Pakistan, Yemen, Afghanistan, Thailand and Mexico). The study observed that in many developed countries the current standards for laboratories necessitate expensive new buildings, high-tech security systems and personnel training. In a simplistic attempt to translate such concepts to low- and middle-income countries, the high cost of these systems is but one of the limitations; poor health infrastructure – such as a dearth of laboratories or the use of laboratory equipment ill-suited to the environment – and lack of enforcement capacity also restrict the impact of biosafety and biosecurity regulation. Additionally, risk mitigation elements are simply not suited to all contexts: for instance, laboratory location conditions vary widely in temperature, elevation, remoteness and in the endemicity[32] of supposedly restricted biological agents. It should be noted here that there is no universal list of restricted biological agents. Each country, or region is expected to develop their own lists.

30 Chatham House. Safe and Secure Biomaterials: Matching Resources to Reality. May 2012. https://www.chathamhouse.org/sites/default/files/public/Research/Global%20Health/170512summary.pdf.

31 Chatham House. Research paper. Centre on Global Health Security. Safe and Secure Biomaterials. A Risk-Based Alternative Approach. Dickmann P. et al. July 2014. https://www.chathamhouse.org/sites/default/files/field/field_document/20140710SafeSecureBiomaterials.pdf.

32 Endemic refers to a continuous presence of a disease or infectious agent at low levels and with low prevalence in a population (human, animal or plant) or geographic region.

ANNEX 1

ORGANISATIONS AND GROUPS THAT CONTRIBUTE TO DISCUSSION OF BIOSAFETY BEST PRACTICE

- *World Health Organisation (WHO)* http://www.who.int/csr/bioriskreduction/ The WHO has at least two sets of relevant activities: the Biosafety and Laboratory Biosecurity Programme; and the project of the Biorisk Reduction for Dangerous Pathogens Team on Life Science Research and Development for Global Health Security
- *World Organisation for Animal Health (OIE)* http://www.oie.int
- *Food and Agriculture Organisation (FAO)* http://www.fao.org/biosecurity/
- *Organisation for Economic Cooperation and Development (OECD)*. Projects in the Biotechnology Division and the International Futures Programme. https://www.oecd-ilibrary.org/
- *UN Environment Programme (Global Environment Facility) (UNEP-GEF)* http://www.gefweb.org/. Biosafety is often related to the Cartagena Protocol on Biosafety of the Convention on Biological Diversity.
- *European Biological Safety Association (EBSA)* http://www.ebsaweb.eu/
- *Asia-Pacific Biosafety Association (A-PBA)* http://www.a-pba.org/
- *American Biological Safety Association (ABSA)* http://www.absa.org/
- *International Biosafety Working Group (IBWG)* http://www.internationalbiosafety.org
- *International Veterinary Biosafety Workgroup (IVBWG)* http://www.vetbiosafety.org/
- (US) Centers for Disease Control and Prevention (CDC) https://www.cdc.gov
- European Centre for Disease Prevention and Control (ECDC). https://www.ecdc.europa.eu/en
- (US) Defence Threat Reduction Agency (DTRA). https://www.dtra.mil

ANNEX 2

ORGANISATIONS AND GROUPS THAT CONTRIBUTE TO DISCUSSION OF BIOSECURITY

- *World Health Organisation (WHO) http://www.who.int/csr/bioriskreduction/* See Annex 1 aboveA
- *Australia Group. https://australiagroup.net/en/*
- *NTI Bio https://www.nti.org/about/biosecurity/*
- *Interpol https://www.interpol.int/*
- *Global Health Security Agenda (GHSA) https://ghsagenda.org*
- *Global Health Security Initiative (GHSI) https://www.phe.gov/Preparedness/international/ghsi/pages/default.aspx*
- *BWC Implementation Support Unit (ISU) https://www.unog.ch/80256EE600585943/(httpPages)/16C37624830EDAE5C12572BC0044DFC1?OpenDocument*
- *(UNSCR) 1440 Committee https://www.un.org/en/sc/1540/*
- *(US) Federation of American Scientists https://fas.org/biosecurity/resource/*
- *(US) Centers for Disease Control and Prevention (CDC).* https://www.aphl.org/aboutAPHL/publications/Documents/POL-2019May-Biosafety.pdf
- (US) Defence Threat Reduction Agency. https://www.dtra.mil

ANNEX 3

PROTOCOLS RECOMMENDED BY THE WHO FOR LABORATORY BIOSECURITY

From: WHO, Biorisk Management: Laboratory Biosecurity Guidance, September 2006. http://www.who.int/csr/resources/publications/biosafety/WHO_CDS_EPR_2006_6.pdf

Accountability for the biological material is crucial for effective biosecurity, to include

- regularly updated inventories with storage locations;
- identification and selection of personnel with access;
- plans of use of biological materials;,
- clearance and approval processes;

- documentation of internal and external transfers within and between facilities;
- plans for inactivation and/or disposal of the material.

Protocols must be established for handling breaches in laboratory biosecurity, to include

- incident notification;
- reporting protocols;
- investigation reports;
- recommendations and remedies, and
- oversight and guidance through the Biosafety Committee.

ANNEX 4

WHO CONCLUSIONS FOR A LABORATORY BIORISK SYSTEM THAT ADDRESSES BIOSECURITY

From: Conclusions, in *WHO, Biorisk Management: Laboratory Biosecurity Guidance, September 2006. http://www.who.int/csr/resources/publications/biosafety/WHO_CDS_EPR_2006_6.pdf*

Under the ultimate responsibility of laboratory directors whose tasks should include the ability to demonstrate that risks are appropriately managed, biorisk management programmes may be divided into seven main components:

1. Identify VBM that require protection on the basis of regularly performed biorisk assessments.
2. Establish clear guidance, roles, responsibilities and authorities for those who work with or have access to VBM and to the facilities that contain them.
3. Promote a culture of awareness, shared sense of responsibility, ethics, and respect of codes of conduct within the international life science community.
4. Develop policies that do not hinder the efficient sharing of reference materials and scientific data, clinical and epidemiological specimens and related information, and that do not impede the conduct of legitimate research.
5. Strengthen collaboration between the scientific, technical and security sectors.
6. Provide appropriate training to employees of laboratory facilities.
7. Strengthen emergency response and recovery plans on the assumption that biorisk management systems can only minimise, but never really eliminate, every conceivable threat.

Furthermore, the commitment to constantly improve biorisk management performance for a facility and its operation through attainable goal-setting and actual goal-achieving should be encouraged and acknowledged at all levels.

ANNEX 5

EU-CBRN CoE projects focused on biosafety and laboratory biosecurity[33]

A · IN THE SEA REGION

PROJECT 03: Knowledge development and transfer of best practice on biosafety/biosecurity/biorisk management. 01/01/2013, for 24 months. EUR 1,920,000.

- **COUNTRIES:** Albania, Algeria, Armenia, Cambodia, Croatia, former Yugoslav Republic of Macedonia, Gabon, Georgia, Lao PDR, Libya, Malaysia, Mauritania, Moldova, Montenegro, Morocco, Myanmar, the Philippines, Senegal, Serbia, Singapore, Thailand, Tunisia, Ukraine, Vietnam.
- **OBJECTIVES:** To promote sustainable knowledge development on biosafety, biosecurity and biorisk management and transfer of best practice through a "train the trainers" model. To harmonise international biosafety and biosecurity standards among the participating countries and strengthen regional and international collaboration and cooperation through knowledge sharing, networking and awareness raising on bio-related issues.
- **KEYWORD(S):** Biosafety; biosecurity; biorisk; management system.

PROJECT 06: Knowledge development and transfer of best practice on chemical and biological waste management. 01/01/2013 for 24 months. EUR 480,000.

- **COUNTRIES:** Vietnam, Laos, Cambodia, Brunei, Philippines, Myanmar, Thailand.
- **OBJECTIVES:** Following the assessment of the needs of and based on discussions with the countries, this project is aimed at developing knowledge in the field of chemical and biological waste management. Specific objectives include the following:
  - Raising awareness on the security concerns associated with toxic chemical and biohazardous waste materials.
  - Promoting safe and secure management procedures for waste materials (toxic chemicals, biological materials) and associated equipment.
  - Reinforcing the sharing and transfer of best practices on chemical and biological waste management.
  - Developing a sustainable training system on the identification and handling of chemical and biological waste materials in the region.
  - Improve regional cooperation and harmonization with international standards on the safe and secure management chemical and biological waste.

33 CBRN Centres of Excellence. Addressing regional CBRN risk mitigation needs. http://www.cbrn-coe.eu/Projects.aspx.

PROJECT 07: **Guidelines, procedures and standardisation on biosafety/biosecurity.** 01/10/2013, for 24 months. EUR 1,199,576.

- COUNTRIES: Brunei Darussalam, Cambodia, former Yugoslav Republic of Macedonia, Lao PDR, Moldova, the Philippines, Serbia, Singapore, Thailand, Vietnam.
- OBJECTIVES: To support the establishment of legislations and regulations in the field of biosafety, biosecurity and laboratory management systems. To establish national procedures to regulate the manufacture, use, import, export, transport and storage of hazardous micro-organisms in line with international standards and guidance.
- KEYWORD(S): Biosafety; biosecurity; laboratory management; legal framework.

PROJECT 12: **Reinforcement of legislations and regulations in the field of biosafety, biosecurity and laboratory management systems in South East Asia: phase 2.** 01/04/2013, for 24 months. EUR 320,000.

- COUNTRIES: Cambodia, Lao PDR, Malaysia, Myanmar, Vietnam.
- OBJECTIVES: To reinforce national regulations in the field of biosafety and biosecurity practice management in laboratories, in the context of the implementation of the 2005 International Health Regulations (IHR 2005).
- KEYWORDS: Legal framework; biosafety; biosecurity; laboratory management; IHR 2005.

PROJECT 15: **Strengthening laboratory bio-safety and bio-security through development of a laboratory iso-bank system.** 01/08/2013 for 23 months. EUR 480,000.

- COUNTRIES: Indonesia, the Philippines, Thailand.
- OBJECTIVES: To strengthen national capacities for biosecurity and biosafety, especially the safe and secure handling of biological agents, through the development of a laboratory iso-bank system (registration and storage of specimen database). To increase the timely and efficient response to the discovery of biological agents through the promotion of the database as a linking mechanism between laboratories and hospital information systems.
- KEYWORD(S): Biosafety; biosecurity; specimen database; laboratory management.

PROJECT 19: **Development of procedures and guidelines to create and improve secure information management system and data exchange mechanisms for CBRN materials under regulatory control.** 01/03/2013 for 24 months. EUR 405,000.

- COUNTRIES: Albania, Algeria, Armenia, Bosnia and Herzegovina, Brunei Darussalam, Burundi, Cambodia, Côte d'Ivoire, Croatia, Democratic Republic of Congo, former Yugoslav Republic of Macedonia, Gabon, Georgia, Ghana, Indonesia, Iraq, Jordan, Kenya, Kyrgyzstan, Lao PDR, Lebanon, Liberia, Libya, Malaysia, Mauritania, Moldova, Montenegro, Morocco, Myanmar, Philippines, Rwanda, Senegal, Serbia, Seychelles, Singapore, Tajikistan, Thailand, Togo, Tunisia, Uganda, Ukraine, Uzbekistan, Vietnam, Zambia.
- OBJECTIVES: The project is aimed at reinforcing national capabilities for secure information management and data exchange on CBRN materials under regulatory control establishing an expert team consisting of leading specialists from both the public and private sectors.
- KEYWORD(S): Crisis management; safeguarding information diffusion; data exchange.

PROJECT 27: **Biorisk Management**. 21/12/2012 for 30 months. EUR 464,129.

- COUNTRIES: Laos, Malaysia, the Philippines, Thailand. Objectives:
- OBJECTIVES:
  - To prevent the abuse of hazardous biological material by enhanced risk management
  - To raise awareness of biosafety issues in private and public sectors and in specific amongst policy makers
  - To foster collaboration between human and animal health communities
  - To support the development of appropriate laboratory capacities in participating countries
  - To provide training for laboratory staff in bio-safety and bio-security

PROJECT 46: **Enhancement of CBRN capacities of South East Asia in addressing CBRN risk mitigation concerning CBRN first response, biosafety and biosecurity, awareness raising and legal framework.** 10/07/2015 for 36 months. EUR 3,000,000.

- COUNTRIES: Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam.
- OBJECTIVES: The overall objective of this project is to enhance CBRN capacities of South East Asia in addressing CBRN risk mitigation in three technical areas (i.e. first response, biosafety and biosecurity, and legal framework).
- KEYWORD(S): Border control and monitoring; crisis management; first response; legal framework; waste management.

B · IN OTHER COE REGIONS.

PROJECT 25: **Knowledge development and transfer of best practice on biosafety/biosecurity/ biorisk management.** 12/12/2012 for 24 months. EUR 480,000.

- COUNTRIES: Iraq, Jordan, Lebanon.
- OBJECTIVES: To strengthen the capacity of identification, management and mitigation of biological risks related to facilities that process biological agents through the development of policies, good practices transfer, best practices sharing and the implementation of international standards**.**
- KEYWORD(S): Biological substances; biosafety; biosecurity; biorisk management.

PROJECT 40 (IFS): **Strengthening health laboratories to minimise potential biological risks.** 18/12/2013 for 36 months. EUR 4,495,712.

- COUNTRIES: Armenia, Azerbaijan, Egypt, Iran, Jordan, Kyrgyzstan, Moldova, Morocco, Oman, Pakistan, Somalia, Sudan, Tajikistan, Tunisia, Turkmenistan, United Arab Emirates, Uzbekistan, Yemen.
- OBJECTIVES: To minimise potential biological risks through the enhancement of laboratory biosafety, biosecurity, quality management and diagnostic capacity. To enhance the ability of partner countries to safely and rapidly detect and respond to natural or deliberate biological events of national and international concern.
- KEYWORD(S): Public health impact mitigation; biosafety; biosecurity; diagnostics; laboratory management.

PROJECT 53: Strenghtening the National Legal Framework and Provision of Specialised Training on Biosafety and Biosecurity in Central Asian Countries. 22/12/2015 for 78 months. EUR 8,521,540

- **COUNTRIES:** Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan, Uzbekistan.
- **OBJECTIVES:** Biosafety and biosecurity systems require to be up-to-date with international standards and staff needs proper trainig and knowledge. The new biosafety and biosecurity initiatives are critical for both public health and to prevent epidemics and pandemics.
- **KEYWORD(S):** Legal framework; public health impact mitigation; crisis management.

It must be noted here that there are other EU-CBRN CoE projects implemented which have components relevant to biosafety. Examples include Projects 36, 37, 39, 48. Project 45 was a high containment mobile lab for on-site detection in West Africa.

CHAPTER 10
Safety and security in handling chemical agents

CHAPTER 10

SAFETY AND SECURITY IN HANDLING CHEMICAL AGENTS

International initiatives in the last two decades are combining to reduce the risks to humans and the environment from poor practice in chemical industry activities. Strategies are being developed to tackle chemical accident prevention, preparedness and response. As one of these strands, the Organisation for the Prohibition of Chemical Weapons (OPCW) draws attention to the scenario of terrorists and criminals attempting to divert or steal toxic materials from legitimate chemical facilities; discussions involving industry, academe, and civil society are relevant to the obligations of countries under UNSCR 1540. The OPCW Education and Outreach website provides modules that would inform strategy development and implementation in CBRN risk mitigation. Experts in CWC State Parties are eligible for OPCW training; hosts for training have included chemical companies in SEA countries. The EU provides funds for specified OPCW international cooperation projects. EU-CBRN CoE projects on chemical safety and security management have to date emphasised waste management.

SYNOPSIS

While the enormous growth of the chemical industry from the early 1900s brought huge economic benefits, by the 1960s concerns were increasing about the safety of certain widely used chemicals because of evidence that their presence in products or their escape to the environment was causing new health problems. Additionally, the 1980s saw several massive accidents at industrial sites that had catastrophic consequences, and this generated new levels of urgency and political importance. There was a developing consensus that dealing with the risks from specific chemicals on a case-by-case basis would not ensure chemical safety into the long term - instead, strategies for chemical accident prevention, preparedness and response would be needed.

The Organisation for Economic Co-operation and Development (OECD) Environment Committee in 1985 reacted by undertaking "*to ensure the existence of appropriate measures to control potentially hazardous installations, including measures to prevent accidents.*" As the Working Group on Chemical Accidents, its work programme continues over 3-4 year periods; the list of OECD Members and Partners includes the EU-CBRN CoE SEA Region countries. Mirroring the product registration requirements that ensure the safety of pharmaceuticals and pesticides, similar overarching arrangements were proposed for industrial chemicals. The OECD now publishes regularly updated guidelines for the regulatory safety testing of chemicals, as a collection of internationally agreed testing methods for use by governments, industry and independent laboratories.

Most countries will have regulations and hazard assessment guidance for the safe use of chemicals in laboratories, often as part of health and safety legislation that also covers other workplaces. EU countries are subject to EU directives covering different aspects of safety and health at work, and there is a directive for exposure to chemical agents and chemical safety.

The last two decades have seen several parallel international initiatives that target industrial safety and security. A major advance was the First International Conference on Chemicals Management (ICCM1) on 6 February 2006 in Dubai, which adopted the Strategic Approach to International Chemicals Management (SAICM) as a policy framework to promote chemical safety around the world. ICCM conferences continue, and ICCM4 held in 2015 linked into the Strategic Development Goal Objectives. The Dubai Declaration on International Chemicals Management proposed that the work should develop under five objectives:

1. Risk reduction
2. Knowledge and Information
3. Governance
4. Capacity-building and technical cooperation; and
5. Illegal international traffic.

The OPCW has a policy, outside its mandate on CW prohibition, to support CWC State Parties by fostering greater international cooperation and coordination on chemical security matters. The OPCW draws attention to the scenario of terrorists and criminals attempting to divert or steal toxic materials from legitimate chemical facilities. This is relevant to the obligations on countries under United Nations Security Council Resolution 1540 (2004), to prevent acquisition of CBRN agents by non-State actors. It is recognised that national capacity building for protection against a chemical attack also enhances capacities to deal with industrial accidents, another prime objective for CBRN risk mitigation. The OPCW operates a Chemical Safety and Security Management Programme, which under its Associate Programme had trained more than 1600 experts up to 2018. Additionally, there are three-week industrial placements at chemical plants in CWC State Parties, giving experience of modern practices with a focus on chemical safety. The list of hosts has included chemical companies in SEA countries.

The OPCW promotes the Hague Ethical Guidelines. These seek to promote discussion and responsible conduct among chemical practitioners and decision-makers in academia, industry, civil society and government, to guard against the misuse of chemistry. The OPCW Education and Outreach website allows educators, policy makers and the public to explore the beneficial uses, misuses, and abuses of multi-use chemicals and to move towards strict codes of conduct that establish guidelines for ethical scientific development. The site also includes E-learning modules for CWC National Authority and Verification functions. These modules could be used to develop understanding and support for CBRN risk mitigation strategies regarding chemical safety and security.

Other key international initiatives described in this Chapter include the International Programme on Chemical Safety (IPCS), the Agenda for Sustainable Development, REACH and the US Chemical Security Engagement Program.

In 2004, the EU began to provide funding to the OPCW to facilitate certain projects falling outside the OPCW core budget, and this included support to specified international cooperation projects in the field of chemical activities. The funding came through Council Joint Actions and subsequently Council Decisions. This EU support can include funding participants at events, which have included

Chemical Safety and Security Management Workshops.
From 2009, EU outreach support to chemical safety was listed among several EU-CBRN CoE objectives for training and assistance. EU-CBRN CoE projects on chemical safety and security management, as listed below in Annex 3, began in 2013. There has been a considerable emphasis on waste management.

Annexes included:

- **Annex 1.** ICCM recommendations to national and regional levels for chemicals and waste management
- **Annex 2.** Events since 2016 organised under the OPCW Chemical Safety and Security Management Programme
- **Annex 3.** CoE projects focused on chemical safety and security

KEY TERMS

- **ASEAN:** Association of Southeast Asian Nations
- **CW:** Chemical weapon
- **CWC:** Chemical Weapons Convention. The full title is Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction.
- **Handling:** any action involved in production, use, storage or transport of an item (See UNSCR 1540 (2004) Paragraph 3 (a))
- **ICCM:** International Conference on Chemicals Management
- **OECD:** Organisation for Economic Co-operation and Development
- **OPCW:** Organisation for the Prohibition of Chemical Weapons. The intergovernmental organisation that implements the provisions of the Chemical Weapons Convention
- **SAICM:** Strategic Approach to International Chemicals Management
- **UNSCR 1540:** United Nations Security Council Resolution 1540 (2004)

A · THE RISKS TO BE ADDRESSED

We use the definitions from the Organisation for the Prohibition of Chemical Weapons (OPCW):[1]

- "Chemical safety" refers to measures to prevent non-deliberate releases of toxic chemicals into the environment and to mitigate the impact if such events occur. Chemical safety comprises disciplines such as occupational safety, public safety, process safety, environment safety, consumer safety and transport safety.
- "Chemical security" refers to measures to prevent deliberate releases of toxic chemicals and to mitigate the impact if such events occur. In a wider context, it also includes policies to prevent attempts to acquire toxic chemicals or chemical weapons precursors.

We will not here cover the preparedness of countries to prevent and respond to attacks involving chemicals, through the obligations of Chemical Weapons Convention (CWC) Article X. We also restrict ourselves to safety and security during the production, storage or use of chemicals – we will not cover the handling of chemicals by first responders, and for transport see **Chapter 8**.

In **Chapter 14** we go on to describe how a major strand of Strategic Development Goal (SDG) activities is reduction of the risks from hazardous chemicals and wastes. Three linked UN Conventions have the common objective to protect human health and the environment from hazardous chemicals and wastes.

Toxic effects from chemical industries

While the enormous growth of the chemical industry from the early 1900s brought huge economic benefits, by the 1960s concerns were increasing about the safety of certain widely used chemicals because their presence and persistence in products or escape to the environment was seen to be causing profound new health problems. As examples, in 1956 in Japan, mercury compounds released by a chemical factory were accumulating in fish;[2] and cadmium releases from mining companies in the mountains had been accumulating in rice,[3] in both cases causing serious disease. Poly-chlorinated biphenyls or 'PCBs', (widely used between about 1950 and 1979 in products like electrical equipment, transformers, fluorescent light ballasts[4] and building materials)[5] were found to be accumulating in human organs and the environment, leading to toxic effects. In reaction, in 1973 the Organisation for Economic Co-operation and Development (OECD) passed a legally binding Council Decision banning the open uses of PCBs. They also agreed a Council Recommendation to reduce all man-made emissions of mercury to the environment.

Nevertheless, it was being argued that dealing with the risks from specific chemicals on a case-by-case basis would not ensure chemical safety into the long term. The need for **strategies for chemical accident prevention, preparedness and response** became increasingly voiced by governments. As many of these industrial processes involve toxic chemicals and high temperatures and pressures, it

1 Definitions from the OPCW. https://www.opcw.org/resources/capacity-building/international-cooperation-programmes/chemical-safety-and-security.

2 Sustainability at Boston University. Minamata disease. https://www.bu.edu/sustainability/minamata-disease/

3 Wikipedia. Itai-itai Disease. https://en.wikipedia.org/wiki/Itai-itai_disease.

4 EHS. PCB's in electrical materials: https://www.ehs.washington.edu/system/files/resources/pcb-management.pdf.

5 EHS. PCBs in Building Materials - Questions & Answers. 28 July 2015. US EPA. https://www.epa.gov/sites/production/files/2016-03/documents/pcbs_in_building_materials_questions_and_answers.pdf July 28, 2015.

was not surprising that the accidental escape of large amounts of chemical could have catastrophic consequences. Some massive accidents in the 1980s injected a new level of urgency and political importance. Four large scale accidents involving toxic industrial chemicals (TICs) have been described in **Chapter 4**. To recap, on 3 December 1984, a pesticide plant at Bhopal, India, leaked approximately 32 tons of toxic gases, with a death toll estimated in the region of 15,000 people. Less than two years later, Europe suffered a major environmental disaster when a fire at a pesticide storage facility in Schweizerhalle, Switzerland resulted in widespread ecological damage, with pollution of the River Rhine for more than 500 km impacting countries along the route.[6]

The OECD responded quickly at Ministerial level, and in 1985 the OECD Environment Committee undertook "*to ensure the existence of appropriate measures to control potentially hazardous installations, including measures to prevent accidents*." A working group was established, with a mandate to increase world-wide co-operation between OECD members and non-members and with other international organisations. Later renamed the Working Group on Chemical Accidents, its work programme continues over 3-4 year periods.[7] The list of OECD Members and Partners includes the CoE SEA Region countries.

Environmental safety

Throughout the 1960s and 1970s, countries began to develop environmental policies as a priority. These were national solutions and concentrated mostly on combating local air and water pollution by applying 'end-of-pipe' technologies to remove contaminants from waste water, air releases and solid waste. Chemical safety policies, however, were seen to require a more systematic approach and also several types of test data: data about the possible effects of chemicals on human health and the environment, data on acceptable exposure levels, on concentrations of a chemical in water, air and soil and on whether it degrades or accumulates. Most countries had systems in place to manage the safety of pharmaceuticals and pesticides: a company introducing a new product was required to register it and provide information to allow the government to assess the potential risks. It seemed logical for countries to develop similar systems for industrial chemicals.[8] The OECD now publishes regularly updated guidelines for the regulatory safety testing of chemicals, as a collection of internationally agreed testing methods used by governments, industry and independent laboratories to determine chemical safety.[9]

Chemicals safety in laboratories

Hazardous chemicals that are handled in clinical, industrial, and academic (school, university) laboratories present physical and/or health risks for workers. Common laboratory chemicals include cancer-causing agents, toxics, irritants, corrosives, and agents that can damage the skin, eyes, lungs or mucous membranes. Laboratory activities can also present environmental health risks, for example by the accidental or deliberate discharge of toxic waste material.

Most countries will have regulations and hazard assessment guidance for the safe use of chemicals in laboratories, often as part of health and safety legislation that also covers other workplaces. EU countries are subject to a EU directives covering different aspects of safety and health at work, and there is one for

6 Swissinfo.ch. Chemical disaster still burns in Swiss memory. 1 November, 2016. https://www.swissinfo.ch/eng/schweizerhalle-fire_chemical-disaster-still-burns-in-swiss-memory/42559954.

7 OECD. 25 Years of Chemical Accident Prevention at OECD: History and Outlook. https://www.oecd.org/chemicalsafety/chemical-accidents/Chemical-Accidents-25years.pdf.

8 OECD. 40 Years of Chemical Safety at the OECD: Quality and Efficiency. https://www.oecd.org/env/ehs/48153344.pdf.

9 OECD. Test Guidelines for the Chemicals. http://www.oecd.org/env/ehs/testing/oecdguidelinesforthetestingofchemicals.htm.

exposure to chemical agents and chemical safety.[10] (See Chapter 9 for Directives for handling biological agents). For Association of Southeast Asian Nations (ASEAN) countries, **the ASEAN Guidelines for Occupational Safety and Health** target Small and Medium Enterprises.[11] The ASEAN-Japan chemical database was officially launched in May 2016.[12]

Other English language guidance from respected associations and institutions is also readily available on the Internet.[13, 14]

B · IMPROVING SAFETY AND SECURITY IN INDUSTRY: THE INCREASING ROLE OF THE OPCW OUTSIDE ITS CW DISARMAMENT MANDATE

By the start of the millennium, there were concerns that the issue of the safety and security of chemical facilities was still only receiving limited international attention compared to the nuclear and biological fields, both from a regulatory perspective and with regard to practical means and capacity building initiatives. In these other science fields, significant progress had been made in developing international guidelines, for example in the form of the International Atomic Energy Agency (IAEA) Nuclear Security Guidelines[15] or the World Health Organisation (WHO) Laboratory Biosafety Manual (LBM) that was published in 1983.[16] In the chemical field, work on developing safety guidelines was largely confined to industry, national laboratories and to some extent, the academic community, and government initiatives of individual countries. However, a major advance was at the First International Conference on Chemicals Management (ICCM1) on 6 February 2006 in Dubai, which adopted the **Strategic Approach to International Chemicals Management (SAICM)** as a policy framework to promote chemical safety around the world. This meeting also launched the Responsible Care Global Charter, which had evolved from a 1985 Canadian industry programme, Responsible Care®. The Global Charter promotes industry commitment to sound chemicals management standards and the adoption of a strong chemical safety and security culture.[17, 18] However, procedures at certified Responsible Care facilities could still cause unacceptable releases into the environment, as happened in poisoning of the river Elbe by the company Draslovka Kolin, Czech Republic, proved in January 2006 to be the result of cyanide waste overflow into groundwater.[19]

10 OSHA. European directives on safety and health at work. European Agency for Safety and Health at Work. https://osha.europa.eu/en/safety-and-health-legislation/european-directives.

11 ASEAN Guidelines for Occupational Safety and Health. https://asean.org/?static_post=asean-guidelines-occupational-safety-health#iLightbox[gallery62176]/0.

12 Chemical Watch. Asean-Japan chemical database officially launched, 12 May 2016. https://chemicalwatch.com/47350/asean-japan-chemical-database-officially-launched.

13 American Chemical Society. Chemical & Laboratory Safety. https://www.acs.org/content/acs/en/chemical-safety.html.

14 Imperial College, London. Laboratory and Chemical Safety Guide. 2003. http://www3.imperial.ac.uk/pls/portallive/docs/1/7274590.PDF.

15 IAEA. Nuclear Security Series. http://www-ns.iaea.org/security/nuclear_security_series.htm.

16 World Health Organization. Laboratory biosafety manual. Third edition. Geneva, 2004. https://www.who.int/csr/resources/publications/biosafety/Biosafety7.pdf?ua=1.

17 ICCA. Responsible Care. The Quest for Performance Excellence. https://www.icca-chem.org/responsible-care/.

18 Wikipedia. Responsible Care. https://en.wikipedia.org/wiki/Responsible_Care.

19 Ruzicka. J. Cyanide accident. 12A - Case-study Draslovka Kollin Ruzicka, UNECE. https://www.unece.org/fileadmin/DAM/env/teia/doc/Prague/presentations/12A-Case-study_Draslovka_Kollin_Ruzicka.pdf.

SAICM comprises the Dubai Declaration on International Chemicals Management, expressing high-level political commitment to SAICM, and an Overarching Policy Strategy which sets out its scope, needs, objectives, financial considerations underlying principles and approaches, and implementation and review arrangements.[20] Objectives are grouped under five themes:

1. Risk reduction
2. Knowledge and Information
3. Governance
4. Capacity-building and technical cooperation; and
5. Illegal international traffic.

The scenario of terrorists and criminals attempting to divert or steal toxic materials from legitimate chemical facilities such as manufacturing sites and warehouses, as well as the harm that these facilities could cause to populations and the environment if attacked by terrorists, were well understood. The first two CWC Review Conferences (2003 and 2008) expressed concerns about these risks. OPCW outreach to Chemical Weapons Convention[21] (CWC) State Parties (SPs) to assist them in implementation and capacity building began to increase, supported by substantial voluntary financial contributions, for example from the European Union (EU) – see below. This outreach primarily focuses on SP actions under three Articles of the CWC: Article VII, National Implementation Measures; Article X, Assistance and Protection against Chemical Weapons; and Article XI, Economic and Technological Development. **In practice, national capacity building for protection against a chemical attack also enhances capacities to deal with industrial accidents, a prime objective for many countries.**

While controlling chemicals is the primary responsibility of states, the OPCW made clear that it would **support CWC State Parties (SPs) by fostering greater international cooperation and coordination on chemical security matters.** In the OPCW Industry and Protection Forum of 2007, a separate working group started a dialogue between industry and government representatives and other experts on the security of chemical plants and operations. To mark the International Year of Chemistry, the OPCW held a Conference on International Cooperation and Chemical Safety and Security on 12-13 September2011. The Conference was attended by more than 400 participants from 129 SPs, with a wide range of expertise from government institutions, industry, and science and academia.[22]

The Third CWC Review Conference in 2013 "*... welcomed the role of the OPCW as a platform for voluntary consultations and cooperation among the States Parties and the relevant stakeholders, including the private sector and academia, to promote a global chemical safety and security culture.*"[23] In 2014, the

20 UNEP. SAICM Overview. http://www.saicm.org/About/SAICMOverview.

21 The CWC is the Convention on the Prohibition of the Development, Production, Stockpiling and use of Chemical Weapons and on their Destruction.

22 OPCW Conference on International Cooperation and Chemical Safety & Security. 12-13 September, 2011. OPCW, The Hague. https://www.opcw.org/sites/default/files/documents/PDF/IYC_Conference_Outcomes.pdf.

23 OPCW. Report of the Third Special Session of the Conference of the States Parties to Review the Operation of the Chemical Weapons Convention.,19 April 2013. paragraph 9.127. https://www.opcw.org/sites/default/files/documents/CSP/RC-3/en/rc303__e_.pdf.

annual Conference of the SPs decided on a regular agenda item dedicated to the chemical industry and the scientific community, with representatives of ICCA invited to participate.

OPCW Chemical Safety and Security Management Programme

Between 2009 and 2018, more than 2000 participants took part in seminars under this OPCW programme, and more than 1600 experts were trained. The programme promotes chemical safety and security by providing tools and knowledge to mitigate the **risks arising from chemical accidents and potential misuse of toxic chemicals,** including the potential threat of terrorism, to ensure that chemicals are only used for peaceful purposes, throughout their lifecycle.[24] It uses forums that share policies and best practices among chemistry practitioners, policy makers, CWC National Authorities, and chemical industry associations. States are invited to offer to host an event for their chemical industry or for the region. Activities are reported annually by the Director General, with details of the industry associations and companies taking part.[25] (See Annex 2 for activities in the Asia OPCW region). Upcoming OPCW events are advertised on the OPCW website Calendar.[26]

Since 2016, SPs have been invited to communicate their needs in chemical safety and security management, and describe their existing tools, guidance and best practices in the chemical industry and laboratories. At the end of 2016, the OPCW reported the initial results including commentaries on each region.[27] The Technical Secretariat (TS) organised a series of workshops in 2017 and 2018 to further discuss needs assessment and dissemination of best practices. (See Annex 2 for recent workshops in the Asia OPCW region).

The Associate Programme

ICCA and national chemical industry associations make a major contribution to OPCW capacity-building activities through their involvement in the Associate Programme. The extensive training annually includes a three-week industrial placement at chemical plants in SPs, giving experience of modern practices with a focus on chemical safety. For instance, in 2018, 18 chemical plant sites from 14 SPs hosted participants of the Associate Programme for a course from 10 - 28 September 2018. Among the 18 host companies were *PT. Nippon Shokubai* in Indonesia, and *Monsanto (M) Sdn.Bhd.* in Malaysia. In the previous reporting year the 18 host companies included *PT Pupuk Kujang* in Indonesia and again *Monsanto Sdn. Bhd* in Malaysia.[28] The 2019 programme is being advertised**.**

The Hague Ethical Guidelines. The Hague Ethical Guidelines were developed by scientists from 29 countries at two workshops held by the OPCW in 2015.[29] They seek to promote discussion and responsible

24 OPCW. Capacity building. Chemical safety and security management programme. https://www.opcw.org/resources/capacity-building/international-cooperation-programmes/chemical-safety-and-security.

25 OPCW. Paper at 23rd session of Conference of the States Parties. Note by the Director-General: Engaging the Chemicals Industry Associations. C-23/DG.14. 13 November 2018. https://www.opcw.org/sites/default/files/documents/2018/11/c23dg14%28e%29.pdf.

26 OPCW. Calendar. https://www.opcw.org/calendar?cHash=68e98f1bea&tx_cal_controller%5Boffset%5D=1.

27 OPCW. Needs and Best Practices on Chemical Safety and Security Management.25 November 2016. https://www.opcw.org/sites/default/files/documents/ICA/ICB/OPCW_Report_on_Needs_and_Best_Practices_on_Chemical_Safety_and_Security_ManagementV3-2_1.2.pdf.

28 OPCW. Paper at 23rd session. OPCW Conference of the States Parties. Note by the Director-General: Engaging the Chemicals Industry Associations. C-23/DG.14. 13 November 2018. https://www.opcw.org/sites/default/files/documents/2018/11/c23dg14%28e%29.pdf.

29 The Hague Ethical Guidelines were developed by scientists and chemistry professionals from 29 countries during two workshops held by the OPCW in 2015. The Guidelines seek to promote discussion and responsible conduct among chemical practitioners and decision-makers in academia, industry, civil society and government to guard against the misuse of chemistry. See OPCW, The Hague Ethical Guidelines. https://www.opcw.org/hague-ethical-guidelines.

conduct among chemical practitioners and decision-makers in academia, industry, civil society and government to guard against the misuse of chemistry. This also relates to the obligations on countries under United Nations Security Council Resolution 1540 (2004) to prevent acquisition of CBRN agents by non-State actors. The OPCW established a link with the Responsible Care Leadership Group (RCLG) of the ICCA, which led to the ICCA endorsing the Guidelines[30] on 27 April, 2018. The **International Union of Pure and Applied Chemistry (IUPAC)**, a leading international scientific federation representing academic and industrial chemists from across the world, had endorsed the Guidelines in 2016.[31] Formal contact between IUPAC and OPCW dates back to the First CWC Review Conference in 2001, and IUPAC is now a permanent observer at sessions of the OPCW Advisory Board on Education and Outreach.

The OPCW Education and Outreach Website

The OPCW collaborated with IUPAC in 2005 -2007 to produce interactive educational material that raises awareness of the multiple uses of chemicals and the CWC; this has since been updated under the aegis of the OPCW Temporary Working Group on Education and Outreach and made available on the OPCW Education and Outreach website.[32] This web material allows educators, students, policy makers and the public to explore the beneficial uses, misuses, and abuses of multi-use chemicals and move towards strict codes of conduct that establish guidelines for ethical scientific development. Other modules on the site include E-learning modules for CWC National Authority and Verification functions.[33] As an example, the Institute of Chemistry, University of The Philippines, Diliman, is using an online OPCW course.

Regional OPCW activities

The OPCW groups its SPs into 5 regions. The Asia region (56 SPs) includes all EU-CBRN CoE SEA region countries. There are regular OPCW regional meetings of CWC National Authorities, for SPs to discuss national implementation issues and the initiatives, capacity-building programmes and activities being organised by the OPCW Technical Secretariat. For the Asia region, the **seventeenth Regional Meeting of National Authorities of States Parties in Asia** will take took place in Ulaanbaatar, Mongolia 25–27 June 2019.[34] There are also specific regional meetings on chemical safety and security management.[35] (See also **Annex 2**.)

30 OPCW. The Hague Ethical Guidelines. https://www.opcw.org/hague-ethical-guidelines.

31 OPCW News. International Council of Chemical Associations Endorses Hague Ethical Guidelines. 23 May 2018. https://www.opcw.org/media-centre/news/2018/05/international-council-chemical-associations-endorses-hague-ethical.

32 OPCW News. OPCW and IUPAC update educational materials for raising awareness of the multiple uses of chemicals and the Chemical Weapons Convention.26 November 2013. https://www.opcw.org/media-centre/news/2013/11/opcw-and-iupac-update-educational-materials-raising-awareness-multiple.

33 OPCW. Education and Outreach. Enhancing understanding of the work and mandate of the OPCW through education materials for students, educators, civil society, and policymakers. https://www.opcw.org/resources/education-and-outreach.

34 OPCW Calendar. Seventeenth Regional Meeting of National Authorities of States Parties in Asia. https://www.opcw.org/calendar/2019/06/25/seventeenth-regional-meeting-national-authorities-states-parties-asia.

35 OPCW. Seminar on the CWC and Chemical Safety and Security Management for Member States in the Asia Region. Doha Regional Centre for CBRN Training Doha, Qatar. 26–28 February 2019. https://www.opcw.org/calendar/2019/02/26/seminar-cwc-and-chemical-safety-and-security-management-member-states-asia.

C · OTHER KEY INTERNATIONAL INITIATIVES.

The International Programme on Chemical Safety (IPCS) started in 1980, as a collaboration between three United Nations (UN) bodies, the WHO, the International Labour Organisation and the UN Environment Programme, to establish a scientific basis for safe use of chemicals and to strengthen national capacities for chemical safety. It covers all chemicals, natural and manufactured, and exposure situations ranging from the natural presence of chemicals in the environment to their extraction or synthesis, industrial production, transport, use and disposal.[36] A WHO leaflet provides information on 10 (groups of) chemicals of major public health concern: air pollutants, arsenic, asbestos, benzene, cadmium, dioxin and dioxin-like substances, inadequate or excess fluoride, lead, mercury, highly hazardous pesticides.[37]

The Agenda for Sustainable Development

At the World Summit on Sustainable Development in 2002, Governments identified the goal of *"achiev[ing] by 2020, that chemicals are used and produced in ways that lead to the minimisation of significant adverse effects on human health and the environment"*. The 2030 Agenda for Sustainable Development was launched by a UN Summit in New York in September 2015 and is aimed at ending poverty in all its forms. At the Fourth Session of the International Conference on Chemicals Management (ICCM4) held in September 2015, the UN Secretary General stressed that "*The 2030 Agenda for Sustainable Development emphasises the importance of sound management of chemicals and waste*."[38] ICCM4 endorsed Overall Orientation and Guidance for Achieving the 2020 Goal as a voluntary tool that sets out action points and is expected to assist in the prioritisation of efforts towards 2020.[39] The 11 basic elements in this guidance to ensure sound chemicals and waste management are listed in Annex 1 below. In **Chapter 14** we again consider SAICM and the results of the conference ICCM4 in September 2015, as they link into Strategic Development Goal 12 for Responsible Consumption and Production.

REACH stands for Registration, Evaluation, Authorisation and Restriction of Chemicals. It entered into force on 1 June 2007 as a regulation of the EU. Generally regarded as the strictest law to date regulating chemical substances, it will **affect industries throughout the world** wishing to import chemicals into the EU. Inside the EU it impacts on manufacturers, importers and downstream users. It aims to improve the protection of human health and the environment from the risks that can be posed by chemicals, while enhancing the competitiveness of the EU chemicals industry. It also promotes alternative methods for the hazard assessment of substances in order to reduce the number of tests on animals.

REACH places the burden of proof on companies. To comply with the regulation, companies must identify and manage the risks linked to the substances they manufacture and market in the EU. They

36 WHO. International Programme on Chemical Safety. https://www.who.int/ipcs/en/.

37 WHO. Action is needed on chemicals of major public health concern. 2010. https://www.who.int/ipcs/features/10chemicals_en.pdf?ua=1.

38 The UN Secretary-General. Message to Fourth Session of the International Conference on Chemicals Management ICCM4. Geneva, 28 September – 2 October, 2015. http://www.saicm.org/Portals/12/Documents/meetings/ICCM4/SG%20REMARKS_HLS%2010CT.pdf.

39 SAICM Implementation towards the achievement of the 2020 goal. http://www.saicm.org/Implementation/Towards2020/tabid/5499/language/en-US/Default.aspx.

must demonstrate to the European Chemicals Agency (ECHA) how the substance can be safely used, and they must communicate the risk management measures to the users. It has especially rigorous provisions for **Substances of Very High Concern** (**SVHC).**[40]

US Chemical Security Engagement Program. This programme raises awareness globally on safety and security of chemical facilities, and works towards reducing the risk of chemical threats by collaborating with partner governments, national and international chemical organisations, and chemical professionals. It provides training opportunities and takes part in developing and implementing training modules. It partners with chemical industrial organisations to promote established best practices in chemical security, such as those reflected in the Responsible Care® Security Code and Responsible Care Management System. Foreign partnership projects have included Chemical Security Program (CSP): Chemical Security Engagement – Asia.[41]

D · EU CONTRIBUTIONS TO GLOBAL CAPACITY BUILDING

EU funding support to OPCW activities

In December 2003, the EU agreed the Strategy against Proliferation of Weapons of Mass Destruction, commonly known as the WMD Strategy. To advance these policy goals, the EU decided to support activities of the OPCW through Council Joint Actions (and subsequently Council Decisions), by providing funding to facilitate specific projects falling outside the core budget of the OPCW. At the time of the first Council Joint Action, 2004/797/CFSP[42] of 22 November 2004, three areas of OPCW activity were agreed as deserving support:

- Promotion of universality of the CWC;
- Support for full implementation of the CWC by States Parties;
- International cooperation in the field of chemical activities, as accompanying measures to the implementation of the CWC.

This initial Council instrument was followed by six others, the latest (CFSP) 2019/538 of 1 April 2019.[43] Over the intervening period, the initial project areas were augmented as necessary to reflect issues that had arisen. The EU's voluntary financial contribution though these instruments so far amounts to EUR 47 million. By the time of the fourth instrument in 2009,[44] among the many activities being supported were **Chemical Safety and Security Management Workshops**, initially only in the project area 'Africa Programme' but in the later EU instruments also under the heading of International Cooperation. These workshops were conducted over two-and-a-half days. They covered safety and security issues in chemical industry, chemical management strategies, chemical process safety management, industry

40 European Chemicals Agency (ECHA). Understanding REACH. https://echa.europa.eu/regulations/reach/understanding-reach.

41 United States, Chemical Security Program (CSP): Chemical Security Engagement - Asia. https://1540assistance.stimson.org/programs/chemical-security-engagement-csp/.

42 Council Joint Action 2004/797/CFSP of 22 November 2004. http://www.sussex.ac.uk/Units/spru/hsp/documents/2004_1122_OPCW_JA[1].pdf.

43 European Council Decision (CFSP) 2019/538 of 1 April 2019. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019D0538&from=EN.

44 European Council. 2009/569/CFSP of 27 July 2009. https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:197:0096:0107:EN:PDF.

best practices and an introduction to Responsible Care®. They were clearly being tailored to regional needs: the 2015 Council Decision states that one workshop would be addressed to the North Africa, Middle East and Gulf (OPCW) sub-regions and would be held in Arabic.

The 2019 Council Decision includes a funding stream to support the **translation and dissemination** of educational and outreach tools and materials, reflecting repeated calls of the OPCW Advisory Board on Education and Outreach for more of these materials to be made available in all six official languages of the OPCW. Besides English, these are French, Spanish, Russian, Chinese and Arabic. Materials are usually produced in English, which seriously limits their use by some stakeholder groups.

EU outreach on chemical safety and security

By 2009, the EU's outreach focus to reduce the risk of proliferation of WMD, the Priority 1 area of the three elements of the Instrument for Stability, expanded to start the CBRN CoE initiative. Support to biosafety and bio-security was another new element (see **Chapter 9**), but support to chemical safety was listed among several EU-CBRN CoE objectives for training and assistance covering CBRN.[45]

EU-CBRN CoE projects on chemical safety and security management, as listed below in **Annex 3**, began in 2013. There has been a considerable emphasis on waste management.

45 EU Commission. The Instrument for Stability - Multi-annual Indicative Programme 2009-2011. Page 23. https://reliefweb.int/sites/reliefweb.int/files/resources/F66EDF39EEAABA8E492575F2000ECA23-Full_Report.pdf.

ANNEX 1

ICCM RECOMMENDATIONS TO NATIONAL AND REGIONAL LEVELS FOR CHEMICALS AND WASTE MANAGEMENT

Recommendations from Fourth Session of the International Conference on Chemicals Management ICCM4 held in September 2015.[46]

ICCM4 urged all stakeholders to take concerted steps to implement the **Overall Orientation and Guidance,** including the 11 basic elements **critical at the national and regional levels to the attainment of sound chemicals and waste management**:

1. Legal frameworks that address the life cycle of chemicals and waste
2. Relevant enforcement and compliance mechanisms
3. Implementation of chemicals and waste-related multilateral environmental agreements, as well as health, labour and other relevant conventions and voluntary mechanisms
4. Strong institutional frameworks and coordination mechanisms among relevant stakeholders
5. Collection and systems for the transparent sharing of relevant data and information among all relevant stakeholders using a life cycle approach, such as the implementation of the Globally Harmonised System of Classification and Labelling of Chemicals
6. Industry participation and defined responsibility across the life cycle, including cost recovery policies and systems as well as the incorporation of sound chemicals management into corporate policies and practices
7. Inclusion of the sound management of chemicals and waste in national health, labour, social, environment and economic budgeting processes and development plans
8. Chemicals risk assessment and risk reduction through the use of best practices
9. Strengthened capacity to deal with chemicals accidents, including institutional strengthening for poison centres
10. Monitoring and assessing the impacts of chemicals on health and the environment
11. Development and promotion of environmentally sound and safer alternatives

46 SALCM. http://www.saicm.org/Meetings/ICCM4/tabid/5464/language/en-US/Default.aspx.

ANNEX 2

EVENTS SINCE 2016 ORGANISED UNDER THE OPCW CHEMICAL SAFETY AND SECURITY MANAGEMENT PROGRAMME [47, 48]

Notices of forthcoming events can be seen on the OPCW Calendar web site.[49]

Past events organised under the programme

In 2018, seven events in total, with one that included OPCW Asia region SPs:

- **TITLE:** Chemical Safety and Security Management for Asian Member States of the OPCW.
- **VENUE AND DATES:** Siem Reap, Cambodia 7–9 May 2018.
- **PARTICIPATING INDUSTRY ASSOCIATIONS AND COMPANIES:** UPL Limited, India; Chemical Manufacturers Association, Pakistan; NCH Philippines Inc, Philippines; SCG Chemical Company Ltd., Thailand

A similar seminar was held at the Doha Regional Centre for CBRN Training Doha, Qatar from 26–28 February 2019.[50]

In 2016/17, seven events in total, with three that included OPCW Asia region SPs:

- **TITLE:** Seoul Workshop on the Peaceful Development and Use of Chemistry
- **VENUE AND DATES:** Chemistry Seoul, Republic of Korea 2 – 4 November 2016
- **PARTICIPATING INDUSTRY ASSOCIATIONS AND COMPANIES:** Lanxess India Pvt. Ltd, India; SK Incheon Petrochem. Co. Ltd, Republic of Korea; Lankem Ceylon Ltd, Sri Lanka; Dain Consulting, Republic of Korea

47 OPCW. Paper at 22nd session of OPCW Conference of the States Parties. Note by the Director-General: Engaging the Chemicals Industry Associations. C-22/DG.18. 10 October 2017. https://www.opcw.org/sites/default/files/documents/CSP/C-22/en/c22dg18_e_.pdf.

48 OPCW. Paper at 23rd session of OPCW Conference of the States Parties. Note by the Director-General: Engaging the Chemicals Industry Associations. C-23/DG.14. 13 November 2018. https://www.opcw.org/sites/default/files/documents/2018/11/c23dg14%28e%29.pdf.

49 OPCW Calendar. https://www.opcw.org/calendar.

50 OPCW. Seminar on the CWC and Chemical Safety and Security Management for Member States in the Asia Region. Doha Regional Centre for CBRN Training Doha, Qatar. 26–28 February 2019. https://www.opcw.org/calendar/2019/02/26/seminar-cwc-and-chemical-safety-and-security-management-member-states-asia.

- **TITLE:** Chemical Safety and Security Management for Asian Member States of the OPCW
- **VENUE AND DATES:** Doha, Qatar 21 – 23 February 2017
- **PARTICIPATING INDUSTRY ASSOCIATIONS AND COMPANIES:** Federation of the Indonesian Chemical Industry, Indonesia; MSJ Industries, Sri Lanka; GLM Korea Business Assurance

- **TITLE:** Executive Programme on Integrated Chemicals Management
- **VENUE AND DATES:** Shanghai, China 29 August – 1 September 2017
- **PARTICIPATING INDUSTRY ASSOCIATIONS AND COMPANIES:** Many, including Petronas Chemical Group Berhad, Malaysia and Myanma Petrochemical Enterprise, Myanmar

Past workshops organised by the Secretariat on Needs Assessment and Best Practices in chemical safety and security management.

In 2018, 2 workshops in total, with one that included OPCW Asia region SPs:

- **TITLE:** Workshop for States Parties in Asia on Needs Assessment and Best Practices in Chemical Safety and Security Management.
- **VENUE AND DATES:** Ho Chi Minh, Viet Nam. 10–12 April 2018
- **PARTICIPATING INDUSTRY ASSOCIATIONS AND COMPANIES:** The Northwest Research Institute of Chemical Industry Co., LTD; Lanka Mineral Sands LTD; Paranthan Chemicals Company LTD; SABIC Company, Saudi Arabia

In 2017, three workshops in total, with one that included OPCW Asia region SPs:

- **TITLE:** Workshop on Needs Assessment and Best Practices on Integrated Chemical Management
- **VENUE AND DATES:** Jakarta, Indonesia 20 – 22 March 2017
- **PARTICIPATING INDUSTRY ASSOCIATIONS AND COMPANIES:** Fatimafert Limited, Pakistan; Metro Industries Inc., Philippines; PT Syngenta Indonesia; PT Petrokimia Gresik, Indonesia; PT Nippon Shokubai, Indonesia.

ANNEX 3

EU-CBRN COE PROJECTS FOCUSED ON CHEMICAL SAFETY AND SECURITY[51]

A · INCLUDING COUNTRIES IN THE EU-CBRN COE SEA REGION

PROJECT 06: Knowledge development and transfer of best practice on chemical and biological waste management. 01/01/2013 for 24 months. EUR 480,000.

- **COUNTRIES:** Brunei Darussalam, Cambodia, Lao PDR, Myanmar, the Philippines, Singapore, Thailand, Vietnam.
- **OBJECTIVES:** To increase awareness and skills of biological and chemical laboratory staff and practitioners on safe and secure chemical and biological waste management at facilities, in line with international standards.

PROJECT 31: Network of universities and institutes for raising awareness on dual-use concerns of chemical materials. 21/12/2012 for 24 months. EUR 800,000**.**

- **COUNTRIES:** Albania, Algeria, Armenia, Azerbaijan, Bosnia and Herzegovina, Brunei Darussalam, Burkina Faso, Cambodia, Croatia, former Yugoslav Republic of Macedonia, Georgia, Indonesia, Iraq, Jordan, Kazakhstan, Kyrgyzstan, Lao PDR, Lebanon, Libya, Malaysia, Mali, Mauritania, Moldova, Montenegro, Morocco, Myanmar, the Philippines, Serbia, Singapore, Tajikistan, Thailand, Tunisia, Turkmenistan, Ukraine, Uzbekistan, Vietnam.
- **OBJECTIVES:** To develop a sustainable network of universities and research institutes to reinforce a culture of chemical safety and security. To raise awareness of dual-use concerns of chemical materials for academics, scientists, researchers, technicians and students. To foster the exchange of information, dissemination of knowledge, transfer of best practice and design of joint initiatives, both internally and externally among network participants and national agencies. To advocate for the incremental incorporation of training materials and agreed common standards on chemical safety and security, and dual-use concerns as a component of the curricula (universities) or fields of research (institutes) of the network participants.
- **KEYWORDS:** Network; chemical safety; chemical security; dual-use; best practices

PROJECT 61: Sound management of chemicals and their associated wastes in Southeast Asia (SEACHEM). 01/09/2017 for 36 months. EUR 3,000,000.

- **COUNTRIES:** Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam.
- **OBJECTIVES:** The overall objective of the project of which this contract will be a part is to achieve enhanced chemical safety and security in the region, taking the country-specific baseline situation into account. The five topics listed include: - Judicial reinforcement with respect to sound management of chemicals and their wastes; - Enhanced capacity

51 CBRN Centres of Excellence. Addressing regional CBRN needs. http://www.cbrn-coe.eu/Projects/TabId/130/PageID/3/PgrID/543/Default.aspx.

for prevention of chemical incidents including both safety and security aspects.
- **KEYWORD(S):** Legal framework; Public health impact mitigation; Safety and security; Waste management.

B · IN OTHER COE REGIONS

PROJECT 35: Management of hazardous chemical and biological waste in North and West Africa. 01/01/2014 for 42 months. EUR 387,180.

- **COUNTRIES:** Côte d'Ivoire, Gabon, Liberia, Mauritania, Morocco, Senegal, Togo, Tunisia.
- **OBJECTIVES:** To enhance best practices in hazardous chemicals and biological waste management in partner countries. To build capacity for laboratory staff with respect to measurements and testing of chemical and biological waste components. This will be achieved through awareness raising and the development of a sustainable training system and provision of training for both hazardous chemical and biological waste management.
- **KEYWORD(S):** Waste management; chemical waste; biological waste; awareness-raising; measurements

PROJECT 41: High-risk chemical facilities and chemical risk mitigation in West Africa. 01/01/2015 for 36 months. EUR 3,000,000.

- **COUNTRIES:** Benin, Cameroon, Côte d'Ivoire, Gabon, Liberia, Mauritania, Morocco, Nigeria, Senegal, Togo.
- **OBJECTIVES:** To enhance sound chemical hazard management in West African countries in order to prevent the occurrence of high-risk chemical accidents inside and around all important chemical installations. To support partner countries in the development of a rapid and appropriate response in case of chemical accident so as to limit the impact on human health and on the environment.
- **KEYWORD(S):** high-risk facility; chemical risk management; legal framework; crisis management; first response; post-incident recovery

PROJECT 42: Chemical safety and security in Central and Eastern Africa. 05/01/2015 for 36 months. EUR 2,978,000.

- **COUNTRIES:** Burundi, Democratic Republic of Congo, Ghana, Kenya, Rwanda, Seychelles, Tanzania, Zambia.
- **OBJECTIVES:** To enhance sound chemical hazard management in Eastern and Central African countries by strengthening the national Chemical legal framework in order to prevent the occurrence of accident inside and around all important chemical installations. To strengthen Chemical preparedness and response capabilities.
- **KEYWORD(S):** High risk facility; legal framework; chemical risk management; crisis management; first response; post-incident recovery

PROJECT 65: Strengthening chemical and biological waste management in Central Asia countries for improved security and safety risk mitigation. 27/12/2017 for 36 months. EUR 2,569,511

- **COUNTRIES:** Afghanistan, Kyrgyzstan, Mongolia, Pakistan, Tajikistan, Uzbekistan.
- **OBJECTIVES:** To **s**trengthen existing chemical and biological waste management

capabilities to ensure safe and secure collection, transportation, separation, processing, storage, disposal and inventory of hazardous CB waste originated by local industry (CB waste producers and CB waste management facilities), trade, agriculture, health care and past practices (dumping sites, historical industrial sites, former military bases etc.), as well as a consequence of emergency.

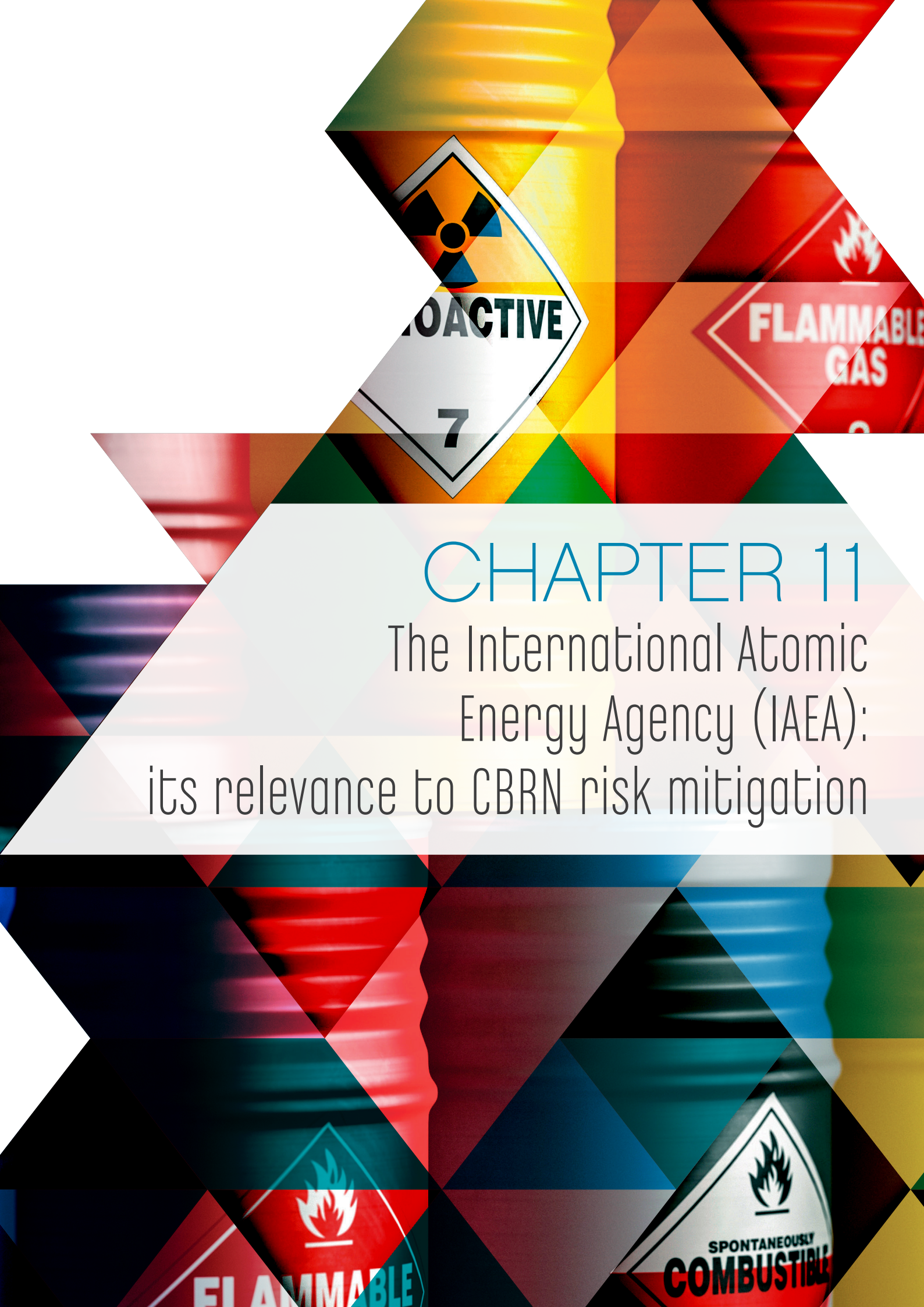
- **KEYWORD(S):** Safety and security; Waste management;

PROJECT 67: **Strengthening CBRN waste management capabilities in South-East and Eastern European countries**. 23/07/2018 for 36 months. EUR 2,999,825.

- **COUNTRIES:** Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, former Yugoslav Republic of Macedonia, Georgia, Moldova, Montenegro, Serbia, Ukraine.
- **OBJECTIVES:** To strengthen and harmonize regulatory framework of CBRN Waste Management (WM) capabilities in the SEEE region. Improve legal framework, regulations and good practices for CBRN WM. Establish sustainable national training program for competencies on CBRN Waste Management. Enhance technical capabilities of CBRN WM effectiveness.

PROJECT 69: **High risk chemical facilities and risk mitigation in the African Atlantic Façade Region (INSTASUR).** 07/12/2018 for 30 months. EUR 2,299,650.

- **COUNTRIES:** Benin, Cameroon, Côte d'Ivoire, Gabon, Liberia, Mauritania, Morocco, Senegal, Sierra Leone, Togo.
- **OBJECTIVES:** To strengthen and consolidate the regional expertise team and to help each Partner Country to move forward to ensure proper control of the risks associated with the use of hazardous chemicals.



CHAPTER 11

The International Atomic Energy Agency (IAEA): its relevance to CBRN risk mitigation

CHAPTER 11

THE INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA): ITS RELEVANCE TO CBRN RISK MITIGATION

The International Atomic Energy Agency (IAEA) international arrangements for regulation, guidance and assistance to support the safety and security of peaceful uses of RN materials are complex. Ensuring that national RN Action Plans derived from this are fully integrated with CBRN risk mitigation arrangements is important. Harm may arise from accidents at nuclear power plants or accidents involving radioactive sources in other legitimate contexts that can be widespread in any country. CBRN risk mitigation must also take account of the potential for malicious use of radioactive material by criminals or terrorists to cause harm through radiation effects.

The EU is a major contributor to the activities of the IAEA, through financing arrangements and technical expertise, providing EUR 111.5 million from 2007-2013. Four EU-CBRN CoE projects starting from 2013 have addressed the safety and security of RN materials in countries of the SEA Region, including other collaborative activities in cooperation with active stakeholders in the region like ASEANTOM (ASEAN Network of Regulatory Bodies on Atomic Energy) and ACE (ASEAN Center for Energy) and ISCN-JAEA (Integrated Support Center for Nuclear Non-Proliferation and Nuclear Security, Japan Atomic Energy Agency).

SYNOPSIS

The International Atomic Energy Authority (IAEA) international arrangements for regulation, guidance and assistance are complex. It is therefore not surprising that many countries deal with the IAEA through specialist agencies, but the history of EU-CBRN CoE projects bodes well for working level links between CBRN risk mitigation implementers and such agencies. Ensuring that CBRN risk mitigation arrangements are integrated with RN Action Plans adopted from IAEA models is important.

In **Chapter 4** we considered accidents at nuclear power plants and accidents involving radioactive sources in other legitimate contexts that may be widespread in any country. The history of harm from radioactive sources out of regulatory control – orphan sources – and the risk of them being acquired for malevolent purposes, has led the IAEA to provide a model methodology for a preventative and remedial action plan. Prevention and response in those contexts should be one element in any national CBRN risk mitigation strategy, in parallel with a focus on the potential for accidental or malicious use of radioactive material to cause harm through radiation effects.
The Non-Proliferation Treaty (NPT) established in 1968 is important because its mandate is to foster the peaceful uses of nuclear energy as well as to prevent the spread of nuclear weapons and weapons technology and to further the goal of disarmament. It establishes a safeguards system under the responsibility of the IAEA, which also plays a central role under the Treaty in areas of technology transfer for peaceful purposes.

It is useful to remember the relationship between the peaceful use of nuclear fission in power generation and its use in nuclear weapons, because both require fissile materials. By the end of 2017 global nuclear power generation capacity had risen to 448 operable reactors. There are calls that the increased IAEA workload in providing the consequent RN guidance and monitoring should be accompanied by a commitment by IAEA Member States to strengthen and integrate their security and safety practices and response capabilities.
We explain the IAEA functional areas and principal programmes including the IAEA Incident and Emergency Centre (IEC) which has over 1000 emergency contact points in countries and organisations. Specific activities are the development of the Low Enriched Uranium or LEU Nuclear Fuel Bank, investigating the Fukushima nuclear power plant accident, and how the EU has interacted with the IAEA through the IAEA-EU Joint Action partnership since 2005.
The EU is a major contributor to the activities of the IAEA, through financing arrangements and technical expertise. One of the objectives of this aspect of external support was to reduce illicit trafficking of CBRN materials and to secure nuclear materials in Former Soviet Union countries. The gross overall sum of EU support in 2007-2013 was EUR 111.5 million. The European Commission's Directorate General for International Cooperation and Development (DG DEVCO) also funded the redirection of former Iraqi Weapons of Mass Destruction (WMD) Scientists during the decommissioning of Iraqi nuclear facilities and radioactive waste management. Four EU-CBRN CoE projects starting from 2013 have addressed the safety and security of RN materials in countries of the SEA Region.

Annexes included:

- **Annex 1.** EU-CBRN CoE projects focused on the safety and security of RN materials

KEY TERMS

- **ACE:** ASEAN Center for Energy
- **ASEANTOM:** ASEAN Network of Regulatory Bodies on Atomic Energy
- **DG-DEVCO:** European Commission Directorate General for International Cooperation and Development
- **Fissile material:** A nuclear material in which nuclear fission can be induced by neutrons, like uranium-233 (U-233), uranium-235 (U-235), plutonium-239 (Pu-239) and plutonium-241 (Pu-241)IAEA: International Atomic Energy Authority ISCN-JAEA: Integrated Support Center for Nuclear Non-Proliferation and Nuclear Security, Japan Atomic Energy Agency
- **LEU Nuclear Power Bank:** Facility of IAEA which stores Low Enriched Uranium with concentrations up to 4.95%; LEU is the nuclear fuel for a typical light water reactor.
- **NPT:** Non-Proliferation Treaty
- **WMD:** Weapons of Mass Destruction

Our scope

Throughout this toolkit, in our examination of CBRN risk mitigation we have not covered the direct and deliberate use of nuclear material to cause explosion. In **Chapter 4** we dealt with accidents at nuclear power plants and accidents involving radioactive sources in other contexts. We came back to this in **Chapter 8** in the context of the unauthorised transportation of radioactive sources. Prevention and response in those contexts should be one element in any national CBRN risk mitigation strategy, in parallel with a focus on the potential for accidental or mischievous use of radioactive material to cause unwanted harm through radiation effects. The International Atomic Energy Agency (IAEA) is a huge international system designed to provide guidance, training and assistance in both these risk scenarios. Because of the complexity and scope of IAEA arrangements and the ways in which they can benefit national CBRN risk mitigation implementation, this chapter is dedicated to an explanation of the IAEA.

A · INTRODUCTION: THE RN ISSUES NEEDING TO BE ADDRESSED

The relationship between peaceful and weapons uses of nuclear fission

Although we are not covering the deliberate use of nuclear material as an explosive weapon, it is important to remember the connection between the peaceful use of nuclear fission[1] in power generation and its use in nuclear weapons, which exists because both require fissile materials. Some of the technology that can be used to produce or purify a fissile material for a nuclear power plant could also be applied to producing nuclear weapons. The main fissile materials used in nuclear reactions are:

- Uranium-233 (U-233)
- Uranium-235 (U-235). This is currently the most common fuel in nuclear reactors. To create a weapon Uranium must be enriched above 80%. Highly enriched Uranium (more than 20% enrichment) is also used for reactors in naval vessels and for research reactors.
- Plutonium-239 (Pu-239). This is the preferred isotope for nuclear weapon design as it has a lower critical mass and is easier to produce in large quantities than U-235.
- In addition, Plutonium-240 (Pu-240) and Plutonium-241 (Pu-241) are produced and consumed in nuclear power production but neither can be used for nuclear Weapons.[2]

The Non-Proliferation Treaty (NPT) established in 1968 is important because its mandate is to foster the peaceful uses of nuclear energy as well as to prevent the spread of nuclear weapons and weapons technology and to further the goal of disarmament. It establishes a safeguards system under the responsibility of the IAEA, which also plays a central role under the Treaty in areas of technology transfer for peaceful purposes.[3] Safeguards are used to verify compliance with the Treaty through inspections

1 A nuclear reaction in which a heavy nucleus splits spontaneously or on impact with another particle, with the release of tremendous amounts of energy.

2 Nuclear Weapons Proliferation, Nuclearinf.net. http://nuclearinfo.net/Nuclearpower/WebHomeNuclearWeaponsProliferation.

3 Treaty on the Non-Proliferation of Nuclear Weapons (NPT). AEA. https://www.iaea.org/publications/documents/treaties/npt.

conducted by the IAEA. The Treaty promotes cooperation in the field of peaceful nuclear technology and equal access to this technology for all States Parties, while safeguards prevent the diversion of fissile material for weapons use.[4]

Nuclear power and the increasing challenges on safety and security

By the turn of the millennium it was becoming recognised that the expected surge in nuclear power capacities worldwide and the emerging security threats from terrorism would demand a significant enhancement of IAEA provisions for RN guidance and monitoring. The increased IAEA efforts would indicate a necessary world-wide commitment by IAEA Member States (MS) to strengthen and integrate their security and safety practices and response capabilities. By the end of 2017 global nuclear power generation capacity had risen to 448 operable reactors, with another 59 under construction, marking the fifth successive year of increase. About half the operable reactors were in the United States (US) and Europe, but there were increases in every region: in the EU-CBRN CoE SEA Region, Thailand, Cambodia and Vietnam had struck technology cooperation agreements with China, which by then had 38 operable nuclear reactors, about 9% of the world's capacity.[5]

The extension of the operating lifetimes of ageing nuclear facilities brought safety and security complications, as did the increasing regulatory burdens from the expanding applications for radioactive materials.[6] There have also been calls in several countries to reduce the dependence on nuclear power generation and instead turn to renewable energy resources. For instance, in South Korea, nuclear energy covered 30% of the country's electricity consumption in 2014, but a strong anti-nuclear movement has grown since the Fukushima nuclear disaster in 2011. Notwithstanding this, the national government planned to increase the number of nuclear reactors from the 24 in 2015 to 26 by 2030. In November 2013, the Mayor of Seoul, Park Won-soon, reacted by appointing a panel of international energy experts to provide expert advice to the Seoul Metropolitan Government (SMG) on its sustainable energy action plan, launching a counterplan called 'One Less Nuclear Power Plant'.[7]

Regulatory control of sources

In **Chapter 4** we dealt at length with accidents at nuclear power plants and accidents involving radioactive sources in other contexts. The history of the latter is that by 2004, the IAEA was becoming concerned that sources outside of control - orphan sources[8] - had caused multiple fatalities or serious injuries when unknowing individuals find them. This problem, along with concerns that orphan or vulnerable sources might be acquired for malevolent purposes, led countries to try to improve controls. The IAEA published

4 Treaty on the Non-Proliferation of Nuclear Weapons (NPT). United Nations. https://www.un.org/disarmament/wmd/nuclear/npt/.

5 World Nuclear Association. World Nuclear Performance Report 2018. https://www.world-nuclear.org/getmedia/b392d1cd-f7d2-4d54-9355-9a65f71a3419/performance-report.pdf.aspx.

6 IAEA. Effective Nuclear Regulatory Systems Facing Safety and Security Challenges. Proceedings of an International Conference, Moscow, 27 February – 3 March 2006. https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1272_web.pdf.

7 IEAC. International Energy Advisory Council. Seoul International Energy Advisory Council (SIEAC). https://www.ieac.info/Seoul-International-Energy-Advisory-Council-SIEAC.

8 An orphan source is a radioactive source that poses sufficient radiological hazard to warrant regulatory control, but which is not under regulatory control because it has never been so or because it has been abandoned, lost, misplaced, stolen or otherwise transferred without proper authorisation. A vulnerable source is one, which is currently under regulatory control, but its level of control is weak.

a model methodology for a preventative and remedial action plan.[9]
Surveying past experience, the IAEA summarised the main causes for loss of control of sources as:

- Mobile sources are lost or stolen while in transit;
- Sources are abandoned, either deliberately or through lack of awareness;
- Sources are stolen, either for the scrap value of the source or its container. (Sources are often perceived as having more value than they do because of the care with which they are treated).

The IAEA developed an internationally harmonised basis for risk informed decision making, by a ranking of sources and practices according to their potential hazard, the most dangerous being Category 1.[10]

The Category 1 sources are:

- Radioisotopic thermoelectric generators (RTGs);[11]
- Sterilisation and food preservation irradiators;[12]
- Self-shielded irradiators, or blood/tissue irradiators;[13]
- Teletherapy units, in medical institutions.[14]

Direct exposure to Category 1 radiation could lead death or permanent injury of individuals who are in close proximity to the source for a short period of time (minutes to hours).

Category 2

These sources could lead to the death or permanent injury of individuals who are in close proximity to the source for a longer period of time than for Category 1 sources.
Examples: industrial gamma radiography equipment and high/medium dose-rate brachytherapy.

9 Strengthening control over radioactive sources in authorized use and regaining control over orphan sources National strategies. IAEA-TECDOC-1388. IAEA 2004. https://www-pub.iaea.org/MTCD/Publications/PDF/te_1388_web.pdf.

10 IAEA. Categorization of radioactive sources. IAEA-TECDOC-1344. 2003. https://www-pub.iaea.org/MTCD/publications/pdf/te_1344_web.pdf.

11 RTGs: devices that use the decay heat of a radioisotope to produce electricity. They tend to be deployed unattended in remote areas, and there they tend to be susceptible to being moved, or taken for malevolent purposes, or dismantled for the scrap value of their shielding material.

12 Sterilisation and food preservation irradiators. These sources are installed in dedicated, large, shielded enclosures that use either a deep pool of water or massive lead or concrete to shield the source when not in use. Because the source 'array' moves around the goods being irradiated, there is the potential for a source to fall out of a badly maintained array and leave the facility in the line of goods.

13 Self-shielded irradiators. Few of these fixed devices have been involved in orphan source incidents because of their robust nature and design.

14 Teletherapy units, in medical institutions: a large source being used externally to irradiate a tumour. Colbalt-60 sources are generally in a solid metallic form with a source capsule comprising a number of pellets or discs. Caesium-137 teletherapy sources are usually caesium chloride, as a powder which is soluble and easily dispersed. Although these hospital staff should be well trained in radiological protection, there are well documented examples of escape of radioisotope causing fatalities and serious environmental contamination.

Category 3

These sources could lead to the permanent injury of individuals who are in close proximity to the source for a longer period of time than Category 2 sources. Sources in Category 3 could, but are unlikely to, lead to fatalities.
Examples: fixed industrial gauges (level gauges, dredger gauges, conveyor gauges, and spinning pipe gauges) and well logging gauges.

Category 4

These sources could lead to the temporary injury of individuals who may be in close proximity to the source for a longer period of time than Category 3 sources. Permanent injuries are unlikely.
Examples: low dose-rate brachytherapy sources, thickness gauges, portable gauges, and bone densitometers.

Category 5

These sources could, but are unlikely to, cause minor temporary injury of individuals.
Examples: X-ray fluorescence devices, static eliminators, and electron capture devices.

The need for a national nuclear security plan

Following the terrorist attacks of 11 September 2001 in the US, the IAEA developed a Nuclear Security Plan of Activities to address issues related to protection against nuclear terrorism. One area of activity in this plan covers the security of radioactive materials other than nuclear material and has the objective of ensuring "*that significant, uncontrolled radioactive sources are brought under regulatory control and properly secured.* A national strategy to improve control over radioactive sources needs to address both the radiation safety problem as well as the security of vulnerable sources and the radiological terrorism threat. The IAEA Plan provides practical guidance to countries on the development of such a national strategy, particularly in regard to dangerous sources (**Categories 1–3**). Part of this process involves the determination of the magnitude of the potential problem with orphan and vulnerable sources and indeed, **whether or not a national strategy is needed**. The ultimate objective is that states will use this report to develop and then implement a plan of action that will result in all significant sources being managed in a safe and secure manner. The primary audience of the publication is the regulatory authorities of developing countries. However, the IAEA suggests that the guidance could help all countries to identify weaknesses or gaps in their existing programmes of radioactive source control.[15]

Illicit trafficking

The EU is a major contributor to the activities of the IAEA, through financing arrangements and technical expertise. One of the main objectives of this aspect of external support was to reduce CBRN illicit trafficking and to secure nuclear and chemical materials in Former Soviet Union countries. Illicit trafficking can be defined as the wilful illegal movement of nuclear or other radioactive material across international borders. Possessing and moving nuclear or other radioactive material across boundaries is not in itself illegal; only if a registration and permission process-when required by law-has not been completed that it becomes an illegal act. Trafficking increases and widens illegal access to nuclear and other radioactive material. Groups or individuals who are considering using nuclear or

15 IAEA. Strengthening control over radioactive sources in authorized use and regaining control over orphan sources. National strategies. IAEA-TECDOC-1388. https://www-pub.iaea.org/MTCD/Publications/PDF/te_1388_web.pdf.

other radioactive material for criminal or terrorist purposes may be able to acquire these substances domestically. If they are not able to do so however, or if they want to clandestinely transport such material to a third country, they may attempt to illegally traffic the material.[16]

B · THE RATIONALE OF THE IAEA

The IAEA is the most competent international organisation that **seeks to promote the peaceful use of nuclear energy while inhibiting its military use. It is the world's nuclear inspectorate working to stop the spread of nuclear weapons.** It was established as an autonomous organisation in July 1957, and although independent of the United Nations (UN) it reports to both the UN General Assembly and the UN Security Council. Its technical functions are carried out by a Secretariat of some 2500 professional and support staff from more than 100 countries.[17] IAEA headquarters are in Vienna, Austria, with Regional offices in Toronto and Tokyo, and Liaison offices in New York and Geneva. Research and testing laboratories are in Seibersdorf, Austria and in Monaco. The IAEA and its former Director General, Mohamed ElBaradei, were jointly awarded the **Nobel Peace Prize** on 7 October 2005.

The underpinning international legal framework for the IAEA nuclear safety and security programmes includes: the NPT; the Convention on the Physical Protection of Nuclear Material; the Amendment to the Convention on the Physical Protection of Nuclear Material; Safeguards Agreements; Nuclear Safety conventions; Non-binding Codes of Conduct, standards and guides; UN Security Council Resolution 1540; and The International Convention on the Suppression of Acts of Nuclear Terrorism.

The Agency assists research, development and practical applications of atomic energy for peaceful uses. In this, it acts as intermediary in securing services or supplying materials, equipment, or facilities. **Its support to the improvement of RN safety and security world-wide also reduces the potential for deliberate misuse**. The key monitoring mechanism is the Safeguards system (see below), set up in 1971 to account as accurately as possible for all nuclear material at 'safeguarded' declared plants. All movements and production of nuclear materials must be reported to the IAEA, which verifies these data by regular inspections and stocktaking. The Safeguards system thus acts as a confidence-building measure, an early warning mechanism, and a trigger for other responses by the international community should the need arise. Although the 1971 safeguards protocols provided for the IAEA to carry out an unscheduled inspection at any time including at undeclared sites, this right was not used until 1991 when the IAEA worked with the United Nations Special Commission (UNSCOM) in the aftermath of the Gulf War to inspect and close Iraq's (undeclared) nuclear weapon facilities.[18] Since 1993, the IAEA has made a continuing series of requests to North Korea to try to resolve international concerns over undeclared facilities with the potential to produce weapons grade plutonium.[19]

16 Illicit Trafficking of Nuclear and other Radioactive Material. The Legislative Response. Vertic. http://www.vertic.org/media/assets/Publications/ITR_WEB.pdf.

17 IAEA Employment. https://www.iaea.org/about/employment.

18 Vertic. Verification 1996. Arms control, Peacekeeping and the Environment. eds Poole JB and Guthrie R. p97 et seq.

19 IAEA. IAEA and DPRK: Chronology of Key Events. https://www.iaea.org/newscenter/focus/dprk/chronology-of-key-events.

C · OVERVIEW OF IAEA PROGRAMMES

IAEA functional areas

The functional areas covered by the Agency are divided into five major departments:

THE DEPARTMENT OF NUCLEAR SCIENCES AND APPLICATIONS assists countries in applying nuclear and (radio)isotopic techniques to sustainable development objectives in agriculture, human health, water resource management, marine environment and industrial applications.[20] It also works with laboratories, universities and research facilities through the IAEA Collaborating Centre scheme.[21] *The Department of Nuclear Energy* fosters the efficient and safe use of nuclear power by supporting existing and new nuclear programmes.[22] It provides technical guidance on the nuclear fuel cycle and the life cycle of nuclear facilities, and builds indigenous capability in energy planning, analysis, and nuclear information and knowledge management.

THE DEPARTMENT OF NUCLEAR SAFETY AND SECURITY works to provide a robust, sustainable and visible global nuclear safety and security framework, protecting people and the environment from the harmful effects of ionising radiation.[23] Specific objectives include: securing vulnerable nuclear and radioactive materials; building enhanced, sustainable nuclear safety and security globally; security of radioactive (and other radiation) sources; harmonisation between nuclear security, nuclear safety and nuclear safeguards worldwide. A large library of guidance is made available, as in the IAEA Safety Standards Series; for example, the Safety Guide Environmental and Source Monitoring for Purposes of Radiation Protection advises on monitoring strategy of monitoring in relation to: (a) control of radionuclide discharges; and (b) intervention, such as in cases of nuclear or radiological emergencies or past contamination of areas with long lived radioisotopes.[24]

THE DEPARTMENT OF SAFEGUARDS fulfils the IAEA's role as the world's nuclear inspectorate working to stop the spread of nuclear weapons.[25] Safeguards are based on assessments of the correctness and completeness of a State's declared nuclear material and nuclear-related activities. Verification measures include on-site inspections, visits, sampling, and ongoing monitoring and evaluation. Importantly, two sets of measures can be applied according to the type of safeguards agreements in force with a State:

- verifying Member State reports of declared nuclear material and activities. These measures are based on nuclear material accountancy complemented by containment and surveillance techniques such as tamper-proof seals and cameras that the IAEA installs at facilities;
- additional measures to strengthen the IAEA's inspection capabilities, incorporated in the "Additional Protocol". This enables the IAEA to verify the **non-diversion** of declared nuclear material and also to provide assurances about the absence of **undeclared** nuclear material and activities in a State.

20 IAEA Department of Nuclear Sciences and Applications. https://www.iaea.org/about/organizational-structure/department-of-nuclear-sciences-and-applications.

21 IAEA Collaborating Centres. https://www.iaea.org/about/partnerships/collaborating-centres.

22 IAEA Department of Nuclear Energy. https://www.iaea.org/about/organizational-structure/department-of-nuclear-energy.

23 IAEA Department of Nuclear Safety and Security. https://www.iaea.org/about/organizational-structure/department-of-nuclear-safety-and-security.

24 IAEA. Environmental and Source Monitoring for Purposes of Radiation Protection Safety Guide no RS-G-1.8. https://www-pub.iaea.org/books/iaeabooks/7176/Environmental-and-Source-Monitoring-for-Purposes-of-Radiation-Protection.

25 IAEA Safeguards Overview: Comprehensive Safeguards Agreements and Additional Protocols. https://www.iaea.org/publications/factsheets/iaea-safeguards-overview.

From 2011, Safeguards Analytical facilities were extended and modernised under three main project streams: the Large Geometry Secondary Ion Mass Spectrometer and Clean Lab Extension; the new Nuclear Material Laboratory (NML); and the expanding Network of Analytical Laboratories. **The EU** contributed EUR 5 million to the costs of the NML,[26] and contributed to 15 smaller projects in amounts between EUR 3,000 and EUR 975,000.[27]

THE DEPARTMENT OF TECHNICAL COOPERATION is the IAEA's primary mechanism for transferring nuclear technology to MS, helping them to address development priorities in areas such as health and nutrition, food and agriculture, water and the environment, industrial applications, and nuclear knowledge development and management. The programme also helps MS to identify and meet future energy needs, and assists in improving radiation safety and nuclear security worldwide including through the provision of legislative assistance.[28]

Incident and Emergency Preparedness. The IAEA Incident and Emergency Centre (IEC) is the global focal point for international emergency preparedness, communication and response to nuclear and radiological incidents and emergencies, regardless of whether these arise from accident, negligence or deliberate act. It maintains a list of more than **1000 emergency contact points** in MS and in other international organisations. Guidance provided covers: event notification and official information exchange; public communication in an incident; assessment of potential emergency consequences and development of systems for emergency crisis management; assistance on request; coordination of inter-agency response. The IEC uses the IAEA Unified System for Information Exchange in Incidents and Emergencies (USIE).[29]

Education and Training

The Agency offers a wide spectrum of training courses and capacity-building programmes. Every year since 2002, the General Conference has stressed the importance of IAEA education and training activities. The fundamental focus is on sustainable IAEA programmes for education and training in nuclear, radiation, transport and waste safety, all serving to build competence in MS. The updated strategy for 2011–2020 recognises the importance of the MS taking **ownership** by implementing national strategies to strengthen education and training in radiation, transport and waste safety, so ensuring that national programmes address the requirements of the International Basic Safety Standards BSS and other Agency safety standards.[30] The IAEA offers a wide spectrum of courses spanning national strategy development and operational aspects, for a range of types of staff up to post graduate.[31] The IAEA's network of regional training centres[32] assists Member States in building competence: in Asia there is a Centre in Malaysia – the Nuclear Malaysia Agency in Bangi, Selangor.[33]

26 EU. Action Fiche (Annex 2). Enhancing the Capability of the IAEA Safeguards Analytical Service (ECAS) - EU contribution to the new Nuclear Material Laboratory (NML). Project area 2 under priority 1 "Support for the objectives of the EU Non-proliferation of weapons of mass destruction Strategy" of the long-term component of the Instrument for Stability.

27 EU Contribution Agreement with an International Organisation IfS/20101/273-571: "Enhancing Capacities of the IAEA Safeguards Analytical Services (ECAS) – EU contribution to the new Nuclear Material Laboratory (NML).

28 IAEA Technical Cooperation Programme. https://www.iaea.org/services/technical-cooperation-programme.

29 IAEA. Incident and Emergency Centre. https://www.iaea.org/about/organizational-structure/department-of-nuclear-safety-and-security/incident-and-emergency-centre.

30 IAEA. Strategic Approach to Education and Training in Radiation, Transport and Waste Safety 2011–2020. 2010/Note 44. https://www-ns.iaea.org/downloads/rw/training/strategic-approach2011-2020.pdf.

31 IAEA. Training Courses. https://www.iaea.org/services/education-and-training/training-courses.

32 IAEA. Regional Training Centres. https://www.iaea.org/services/training/regional-centres-radiation-transport-waste-safety

33 Malaysian Nuclear Agency. https://www.nuclearmalaysia.gov.my/new/public.php.

D · SPECIFIC ACTIVITIES

Development of the LEU Nuclear Fuel Bank

The Low Enriched Uranium Fuel Bank, owned and managed by the IAEA, is intended to provide a secure source of nuclear reactor fuel to countries that institute national civil nuclear programmes. This limits the global proliferation risks because it allows countries to develop civilian nuclear power programmes without the need for enrichment capability - a technology that also can be used to produce fuel for nuclear weapons. For MS participating in the IAEA scheme, the risks of unexpected fuel supply disruptions are then also reduced. Other LEU banks exist in Russia, the UK and the US. Countries will be supplied with IAEA LEU fuel under specific conditions, including assessment of **the seismic situation, measures against potential flooding, comprehensive risk management strategy, and special security arrangements**. The bank will be in Kazakhstan. Kazakhstan will benefit by an upgrading of its nuclear regulatory infrastructure and more frequent IAEA evaluation missions and training events. By late 2018 the IAEA had signed contracts to purchase LEU, in preparation to open the bank in 2019.[34]

Investigating the Fukushima accident

The EU has expressed its support for the IAEA Action Plan on Nuclear Safety.[35] This defined a programme of work to strengthen the global nuclear safety framework in response to the March 2011 accident at **TEPCO's Fukushima Daiichi Nuclear power plant.** The plan outlined actions to strengthen safety in 12 areas: safety assessment of nuclear power plants; IAEA peer reviews; emergency preparedness and response; national regulatory bodies; operating organisations; IAEA safety standards; the international legal framework; Member States planning to embark on a nuclear power programme; capacity building; protection of people and the environment from ionising radiation; communication and information dissemination; and research and development. The results of the project and the specific Fukushima investigation were reported in July 2016.[36] Over 1000 activities had been carried out, at a cost of EUR 40 million. As well as 15 missions to Japan, the number of IAEA Peer Review missions had increased by more than 60%. These missions assess the safety of an activity or facility in a MS, also providing advice based on relevant safety standards and promoting information sharing for example by national hosting of peer reviews of facilities. International meetings under the plan brought together experts from 87 MS and 22 international organisations, ensuring that lessons learned from the accident and relevant best practices were widely discussed.

Cooperation with the EU

The EU is a major contributor to the activities of the IAEA, through financing arrangements and technical expertise. The IAEA is the major implementer of radiological and nuclear safety related projects for the EU. IAEA-EU cooperation started with nuclear non- proliferation, and was extended to nuclear, radiation and waste safety aspects, and to emergency preparedness and response and specific areas associated with the fight against global threats of radiological and nuclear terrorism. Coordination between the EU and the IAEA in meeting their targets is publicised as strengthening nuclear safety and security worldwide.[37] The Agency's Technical Cooperation objectives address issues relevant to the EU-CBRN CoE initiative.

34 IAEA Buys uranium for LEU Bank. World Nuclear News. 21 November 2018. http://www.world-nuclear-news.org/Articles/IAEA-buys-uranium-for-LEU-Bank.

35 IAEA Action Plan on Nuclear Safety, Vienna (2011). https://www.iaea.org/topics/nuclear-safety-action-plan.

36 IAEA. Completion of the IAEA Action Plan on Nuclear Safety and release of the report on the Fukushima Daiichi accident. 4 July 2016. https://www.vie-mission.emb-japan.go.jp/lentijo.pdf.

37 EU and IAEA Joint Press Statement of the first EU-IAEA Senior Officials Meeting on 25 January 2013, Brussels (25 January 2013).

The IAEA-EU Joint Action partnership was established in 2005.[38] Priority is given to states needing assistance in determining what radioactive and nuclear material they have, how to control it and how to reduce the risks. Efforts focus on three main areas, strengthening:

- a state's legislative and regulatory infrastructure related to nuclear and other radioactive material, to enable the country to fulfil its national and international obligations;
- security measures for nuclear and other radioactive material in use, storage and transport and their related facilities;
- a state's capabilities for dealing with nuclear and radioactive material outside national regulatory control.

In 8 years (2005–2012) under this Joint Action, some EUR 26 million was spent on strengthening nuclear security in 82 Member States, with over 360 nuclear security tasks successfully implemented. EU-CBRN CoE SEA region countries were among those receiving support: through the funding support of EU-JA IV, between October 2008 and June 2012, Brunei, Cambodia, Indonesia, Philippines, Singapore, Vietnam were among the 44 beneficiaries; under CD V, between January 2011 and December 2012, Indonesia and Philippines were among the 48 beneficiaries.

The Instrument for Nuclear Safety Cooperation (INSC) is an important mechanism by which the EU supports the promotion of nuclear safety, radiation protection, and the application of efficient and effective safeguards of nuclear material in all third countries, but with priority for accession and neighbouring countries.[39] The EU has been a major donor to IAEA programmes and projects through the INSC and the EU's Instrument for Stability (the forerunner of the IcSP). The gross overall figure for the Multi-annual Indicative Programme MIF 2007-2013 was EUR 111.5 million, which included contributions of EUR 20 million to the development of the LEU Fuel Bank.[40] The European Commission's Directorate-General for International Cooperation and Development (DG DEVCO) also funded the redirection of former Iraqi WMD Scientists during the decommissioning of Iraqi nuclear facilities and radioactive waste management.[41] Four CBRN CoE projects starting in 2013 have specifically addressed the safety and security of RN materials in countries of the SEA Region: Projects 21, 28, 29, and 30. Project 16 supported the development of an integrated national nuclear security system in three North African countries. (See list of EU-CBRN CoE Projects in **Annex 1**).

38 IAEA–EU Joint Action. Partnership in Improving Nuclear Security. https://www.iaea.org/sites/default/files/nseu0613.pdf.

39 EC. International Cooperation and Development. Building partnerships for change in developing countries. Instrument for Nuclear Safety Cooperation. https://ec.europa.eu/europeaid/funding/funding-instruments-programming/funding-instruments/instrument-nuclear-safety-cooperation_en.

40 EU. Fact Sheet. Overview of EU support to the International Atomic Energy Agency (IAEA) in the field of nuclear safety, safeguards, security and Technical cooperation financed during the current Multiannual Financial Framework 2007-2013. http://eeas.europa.eu/archives/docs/250113_fact_sheet_eu_support_to_iaea.pdf.

41 ICIS - Insubria Center on International Security. Redirection of former Iraqi WMD Scientists through capacity building for decommissioning of nuclear facilities, including site and radioactive waste management. EU Service Contract 247-264. http://icis-uninsubria.eu/wp-content/uploads/2013/09/Summary-EC-Iraq.pdf.

ANNEX 1

EU-CBRN COE PROJECTS FOCUSED ON THE SAFETY AND SECURITY OF RN MATERIALS[42]

A · INCLUDING COUNTRIES IN THE CBRN COE SEA REGION

PROJECT 21: **Building regional border control capacity to identify and detect CRN materials.** 21/12/2012 for 24 months. EUR 700,000**.**

- **COUNTRIES:** Brunei Darussalam, Cambodia, Gabon, Indonesia, Lao PDR, Malaysia, Mauritania, Morocco, Myanmar, the Philippines, Senegal, Singapore, Thailand, Vietnam.
- **OBJECTIVES:** To develop and strengthen national border control capacity by improving the understanding of Chemical, Radiological and Nuclear (CRN) materials and raising awareness of the risk posed by such materials if they are not properly managed and handled by national authorities at borders (land, sea and air). To foster regional inter-agency cooperation and promote synergies between national border control authorities.
- **KEYWORD(S):** Border control; detection and identification; inter-agency cooperation; regional cooperation

PROJECT 28: **Supporting development of an integrated national security system for nuclear and radioactive materials.** 21/12/2012 for 24 months. EUR 700,000.

- **COUNTRIES:** Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Vietnam.
- **OBJECTIVES:** To enhance national capacity in the radiological and nuclear safety and security field. To contribute to the development of a national strategy to combat illicit trafficking of radiological and nuclear material. To contribute to the elaboration of a national response plan for potential radiological or nuclear incidents**.**
- **KEYWORD(S):** Illicit trafficking; national response plan; radiological and nuclear safety; radiological and nuclear security.

PROJECT 29: **Regional Human Resource Development for Nuclear Safety, Security, and Safeguards Management through a University Master's Programme carried out in Thailand.** 21/12/2012 for 39 months. EUR 649,812.

- **COUNTRIES:** Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Thailand, Vietnam.
- **OBJECTIVES:** To improve South East Asian students' skills on nuclear safety, security and safeguards by facilitating their participation in a Master's Programme on nuclear non-proliferation conducted by the Department of Nuclear Engineering of Chulalongkorn University (Thailand). To foster networking activities in the region through the programme graduates.
- **KEYWORD(S):** Master programme; national response plan; nuclear safety; nuclear security; nuclear safeguards.

42 CBRN Centres of Excellence. Addressing regional CBRN needs. http://www.cbrn-coe.eu/Projects/TabId/130/PageID/3/PgrID/543/Default.aspx.

PROJECT 30: Network of Excellence for Nuclear Forensic in South East Asia Region. 01/01/2013 for 24 months. EUR 600,000.

- **COUNTRIES:** Azerbaijan, Georgia, Lao PDR, Malaysia, Moldova, Philippines, Singapore, Thailand, Ukraine, Vietnam.
- **OBJECTIVES:** Reinforce regional public security by upgrading nuclear forensics capabilities, technologies and methodologies to assess radioactive and nuclear materials by upgrading a regional laboratory in Thailand**.**
- **KEYWORD(S):** Safety and security; illicit trafficking; nuclear forensics; crime scene management.

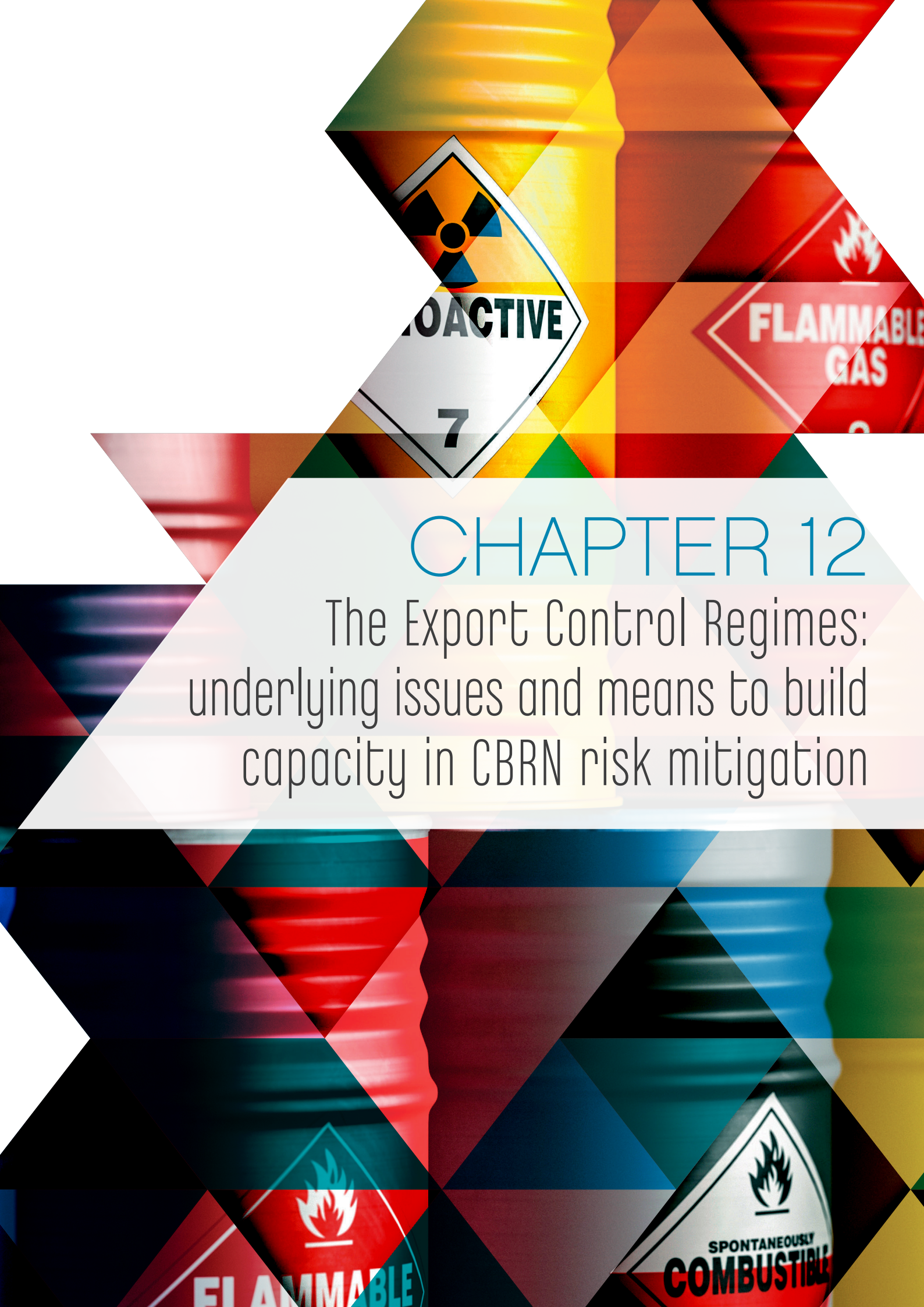
Other collaborative activities involving EU-CBRN CoE in SEA included meetings and conferences to address CBRN risk mitigation as well as good practices on regional cooperation in nuclear security, with stakeholders such as ISCN-JAEA and ACE.[43]

B · FOR OTHER COE PARTNER COUNTRIES

PROJECT 16: Supporting development of an integrated national nuclear security system. 01/01/2013 for 24 months. EUR 400,000.

- **COUNTRIES:** Algeria, Morocco, Tunisia.
- **OBJECTIVES:** The project aim is the elaboration of a National Response Plan for potential radiological and nuclear incidents, the developing of a national strategy to combat illicit trafficking of radiological and nuclear materials.
- **KEYWORD(S):** Illicit trafficking, safety and security, nuclear, radiological

43 https://www.doe.gov.ph/press-releases/doe-hosts-9th-asean-nuclear-energy-cooperation-sub-sector-network.



CHAPTER 12

The Export Control Regimes: underlying issues and means to build capacity in CBRN risk mitigation

CHAPTER 12

THE EXPORT CONTROL REGIMES: UNDERLYING ISSUES AND MEANS TO BUILD CAPACITY IN CBRN RISK MITIGATION

The last 20 years has witnessed a developing international consensus for export controls of dual-use CBRN agents and associated items, as a means to prevent the proliferation of weapons and also the acquisition of agents by terrorists and other non-state actors. UN Security Council Resolution 1540 (2004) obliged all countries to legislate for and implement *effective* export and border controls, explicitly including the context of non-state actors. The Chemical Weapons Convention (CWC) imposes export controls on transfers of the dual-use chemicals on its Schedules. The EU carries out assistance and cooperation projects with partner countries to build capacity in export controls for dual-use goods. Since 2013 there have been five EU-CBRN CoE projects on export controls, three of them for countries in the SEA Region.

The concept of five overlapping areas, sometimes labelled as 'five pillars', allows specific support actions to be planned:

National laws and regulations;

Export licensing;

Industry (and R&D institutions) awareness and compliance;

Enforcement: detection and interdiction;

Investigation and prosecution.

It is important for CBRN risk mitigation strategists to recognise the practical difficulties and costs of establishing capacities in all five of these pillars so that they interlock and provide a truly '*effective*' system.

SYNOPSIS

Since the turn of the millennium, the concept of export controls on dual-use items has increasingly been accepted as necessary, both in regards to the non-proliferation of CBRN weapons and their associated items, and in preventing the acquisition of agents by terrorists and other non-state actors. UN Security Council Resolution 1540 (2004) imposed a legal obligation on all countries to legislate for and implement effective export and border controls, explicitly including the context of non-state actors. The three main prohibition treaties for CBRN weapons, the nuclear Non Proliferation Treaty (NPT) , the Chemical Weapons Convention (CWC) and the Biological and Toxin Weapons Convention (BWC or BTWC), all forbid the transfer (and possession) of weapons, but only the CWC imposes export controls on transfers of the dual-use chemicals on its Schedules.

Prior to UNSCR 1540, there were four **voluntary, informal** international regimes that aimed to harmonise the export control scope and arrangements of each member country:

- the Australia Group (for chemical and biological agents and related items);
- the Nuclear Suppliers Group (nuclear technology);
- the Missile Technology Control Regime (rocket and other unmanned air vehicle delivery systems); and
- the Wassenaar Arrangement (sensitive items that contribute to the development of military capabilities).

The Nuclear Suppliers Group (NSG) enforces the NPT by implementing guidelines for exports from nuclear supplier countries, to ensure that peaceful nuclear trade does not contribute to the proliferation of nuclear weapons. It was created following the explosion in 1974 of a nuclear device by a non-nuclear weapon State, India, indicating that nuclear technology transferred for peaceful purposes could be misused.

The Missile Technology Control Regime (MTCR) is an informal export control arrangement established in 1987 by 7 countries, but now comprising 35 Partner nations, none in the SEA Region. The objective was to prevent the spread of ballistic and cruise missiles capable of delivering a 500-kilogram payload 300 kilometres or more, by establishing a common export control policy and a shared list of controlled items. However, in January 1993 the original focus on missiles capable of carrying a nuclear warhead was extended to cover delivery systems for CW and BW, and the payload and range criteria were removed so as to cover all missiles 'intended' for the delivery of WMD.

The Wassenaar Arrangement, established in July 1996, is a voluntary export control regime for the exchange of information on transfers of conventional weapons and dual-use goods and technologies. There are currently 42 members, none from the SEA Region. It was derived from the earlier Coordinating Committee for Multilateral Export Controls (COCOM) regime in the Cold War period by which western countries (most of which were NATO members), agreed export controls at the east-west interface; but since then some former Soviet Union countries including Russia have been welcomed.

The International Atomic Energy Agency (IAEA) can provide technical specifications for the design, testing, qualifying and purchasing of border radiation monitoring equipment. There is, however, no simple equipment available for real-time on-site detection and identification of biological agents and toxins or chemicals on export control lists.

The Australia Group (AG) was first convened as a reaction to the findings of the 1984 UN investigation of Iraqi chemical attacks, which indicated that some of the precursor chemicals used in Iraq had been sourced through legitimate trade channels. In 1989, 50 dual-use precursor chemicals were put on an AG 'warning list' with a suggestion that members place controls on them on a worldwide basis. In 1991, concerns about the potentials for diversion of dual-use biological agents into weapons programs led to AG control lists on specific microorganisms and toxins. Control lists have since been extended, and new lists agreed for equipment related to the manufacture of CW precursors, and equipment potentially relevant to production or dispersal of chemical or biological agents. Although the group focused initially on preventing state acquisition

of CBW related materials, the June 2002 AG meeting decided to extend the scope of the control lists to cover the potentials for acquisition by non-state actors such as terrorists. There are currently 43 members including the European Union.
Although there have been claims that Australia Group controls are a punitive measure at the interfaces with developing countries, the AG website refutes this. It claims that a licensing system reassures exporters that they won't unwittingly export products for use in CBW programs, and so gives companies greater confidence to trade in dual-use products. Licensing deters proliferation by increasing the visibility of trade in relevant materials, and provides legal authority to stop an export if an item is likely to contribute to a CBW program. Controls are neither intended to favour the commercial development of industries in participating states, nor to hinder legitimate economic development in other countries. The UN has endorsed the principle of dual-use export controls by including it as one of the elements of UNSCR 1540.

On 1-5 June 2015, the AG met in Perth, Australia, to commemorate its 30th anniversary. None of the 43 AG members are from the SEA region, but dialogue partners at the 2015 meeting included Myanmar, China, India, Vietnam, the Philippines and Singapore.

EU outreach. It is EU policy to carry out assistance and cooperation projects with third countries on export controls for dual-use goods, implemented through the European Commission (EC). The concept of five overlapping areas, sometimes labelled as 'five pillars', allows specific support actions to be planned:

- National laws and regulations;
- Export licensing;
- Industry (and R&D institutions) awareness and compliance;
- Enforcement: detection and interdiction;
- Investigation and prosecution.

From 2006, the German Federal Office of Economics and Export Control (BAFA) took responsibility for the Commission's CBRN assistance and cooperation projects with partner countries, designed as the Long Term Programme. This included contact with countries in Asia, for example in 2011, cooperative actions at legal and operational levels were discussed with China, Malaysia and Thailand. , The LTP recently became integrated with the EU-CBRN CoE programme. Since 2013 there have been five EU-CBRN CoE projects to build capacity on export controls, three of them included all countries in the SEA Region.

The fact that EU assistance was engineered over many years through the so-called Long Term Programme reflects the **practical difficulties of building partner capacity in all five pillars**. The objective must be a comprehensive set of measures that interlock and thus provide an 'effective' system as required by UNSCR 1540. This is a complex and potentially costly target for CBRN risk mitigation.
In February 2016, the EU Outreach in Export Control programme was renamed the EU P2P (Partner-to-Partner) Export Control Programme, with a re-branded web portal which provides information on EU activities. The EU P2P programme is a joint effort between Partner Countries, EU Member States and the European Commission. The first EU P2P regional event for Asia took place from 22 March 2017 in Kuala Lumpur, Malaysia, as the South East Asia Regional Seminar on Transit & Transhipment. There were participants from eight South East Asian countries (Malaysia, Singapore, the Philippines, Thailand, Cambodia, Laos, Vietnam, Myanmar), and members of a UN

panel of experts on North Korean sanctions. The event also noted the evolving progress in the region towards export control legislation and implementation.

Annexes included:

- **Annex 1.** CBRN CoE projects focused on Export Controls
- **Annex 2.** Transfer and Declaration obligations of CWC States Parties (SPs)

KEY TERMS

- **AG:** Australia Group
- **BWC:** Biological and Toxin Weapons Convention (BWC or BTWC)
- **CWC:** Chemical Weapons Convention.
- **Dual-use:** research, knowledge, technology and material that is intended for good purposes but could potentially be misused to harm humans, animals or the environment.
- **IAEA:** International Atomic Energy Authority
- **MTCR:** Missile Technology Control Regime
- **NPT:** Non-Proliferation Treaty
- **NSG:** Nuclear Suppliers Group
- **P2P:** EU P2P (Partner-to-Partner) Export Control Programme
- **UNSCR 1540 (2004):** United Nations Security Council Resolution 1540 (2004)
- **WMD:** Weapons of Mass Destruction

A · INTRODUCTION

Our objective

The legally binding requirement under UN Security Council Resolution 1540 (2004) for every country to have effective national export control systems in place has imposed a pressure on all countries to examine their current arrangements and if necessary improve them. UNSCR 1540 requires in paragraph 3 *inter alia* effective border controls and law enforcement efforts on illicit trafficking and brokering; and the establishment, development, review and maintenance of appropriate effective national export and trans-shipment controls. The EU has been supporting SEA region partner countries in export control capacity building since 2013, and there are other EU and international advisory and support networks which we will refer to. This chapter does not attempt to be a training manual for how to develop and implement CBRN export controls. But the breath of effort needed to ensure that controls are effective across the whole spectrum from legislation through implementation to investigation and prosecution, is truly complex. This chapter is therefore a reminder of the rationale and present breadth of these international interactions and potential assistance frameworks, as an aid to making best use of specific training and capacity building opportunities.

The legally binding and voluntary international Instruments.

In the second half of the 20th century, determination to prevent the proliferation of Weapons of Mass Destruction (WMD)[1] led many countries to develop export controls that could monitor and if necessary, legally stop a specific trade of a 'dual-use' item – an item which may be defined as

> *goods, software and technology normally used for civilian purposes but which may have military applications, or may contribute to the proliferation of weapons of mass destruction (WMDs).*[2]

Such controls were made **compulsory** by United Nations (UN) Security Council Resolution 1540 (UNSCR 1540), adopted on 28 April 2004. Furthermore, reflecting concerns about the 2001 terrorist attacks on the US on 9/11, the Resolution explicitly places export controls in the context of acquisition by non-state actors.[3] It requires States to establish *inter alia*

- effective border controls and law enforcement efforts to prevent illicit trafficking and brokering;
- effective national export and trans-shipment controls.

1 WMD: Weapons of Mass Destruction. UN Security Council Resolution 1540 implicitly defines weapons of mass destruction as nuclear, chemical and biological weapons, including their means of delivery (missiles, rockets and other unmanned systems).

2 CBRNE Glossary. EU Joint Research Centre. 2015.

3 Resolution 1540 (2004). United Nations Security Council. 28 April 2004. https://undocs.org/S/RES/1540(2004).

Prior to that, export control measures to prevent WMD proliferation by forbidding the transfer of weapons and associated items were also required of States Parties to the nuclear Non Proliferation Treaty (NPT),[4] the Chemical Weapons Convention (CWC)[5] and the Biological and Toxin Weapons Convention (BWC or BTWC).[6] Of these three instruments, only the CWC includes transfer obligations on other items, in this case in respect of transfers of Schedule 1 and 2 chemicals.[7] Most of the scheduled chemicals may be described as 'dual- use'.[8]

Also prior to UNSCR 1540, four **voluntary informal** international regimes had been established that aimed to harmonise the export control scope and arrangements of each member country:

- the Australia Group (for chemical and biological agents and related items);
- the Nuclear Suppliers Group (nuclear technology);
- the Missile Technology Control Regime (rocket and other unmanned air vehicle delivery systems); and
- the Wassenaar Arrangement (sensitive items that contribute to the development of military capabilities).

The implementation of effective national export controls

The objective for export controls to be truly 'effective' imposes a considerable burden on government. It must ensure that controls are legally based, recognised by potential traders, and implemented by licensing officers and a border force having appropriate technical training. Once the items to be controlled are decided, systems must be put in place in five overlapping areas, sometimes labelled as 'five pillars':

- National laws and regulations;
- Export licensing;
- Industry (and R&D institutions) awareness and compliance;
- Enforcement: detection and interdiction;
- Investigation and prosecution.

4 Treaty on the Non-Proliferation of Nuclear Weapons (NPT). Text of the Treaty. United Nations. https://www.un.org/disarmament/wmd/nuclear/npt/text.
In Article I, "Each nuclear-weapon State Party to the Treaty undertakes not to transfer to any recipient whatsoever nuclear weapons or other nuclear explosive devices or control over such weapons or explosive devices directly, or indirectly". In Article II, "Each non-nuclear-weapon State Party to the Treaty undertakes not to receive the transfer from any transfer or whatsoever".

5 CWC. Download the Convention. https://www.opcw.org/chemical-weapons-convention/download-convention. In Article I General Obligations 1 (a), State Parties are not … 'to transfer, directly or indirectly, chemical weapons to anyone'.

6 Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction. Text of the treaty. UNODA. http://disarmament.un.org/treaties/t/bwc/text. In Article III, each State Party undertakes ….'not to transfer … agents, toxins, weapons, equipment or means of delivery specified in Article I.'

7 CWC Annex on Implementation and Verification. Part VI allows transfers of Schedule 1 chemicals only to another State Party and only for research, medical, pharmaceutical or protective purposes. It does not allow retransfers to a third State. Part VII allows transfers of Schedule 2 chemicals only to State Parties.

8 OPCW. Monitoring Chemicals with Possible Chemical Weapons Applications. Fact Sheet 7. https://www.opcw.org/sites/default/files/documents/Fact_Sheets/English/Fact_Sheet_7_-_Schedule_of_chemicals.pdf.

A typical shorthand for a national system that is effective in all these areas is 'Export Control and related Border Control'. Such a capability is no longer a matter of national prioritisation but is a legally binding requirement under UNSCR 1540. 1540 does not endorse or require any specific control lists, but requires in paragraph 3 (d) that States

> *"Establish, develop, review and maintain appropriate effective national export and trans-shipment controls over such items, including appropriate laws and regulations to control export, transit, trans-shipment and re-export and controls on providing funds and services related to such export and trans-shipment such as financing, and transporting that would contribute to proliferation, as well as establishing end-user controls; and establishing and enforcing appropriate criminal or civil penalties for violations of such export control laws and regulations".*

Enforcement: detection and interdiction

In the spectrum of national measures to detect illicit trafficking and inadvertent movements of CBRN related material, a major role falls on border controls, with significant implications for awareness raising and training of staff. It is relatively easy to detect radioactive emissions by means of active measuring devices (so-called 'Geiger counters'). The International Atomic Energy Agency (IAEA) can provide technical specifications for the design, testing, qualifying and purchasing of border radiation monitoring equipment.[9], [10] There is, however, no **simple** equipment available for real time on site detection and identification of biological agents and toxins or chemicals on the export control lists; in the past the only practical prospect has been to take samples for testing of basic properties such as pH e.g. using test strips, or to remove them for subsequent specialist laboratory analysis.[11]

However modern technology is changing this, with relevance not only to Border Controls but investigations by **First Responder (HAZMAT teams) at CBRN incidents**. Military detectors for certain Chemical Weapons (CW) agents could be used to detect leaking vapours. There is some commercially available portable equipment, if rather expensive, based on sophisticated analysis techniques normally only available in a laboratory: vapour analysis equipment using gas chromatography/mass spectrometry[12] or Raman spectroscopy;[13] and Mini PCR[14] for detection of specific microorganisms. (This PCR device was used successfully in the field in West Africa to detect Ebola virus in clinical material).

9 IAEA. Technical and Functional Specifications for Border Monitoring Equipment. IAEA Nuclear Series no.1. https://www.iaea.org/publications/7400/technical-and-functional-specifications-for-border-monitoring-equipment.

10 IAEA. Detection of radioactive materials at borders. IAEA-TECDOC-1312. https://www-pub.iaea.org/MTCD/Publications/PDF/te_1312_web.pdf.

11 Weerth C. The cross-border detection of radiological, biological and chemical active and harmful terrorist devices. World Customs Journal Vol 3, no. 2, Sept 2009 http://worldcustomsjournal.org/Archives/Volume%203,%20Number%202%20(Sep%202009)/08%20WCJ_V3N2_Weerth_(web).pdf.

12 HAPSITE® ER Chemical Identification System. https://products.inficon.com/en-us/nav-products/product/detail/hapsite-er-identification-system/.

13 CBRNE Tech Index. Raman spectroscopy. http://www.cbrnetechindex.com/Explosives-Detection/Technology-ED/Molecular-Spectroscopy-ED-T/Raman-ED-MS.

14 Minipcr. https://www.minipcr.com/applications/in-the-field/.

Capacities evolving in ASEAN countries

All CBRN CoE partner countries have submitted position statements to the UNSCR 1540 Committee, in the form of the questionnaire 'Committee Approved Matrices'; in every case these were approved on 23 December 2015. They included statements about the status of a country's export controls of CBRN and related material, in two contexts, '*National Legal Framework*' and '*Enforcement: civil criminal penalties, measures of implementation etc.*' [15] It is also possible to find an overview of the generic issues and specific progress on CBRN controls in SEA countries in the years before that, e.g. in a presentation covering Indonesia, Philippines, Thailand and Vietnam up to 2011.[16] However, as described below, significant progress has been made in the last five years, both through EU P2P (Partner to Partner) and EU-CBRN CoE projects 21, 47 and 64. The EU P2P export control programme (formerly "EU Outreach in Export Control programme") includes projects in all three main areas of export controls:

- Dual-Use export controls
- Arms Trade Treaty implementation
- Conventional Arms export control

The first EU P2P regional event for Asia took place from 22 March 2017 in Kuala Lumpur, Malaysia, as the South East Asia Regional Seminar on Transit & Transhipment.[17] The event noted the evolving progress in the region. The long-established trade control system of Singapore was followed by Malaysia's Strategic Trade Management Act in 2010. The Philippines adopted its own Strategic Trade Management Act in 2016; it recently established a Strategic Trade Management Office and would soon adopt the Act's Implementing Rules and Regulations. Thailand was expected to be able to adopt controls in 2018. Other countries in the region, including Vietnam, Cambodia, Lao PDR, and Myanmar were reported to be at various stages of planning towards export control legislation.

Further information on progress are made available to SEA officials and industry representatives participating in the three EU-CBRN CoE projects:

- Project 21: Building regional border control capacity to identify and detect CRN materials, which ran from January 2013, for 24 months.
- Project 47: EU Outreach programme – Export Control Cooperation in South East Asia, which ran from January 2015.
- Project 64: EU P2P - Export Control Programme for dual-use goods. The so called global project. From 2017, for four years. From 01/07/2019 this was expanded to include former Project 47 and thus the SEA partner countries.

15 1540 Committee. 1540 Matrices. https://www.un.org/en/sc/1540/national-implementation/1540-matrices.shtml. In the Matrix, question section OP 3 (c) and (d) and related matters from OP 6 and OP 10 - Controls of NW, CW and BW, including Related Materials.

16 Bryan Cave International Consulting, Emerging Export Control Regimes in ASEAN, and best practices for ICP: Challenges and pitfalls. Tan G. https://supportoffice.jp/outreach/2011/malaysia/1-3_Mr._Tan_Brayan_Cave.pdf.

17 EUP2P. News by EU P2P Programme: South East Asia Regional Seminar in Kuala Lumpur, Malaysia. Dual-Use. 22/03/2017 - 23/03/2017. https://export-control.jrc.ec.europa.eu/News/ArtMID/481/ArticleID/14304/-South-East-Asia-Regional-Seminar-in-Kuala-Lumpur-Malaysia.

DETECTION EQUIPMENT

1 · Ion Mobility Spectra based detectors

- CAM2+ = Chemical Agent Monitor
- APD 2000
- Multi-IMS/ ChemPro 100 / ChemRae

2 · Flame Photometric Detection Technology based detectors

- AP4C
- MINICAMS

3 · Infra-Red (IR) Spectroscopy Based

- TravelIR HCI
- HazMat ID

4 · Raman Spectroscopy Technology Based

- FirstDefender
- JCSD

5 · Surface Acoustic Wave (SAW) Based

- HAZMATCAD
- CW Sentry Plus

6 · Colorimetric Based

- Chemical Detector Paper (3-Way Chemical Agent Liquid Detection Paper)
- Colorimetric Detection Tubes (Simultaneous Test Sets by Drager Safety)

7 · Photo Ionisation Detection (PID)

- RAE Systems - MultiRAE Plus; ToxiRAE Plus PID

8 · Flame Ionisation Detection (FID)

- Photovac MicroFID Handheld Flame Ionisation Detector

Sferopoulos, Rodi. "A Review of Chemical Warfare Agent (CWA) Detector Technologies and Commercial-Off-The-Shelf Items." 2009. Australian Government, Department of Defence, Defence Science and Technology Organisation (DSTO). Accessible at **https://apps.dtic.mil/sti/pdfs/ADA502856.pdf**.

DETECTION EQUIPMENT
BIOWARFARE AGENT DETECTION METHODS

Biowarfare agent detection methods and Equipment

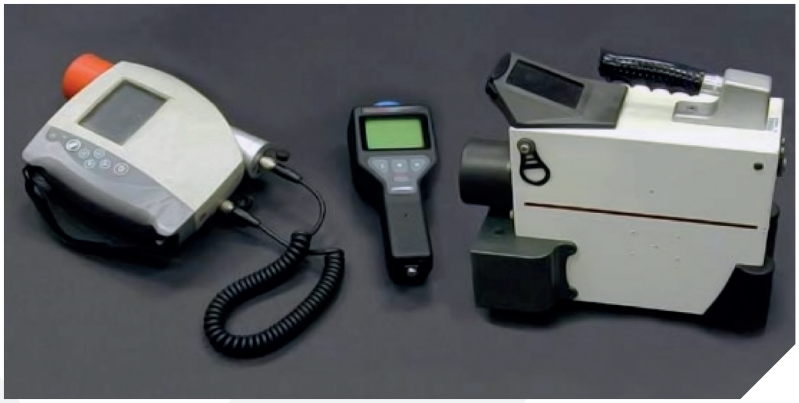
- Microscopy
- Culture-Based Assays
- Biochemical And Immunological Assays
- Polymerase Chain Reaction Amplification
- Microchips
- Molecular Beacons
- Electrochemiluminescence Immunoassay
- Biosensors
- Mass Spectrometry
- Flow Cytometry

Current Detection Equipment

- Biological Integrated Detection System
- Interim Biological Agent Detector
- XM94 Long-Range Biological Stand-off Detection System
- Nuclear, Biological, and Chemical Reconnaissance System
- Integrated CBMS and BIDS
- Joint Biological Point Detection System
- Portal Shield Advanced Concept Technology Demonstration
- MAGIChip (Micro-Array of Gel-Immobilized Compounds)
- Phosphor-Diode Laser Technology for Biological Agent Detection
- Spore-Specific Phosphorescence
- RT-PCR (Rapid Identification)
- CRSPR (sequencing of DNA/RNA for identification)

DETECTION EQUIPMENT
RADIOISOTOPE IDENTIFICATION DEVICES (RIIDs)

Instruments that are designed to determine the identity of radioactive materials by measuring the energy of the emitted gamma rays. Law enforcement, customs, and other personnel are often equipped with RIIDs as part of a national strategy to interdict illicit movement of radioactive material.



Typical handheld RIID detection systems; left to right: LaBr3(Ce), NaI(Tl), and HPGe.
Reference: https://www.dhs.gov/sites/default/files/publications/RadiationDetectorsIdentifiers-TN_1009-508.pdf

B · EU STRATEGY ON CBRN EXPORT CONTROLS, AND EU OUTREACH

For European Union (EU) Member States (MS), export controls on WMD relevant items are required by the EU Strategy against Proliferation of Weapons of Mass Destruction of 12 December 2003 (EU WMD Strategy), updated by the Council Conclusions of 21 October 2013 to cover new challenges.[18] EU export controls were developed under the Dual-Use Export Controls Programme, the Council Working Group on Conventional Arms Exports (COARM) Outreach Programme, and the EU Arms Trade Treaty Outreach Project. Regulation (EC) No 428/2009 provides for common control rules, a common EU control list and coordination of implementation. Controls apply to **export – including electronic transmission – brokering and transit**: and, for some sensitive items, to internal transfer within the EU. A 2016 review concluded that these were high standards of control that served as a benchmark for many countries around the world, and that controls were generally effective in reducing the risks of sensitive items being procured from European suppliers. In spite of this, denials issued by Competent authorities and enforcement and violations of controls emphasise that risks remained acute. The determination as to which agency is the Competent authority in an EU country is also sometimes uncertain. Furthermore, controls on brokering and transit were not necessarily able to control items that could be misused for terrorism or human rights violations. Dual-use controls directly complement controls on arms exports and pursue largely similar objectives.[19]

EU outreach

It is EU policy to carry out assistance and cooperation projects with third countries on export controls for dual-use goods, implemented through the European Commission (EC). The first outreach project, Pilot Project 2004 (PP04), was carried out by the Stockholm International Peace Research Institute (SIPRI).[20] From 2006, the German Federal Office of Economics and Export Control (BAFA),[21] by then already implementing a Federal programme for export control outreach, took responsibility for the Commission's CBRN assistance and cooperation projects with third countries. Training and assistance was divided under the 'five pillars' described above, through tailored approaches according to the particular improvements needed by a Partner Country (PC). There was a strong emphasis on working as equal partners, to lay the groundwork for continuing working level collaborative links. Projects PP05 and PP06 developed into the so-called Long Term Programme (LTP).[22] This had a vision and objectives for the long term shared between the EU and PCs. Work was closely coordinated with the United States (US) through the Export Control Capacity Building Working Group.

The LTP included contact with countries in Asia. For example, an experts meeting at BAFA in 2011 considered outreach challenges and proposed cooperative actions at legal and operational levels with

18 These EU controls are governed by Regulation (EC) No 428/2009 setting up a Community regime for the control or exports, transfer, brokering and transit of dual-use items.

19 EU. Commission Staff Working Document. Impact assessment. Report on the EU Export Control Policy Review. SWD(2016) 315 final, 28 September 2016. http://trade.ec.europa.eu/doclib/docs/2016/october/tradoc_155008.pdf.

20 SIPRI Yearbook 2011. 11. Strategic trade controls: countering the proliferation of weapons of mass destruction. Bauer S. et al. https://www.sipri.org/sites/default/files/SIPRIYB1111.pdf.

21 Federal Office for Economic Affairs and Export Control. Foreign Trade. Export Control. https://www.bafa.de/EN/Foreign_Trade/Export_Control/export_control_node.html;jsessionid=2DD8DBBFA35FB64FC89E4CE7BE9034DF.1_cid362.

22 EU Cooperation in Export Control. The Long Term Programme (LTP): EU outreach in the field of export control Eschborn 2011. https://export-control.jrc.ec.europa.eu/DesktopModules/Bring2mind/DMX/Download.aspx?Command=Core_Download&EntryId=260&language=en-GB&PortalId=0&TabId=98.

China, Malaysia and Thailand.[23] The LTP recently became integrated with the EU-CBRN CoE programme. The number of PCs expanded from three in PP04 to larger groups according to needs, for instance 20 countries in 2015 (EUP2P- global) by then including countries from the SEA Region.[24] Central Asian countries are being supported through two additional EU initiatives funded through the Instrument contributing to Peace and Stability (IcSP): one is implemented by the International Science and Technology Centre in Astana (ISTC); the other through the Science and Technology Center in Ukraine.[25]

BAFA brought the advantage of already being a significant player in the international export control arena, with widespread working contacts and close links with the US EXBS programme (See below). For example, in 2012 BAFA on behalf of the EU co-organised with the United States the world's largest export control conference yet, number 13 in the series and bringing together 300 participants from 81 countries. From such a background BAFA was well able to organise the use of EU experts who themselves worked in export licensing on a daily basis, a prerequisite for building networks from the LTP co-operations.

The EU's Instrument for Stability (IfS) Multi-annual Indicative Programme 2009-2011 - Support for the Objectives of the EU Non-proliferation of Weapons of Mass Destruction Strategy - included as one of the six Priority 1 project areas assistance and cooperation on export controls on dual-use goods.[26] Since 2013 there have been five EU-CBRN CoE projects to build capacity on export controls, three of them include all for countries in the SEA Region. (See **Annex 1**).

The EU P2P programme

In February 2016, the EU Outreach in Export Control programme was renamed as the EU P2P (Partner-to-Partner) Export Control Programme, with a re-branded web portal which provides information on EU activities, outreach news, events, training, links and documents, and information on EU experts and partner countries.[27] Funding comes through the IcSP, the successor of the IfS as the strategic EU tool addressing global security and development challenges in complement to geographic instruments. The EU P2P programme is a joint effort between PCs, EU MS and the European Commission, contributing to capacity building in PCs, promoting effective practices and standards in export control and supporting legitimate trade.[28] It is able to call on inputs from various EU MS agencies and some 200 EU experts from MS licensing authorities, customs administrations, industry and scientific institutions and the judicial sector.

23 EU Cooperation in Export Control of Dual-Use Goods. Breakout Group 4: Southeast Asia and China. Experts Meeting 28 February – 1 March 2011, Frankfurt. https://export-control.jrc.ec.europa.eu/DesktopModules/Bring2mind/DMX/Download.aspx?Command=Core_Download&EntryId=258&language=en-GB&PortalId=0&TabId=98.

24 Seminar on the Export Control of Dual-use Materials and Technologies in GUAM Countries Kiev, March 14-15, 2018. http://www.stcu.int/documents/reports/distribution/expcontrol2018/3_Christos_Charatsis_EU_Policy_on_XC.pdf.

25 Annual Report 2012/2013. Federal Office of Economics and Export Control, BAFA. The 14th International Export Control Conference was co-organised by the USA and the UAE in March 2014, with 150 participants from 60 countries (http://www.state.gov/strategictrade/program/161846.htm).

26 Commission of the European Communities. The Instrument for Stability - Multi-annual Indicative Programme 2009-2011. Brussels, 8.4.2009. C(2009)2641 page 9. https://reliefweb.int/sites/reliefweb.int/files/resources/F66EDF39EEAABA8E492575F2000ECA23-Full_Report.pdf.

27 EU P2P. Export control programme for dual use goods. https://export-control.jrc.ec.europa.eu/projects/Dual-use-trade-control.

28 EU P2P. Export control programme for dual use goods. Success stories. https://export-control.jrc.ec.europa.eu/DesktopModules/Bring2mind/DMX/Download.aspx?Command=Core_Download&EntryId=3058&language=en-GB&PortalId=0&TabId=98.

ASEAN trade and security coordination, and EU outreach

The Association of Southeast Asian Nations (ASEAN) was formed in 1967 by Indonesia, Malaysia, the Philippines, Singapore, and Thailand. By 1999, Brunei, Vietnam, Lao Peoples Democratic Republic (Lao PDR), Myanmar and Cambodia had all joined.[29] With the primary objective to accelerate economic growth, social progress and cultural development in the region, ASEAN commands far greater influence on Asia-Pacific trade, political, and security issues than its members could achieve individually. ASEAN's community building efforts are based on consultation, consensus, and cooperation, under three pillars: the Political-Security Community; the Economic Community and the Socio-Cultural Community.

Another important mechanism for SEA regional dialogue on security issues is the non-governmental Council for Security Cooperation in the Asia Pacific (CSCAP).[30] In 2007, a CSCAP working group 'Export Controls Expert Group' drafted guidelines for CBRN export controls, to be part of the CSCAP *Asia Pacific Handbook and Action Plan for Preventing the Proliferation of Weapons of Mass Destruction (WMD).* It was proposed that these export control standards could be embedded in mechanisms promoting regional economic integration such as APEC[31] and ASEAN Plus Three,[32] and used in building partnerships with industries and trade associations to facilitate compliance with national laws and global instruments such as UNSCR 1540.

The first EU P2P regional event for Asia took place from 22 March 2017 in Kuala Lumpur, Malaysia, as the South East Asia Regional Seminar on Transit & Transhipment.[33] There were participants from eight South East Asian countries (Malaysia, Singapore, the Philippines, Thailand, Cambodia, Lao PDR, Vietnam, Myanmar), and members of a UN panel of experts on North Korean sanctions. The meeting record noted that this complemented national actions by facilitating discussion about regional cooperation, particularly in the context of the ASEAN Economic Community and the ASEAN single window project, as well as the issue of transit and transhipment in the context of ASEAN Economic Integration. Discussion included the obligations imposed by North Korea related UN resolutions from UNSCR 1718 onwards, and the importance of implementing transit and transhipment control to fulfil those obligations in addition to UNSCR 1540. Case studies on transit and transhipment indicated that ASEAN countries had been involved in North Korea's illicit procurement and sales of weapons.[34]

To date, Singapore, Malaysia, the Philippines and Thailand have their strategic goods control list that may include dual-use goods list. The strategic trade management and export control programmes of the EU and other stakeholders in the SEA region encouraged and supported the development of export controls in the Partner Countries of the region to prevent the proliferation of WMDs.

29 ASEAN. https://asean.org/.

30 Council for Security Cooperation in the Asia Pacific (CSCAP). http://www.cscap.org/.

31 Asia-Pacific Economic Cooperation (APEC) is an inter-governmental forum for 21 Pacific Rim countries. https://www.apec.org/.

32 ASEAN plus China, South Korea and Japan.

33 EUP2P. News by EU P2P Programme: South East Asia Regional Seminar in Kuala Lumpur, Malaysia. Dual-Use. 22/03/2017 - 23/03/2017. https://export-control.jrc.ec.europa.eu/News/ArtMID/481/ArticleID/14304/-South-East-Asia-Regional-Seminar-in-Kuala-Lumpur-Malaysia.

34 EUP2P. News by EU P2P Programme. Tags. South East Asia Regional Seminar in Kuala Lumpur, Malaysia. 22 March 2017. https://export-control.jrc.ec.europa.eu/News/ArtMID/481/ArticleID/14304/-South-East-Asia-Regional-Seminar-in-Kuala-Lumpur-Malaysia.

Data sharing: UNICRI CBRN Knowledge Management System

In 2008, the United Nations Interregional Crime and Justice Research Institute (UNICRI), in cooperation with the EC (DG AIDCO and DG RELEX) and with the technical support of the IAEA, the Organisation for the Prohibition of Chemical Weapons (OPCW), European Police Office (EUROPOL), the Southeast European Law Enforcement Center and the World Customs Organization (WCO), launched a Knowledge Management System in South-East Europe and the Caucasus. Designed to facilitate knowledge dissemination, information sharing and effective communication, the System aims to improve the interaction of national experts and representatives from international and regional organisations, to prevent illicit trafficking of CBRN materials. A network of National Focal Points liaise with relevant national agencies in the region. In 2009 UNICRI, in cooperation with the EC, launched a second phase of Knowledge Management Systems to promote the exchange of information in North Africa.[35]

Other useful cooperative links

The **US Export Control and Related Border Security Programme (EXBS)** provides outreach assistance in areas of Laws and Regulations, Licensing, Enforcement, Government-Industry Cooperation, Interagency and International Cooperation and Coordination. It is active in more than 60 countries, with a budget in 2016 of about $58.7 million.[36] There are some 20 EXBS Program Advisors assigned around the world, covering over 40 countries to be the lead US contact to support promotion of improvements to strategic trade control and border security systems, legal and institutional reform and regional cooperation.[37] The **World Customs Organisation** is an independent intergovernmental body whose mission is to enhance the effectiveness and efficiency of customs administrations. With a membership of 183 Customs Administrations, it is a forum for dialogue and exchange of experiences, and the Secretariat offers or organises technical assistance and training services.[38] For cooperation under the aegis of the **IAEA,** see Chapter 11 and the specific non-legally binding guidance and points of contact on export and import of radioactive sources.[39], [40]

C · THE NUCLEAR SUPPLIERS GROUP

The Nuclear Suppliers Group (NSG) is an informal arrangement that enforces the Nuclear Non-Proliferation Treaty by implementing guidelines for exports from nuclear supplier countries, to ensure that peaceful nuclear trade does not contribute to the **proliferation of nuclear weapons.** It was created following the explosion in 1974 of a nuclear device by a non-nuclear weapon State, India, indicating that nuclear technology transferred for peaceful purposes could be misused. The NSG Guidelines also contain the so-called "Non-Proliferation Principle," adopted in 1994, whereby a supplier authorises a transfer only when satisfied that the transfer would not contribute to the proliferation of nuclear weapons. There are currently 48 Participating Governments, none in the SEA region.[41]

35 UNICRI. CBRN Knowledge Management System. http://www.unicri.it/topics/cbrn/kms/.

36 US Department of State. Export Control and Related Border Security Program. EXBS. https://www.state.gov/t/isn/ecc.

37 EXBS Advisor Program. https://www.state.gov/t/isn/ecc/c27918.htm.

38 World Customs Organisation. WCO in brief. http://www.wcoomd.org/en/about-us/what-is-the-wco.aspx.

39 IAEA. Guidance on the Import and Export of Radioactive Sources. 2012 Edition. https://www-pub.iaea.org/MTCD/Publications/PDF/8901_web.pdf.

40 IAEA. IAEA Guidance on the Import and Export of Radioactive Sources. List of Points of Contact. https://www-ns.iaea.org/downloads/rw/imp-export/import-export-contact-points.pdf.

41 Nuclear Suppliers Group. http://www.nuclearsuppliersgroup.org/en/.

D · THE AUSTRALIA GROUP

Established in 1985, the Australia Group (AG) is a voluntary, informal arrangement by which countries harmonise their national export controls on dual-use items that could contribute to the development of chemical or biological weapons. It was first convened as a reaction to the findings of the 1984 UN investigation of Iraqi chemical attacks, which indicated that **some of the precursor chemicals used had been sourced through legitimate trade channels.** The original AG group of 15 countries plus the European Commission agreed in 1985 to introduce export controls on certain chemicals that could be used to manufacture chemical weapons (CW). Key considerations were: the measures should be effective in impeding the production of CW; they should be reasonably easy to implement, and should be practical; and they should not impede the normal trade of materials and equipment used for legitimate purposes.

The control lists are dynamic, proposed changes being discussed at an annual AG meeting. In 1989, 50 dual-use chemicals were put on an AG "warning list" with a suggestion that members place controls on them. In 1991, concerns about the potentials for diversion of dual-use biological agents into weapons programs led to AG control lists on specific microorganisms and toxins. Control lists were also agreed for equipment related to the manufacture of CW precursors, and one item of biological weapons (BW) related equipment. All 50 (currently 63) precursor chemicals were to be controlled on a worldwide basis. Since then, there has been considerable extension of the control lists of microorganisms and toxins and of equipment potentially relevant to production or dispersal of chemical or biological agents.[42]

A key AG objective is for these licensing measures to assist members in implementing their obligations under the Chemical Weapons Convention (CWC) in Article I, 1 (a) and (d)), and the BWC in Articles I and III. Although the group focused initially on preventing state acquisition of CBW related materials, the June 2002 AG meeting decided to extend the scope of the control lists to additionally cover the potentials for acquisition by non-state actors such as terrorists. On 1-5 June 2015, the AG held its annual plenary meeting in Perth, Australia, to commemorate its 30th anniversary. In addition to AG member countries, dialogue partners participating in the meeting included **Myanmar, China, India, Vietnam, the Philippines and Singapore.**[43] There are currently 43 AG members, none from the CoE SEA Region. The European Union is a participant.

AG members share export licence denials; and there are procedures to rule out undercutting of an export denial by another member, and to require **end user certification**[44] by the recipient. Awareness raising guidelines have been written for each AG country to use with its potential exporters – in the various sectors wishing to export equipment, chemicals, microorganisms or related technologies. The official AG web site publishes the Group procedures, control lists of agents and detailed **illustrated technical notes** on the types of equipment covered.[45] The categories of items currently controlled are:

42 NTI Australia. https://www.nti.org/learn/treaties-and-regimes/australia-group-ag/.

43 Ibid.

44 End user certification: an undertaking by the final end-user not to tranship or re-export the goods, without approval from the original exporting country.

45 The Australia Group: Fighting the spread of chemical and biological weapons. Strengthening global security. https://australiagroup.net/en/dual_biological.html.

- Chemical weapons and precursor-chemicals used in the production of chemical weapons. (65 chemicals: all but 25 appear on the CWC Schedules);
- Dual-use chemical manufacturing facilities, equipment, related technology and software;
- Pathogens affecting humans, animals or plants, whether natural or genetically modified. And toxins. (currently 7 viruses, 22 bacteria, 18 toxins and their subunits, 2 fungi; and six organisms on a warning list);
- Dual-use biological equipment, related technology and software;
- In June 2002, the AG decided to control the spread of technology by intangible means, prohibiting the transmission of CBW technologies by e-mail, phone, or fax.

From the start the AG faced criticism that its export controls were a punitive feature at the North-South interface; and there was further criticism when the AG remained in existence after the CWC had entered into force. Nevertheless, other countries evidently recognise its continuing utility, and have joined since than: most recently India in January 2018. According to the AG web site, the group believes that AG arrangements have important advantages. Thus, a licensing system reassures exporters that they won't unwittingly export products for use in CBW programs, and so gives companies greater confidence to trade in dual-use products. Licensing deters proliferation by increasing visibility of trade in relevant materials, and provides legal authority to stop an export if an item is likely to contribute to a CBW program. Although overall the AG controls have a minimal impact on the total trade in these items, controls do impact on sales to a small number of countries believed to have an interest in developing or maintaining a CBW capacity or where there is a risk of diversion to terrorist groups. The Group's activities are limited to non-proliferation measures, and are neither intended to favour the commercial development of industries in participating states, nor to hinder legitimate economic development in other countries. The UN has endorsed the principle of such export controls by including it as one of the elements of UNSCR 1540.

E · THE WASSENAAR ARRANGEMENT ON EXPORT CONTROLS

The Wassenaar Arrangement, established in July 1996, is a voluntary export control regime for members to exchange information on transfers of conventional weapons and dual-use goods and technologies. There are currently 42 members, none from the CoE SEA Region. It was derived from the earlier COCOM[46] regime in the Cold War period by which western countries agreed export controls at the east-west interface; but since then some former Soviet Union countries including Russia have been welcomed. To promote transparency, the Arrangement calls on states to make voluntary information exchanges and notifications on their exports related to weapons and items appearing on the arrangement's two control lists. The Arrangement covers conventional munitions as well as dual-use goods and technologies, including specified chemicals relevant to chemical weapons, and biological agents *adapted for use in war;* while the dual goods list includes protection and detection equipment and components against biological and chemical weapons. Members exchange information on deliveries and denials at various periodicities determined by the sensitivity of the category of item.[47]

46 The Coordinating Committee for Multilateral Export Controls (CoCom).

47 The Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies. https://www.wassenaar.org/about-us/.

F · THE MISSILE TECHNOLOGY CONTROL REGIME

The Missile Technology Control Regime (MTCR) is an informal export control arrangement established in 1987 by 7 countries, but now comprising 35 Partner nations, none in the CoE SEA Region. The objective was to prevent the spread of ballistic and cruise missiles capable of delivering a 500-kilogram payload 300 kilometres or more, by establishing a common export control policy and a shared list of controlled items. However, in January 1993 the original focus on missiles capable of carrying a nuclear warhead was extended to cover delivery systems for CW and BW, and the payload and range criteria were removed so as to cover all missiles "intended" for the delivery of WMD.[48]

G · EXPORT CONTROLS REQUIRED OF CWC STATES PARTIES (SPS)

The legally binding obligations of CWC State Parties in respect of the transfers (imports/exports) of chemicals are complex. A SP must adopt measures to ensure that (all) toxic chemicals and their precursors are only transferred within the country for purposes not prohibited; with respect to the Scheduled chemicals, a SP must subject their import/export to control. Some minor clarifications of unresolved issues were agreed after entry into force: regarding transfers to States not Party; and rulings to avoid the need for Aggregate National Declarations to take account of 'low level' activities, for example production or import of a few grams of a Schedule 2 chemical for research.[49], [50] The requirement for licensing necessitates a competent authority which some SPs chose to be the CWC National Authority (NA), but in other SPs it is some other agency that consults with the NA before issuing the licence. An overview of the obligations for licensing and declaration of transfer data to the OPCW is given in Annex 2.

48 Missile Technology Control Regime. http://mtcr.info/mtcr-guidelines/.

49 OPCW Declarations Handbook 2013, revised January 2017. https://www.opcw.org/sites/default/files/documents/VER/DEB/declarations_handbook/2013/Sections_A_B_C_K_L_and_M___App_1and3_to_8.pdf.

50 OPCW. Legal Framework for CWC transfer controls and enforcement. https://www.opcw.org/documents/2009/03/legal-framework-cwc-transfer-controls-and-enforcement-unicri-seminar.

ANNEX 1

CBRN COE PROJECTS FOCUSED ON EXPORT CONTROLS[51]

A · IN THE EU-CBRN COE SEA REGION

PROJECT 47 (IFS): EU Outreach programme – Export Control Cooperation in South East Asia. 30/04/15, for 18 months. EUR 3 million.

- **COUNTRIES:** Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam.
- **OBJECTIVES:** to contribute to the creation, consolidation or updating the effective export control system for dual-use items in partner countries by continuing to offer them a long-term perspective for cooperation.
- **KEYWORDS:** Border control and monitoring; import/export control; illicit trafficking.

PROJECT 64: EU P2P - Export Control Programme for dual-use goods. The so-called global project. 2017, for four years. 13 countries. From 01/07/2019 expanded to include former Project 47 and thus the SEA region partner countries.[52]

- **OBJECTIVES:** contributing to the creation, consolidation or updating the effective strategic trade control systems for dual- use goods in partner countries by continuing to offer them a long-term perspective for cooperation and mutual economic benefits of export control standardisation.
- **KEYWORDS:** Border control and monitoring, Illicit trafficking, Import/export control, Transit and trans-shipment control.

B · IN OTHER EU-CBRN COE REGIONS

PROJECT 43 (IFS): EU Outreach Programme 2015-17 on export control of dual-use goods. 17/12/2014 for 22 Months. EUR 2,249,300. 19 countries.

- **OBJECTIVES:** to contribute to the creation, consolidation or updating of effective export control systems for dual-use items in partner countries. To reduce the risk of proliferation by strengthening international cooperation in the field export controls, focusing in particular on dual-use materials, equipment, and technology.
- **KEYWORDS:** Import/export control; dual-use; illicit trafficking; international cooperation.

PROJECT 64: EU P2P Export Control Programme for dual-use goods. 05/10/2017 for 45 months. EUR 5,500,000.

- **COUNTRIES:** Albania, Algeria, Armenia, Belarus, Bosnia and Herzegovina, Brunei Darussalam, Cambodia, Indonesia, Iran, Kosovo, Lao PDR, Malaysia, Montenegro, Morocco, Myanmar, North Macedonia, Philippines, Serbia, Singapore, Thailand, Tunisia, Ukraine, Vietnam.

51 CBRN Centres of Excellence. Addressing regional CBRN risk mitigation needs. http://www.cbrn-coe.eu/Projects.aspx.

52 EU P2P export control programme for dual use goods. EU P2P. https://ec.europa.eu/jrc/en/research-topic/chemical-biological-radiological-and-nuclear-hazards/eu-p2p-outreach-programmes-export-control/dual-use-goods.

- **OBJECTIVES:** The overall objective of this programme is to contribute to the creation, consolidation or updating of effective strategic trade controls systems for dual-use goods in partner countries by continuing to offer them a long-term perspective for cooperation and mutual economic benefits of export controls standardisation.

ANNEX 2

TRANSFER AND DECLARATION OBLIGATIONS OF CWC STATES PARTIES (SPS)

For Schedule I chemicals:

- Any transfer of a Schedule 1 chemical from one State Party to another must be notified by both SPs to the Technical Secretariat at least 30 days before the planned transfer; except for quantities of 5 milligrams or less of the Schedule 1 chemical Saxitoxin, if the transfer is for medical/diagnostic purposes, when the notification must be made by the time of the transfer.
- A SP must make a detailed annual declaration on transfers during the previous year. This declaration shall be submitted no later than 90 days after the end of that year, with specific information on each Schedule 1 chemical transferred.
- No transfers to or from anyone in a State not Party. Schedule 1 chemicals may only be transferred to other CWC States Parties, and only for research, medical, pharmaceutical, or protective purposes.
- No re-transfers.
- The total national aggregate amount of Schedule 1 chemicals that are produced at any given time must not exceed one tonne.

For Schedule 2 and 3 chemicals:

States Parties are required to make initial and annual declarations on **aggregate national data** for the previous calendar year on:

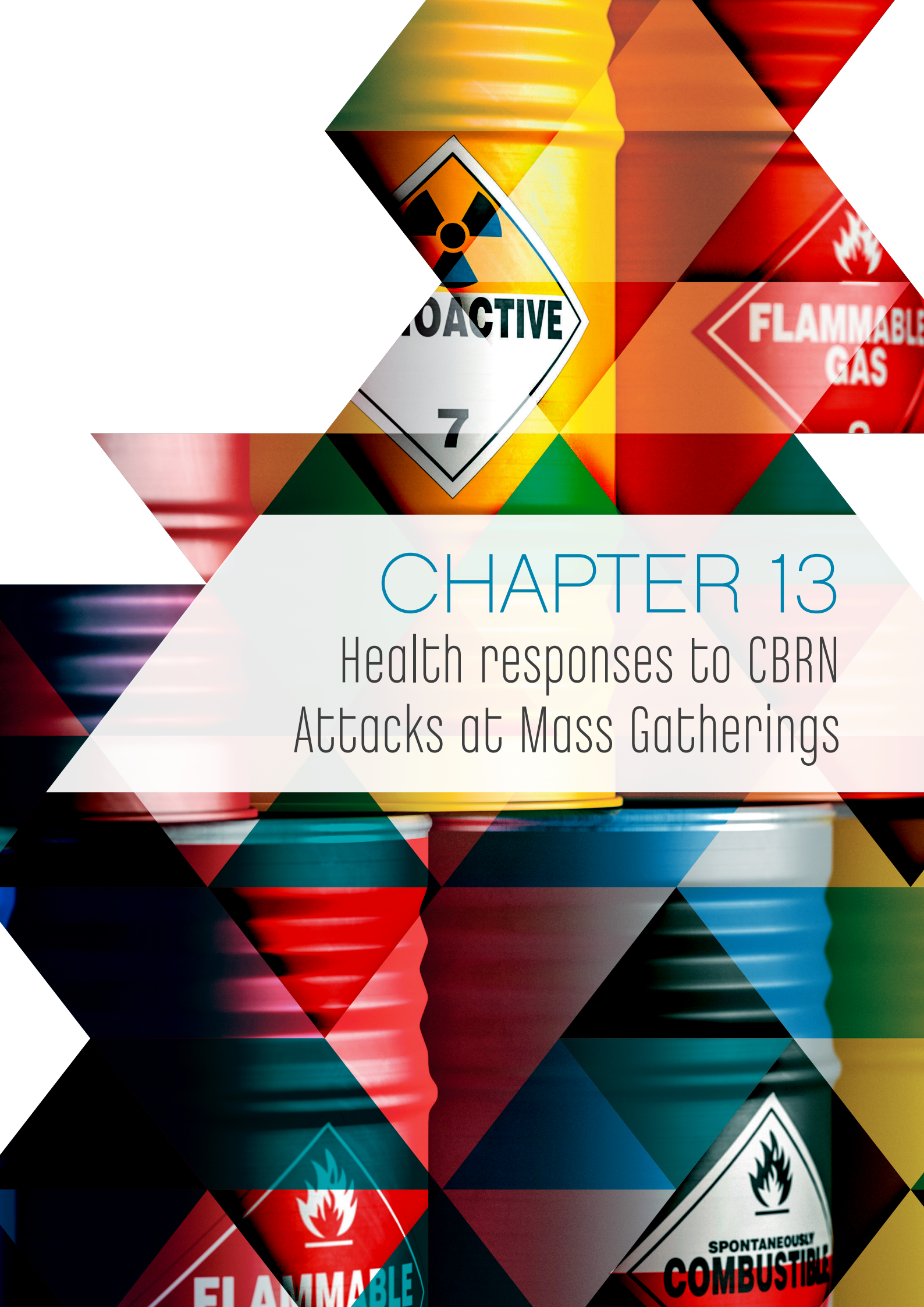
- The quantities of each Schedule 2 chemical produced, processed, consumed, imported and exported;
- The quantities of each Schedule 3 chemical produced, imported and exported;
- A quantitative specification of import and export for each country and chemical involved;
- Schedule 2 chemicals may be transferred to/from States not Party for : (a) products containing one percent or less of a Schedule 2A or 2A* chemical; (b) products containing 10

percent or less of a Schedule 2B chemical; and (c) products identified as consumer goods packaged for retail sale for personal use or packaged for individual use

- For transfers of Schedule 3 chemicals to States not Party, a SP must adopt measures to ensure that the transferred chemicals shall only be used for purposes not prohibited under this Convention. Inter alia, the SP shall require beforehand from the recipient State a certificate stating, in relation to the transferred chemicals: (a) That they will only be used for purposes not prohibited under the Convention; (b) That they will not be re-transferred; (c) Their types and quantities; (d) Their end-use(s); and (e) The name(s) and address(es) of the end-user(s). A sample 'End- Use Certificate' form is available.

For Discrete organic chemicals:

No restrictions or reporting requirements on transfers of these chemicals to/from States not Party.



CHAPTER 13

Health responses to CBRN Attacks at Mass Gatherings

CHAPTER 13

HEALTH RESPONSES TO CBRN ATTACKS AT MASS GATHERINGS

First responder training on CBRN alert and response aspects is well established in training schedules provided through the CBRN CoE initiative. Training often brings together participants from different disciplines such as police, armed forces, fire and rescue, and health, to build inter-agency cooperation and to explore technical capabilities and novel strategies. An example in the SEA region is Project 46 of the EU-CBRN CoE initiative.

In the aftermath of the 2001 terrorist attacks in the US on 9/11, many countries were determined to improve their measures to identify and respond to future terrorist attacks that involve CBRN agents. This included table-top or field simulations of CBRN attack with inter-agency and sometimes regional and international participation and co-organised with international organisations We here describe lessons learned from some of these exercises and refer to World Health Organisation (WHO) guidance *'Communicable disease alert and response for mass gatherings: Key considerations'*. The WHO recommends proactive actions before a mass gathering (MG), to mitigate the effects of a deliberate CBRN attack; these preparations could however bring significant local and national logistic burdens and costs.
The choice of key considerations to be designed into an exercise will depend on national and regional CBRN risk mitigation policies and local infrastructure and conditions. To aid such choices, this Chapter is offered as a potential adjunct to the information and training already provided in the EU-CBRN CoE projects.

SYNOPSIS

First responders training on CBRN aspects is well established in training schedules provided through the EU-CBRN CoE initiative. Training often brings together participants from different disciplines such as police, armed forces, fire and rescue, and health, to build inter-agency cooperation and to explore technical capabilities and novel strategies. An example in the SEA region is Project 46.

The World Health Organisation (WHO) recognises that gatherings involving exceptionally large numbers of people could strain the planning and resources capabilities of many countries. The WHO accepts the definition of a **mass gathering** (MG) as including more than 1000 people though much of the literature assumes gatherings of 25,000 or more. The WHO has built on its experience of supporting past MGs by developing a detailed guidance tool for alert and response to health issues arising at MGs - *Communicable disease alert and response for mass gatherings: Key considerations*. One scenario included is malicious CBRN action. The guidance points out that the scale of a MG has significant implications for post-attack physical and medical interventions by authorities, which could be much more difficult than for isolated events. The WHO recommends proactive actions before a MG, to mitigate the effects of any possible deliberate CBRN attack. These preparations could however bring significant local and national logistics burden and costs.

The terrorist attacks on New York and Washington DC on 9/11 2001 and the deliberate release of anthrax contaminated letters also in 2001, stimulated many countries to improve measures to identify and respond to future terrorist attacks that use CBRN agents. The start of the millennium saw collaborative discussions between groups of countries and other bodies such as the European Commission and the WHO, which led to table-top or field simulations of CBRN attack with inter-agency and sometimes regional and international participation. Particularly involved were agencies in the G8 Global Health Security Advisory Group member countries, which often co-organise and sponsor these exercises especially in developing countries, in cooperation international organisations.

Publications reporting such exercises indicate that these tend to be very resource intensive and demand a high level of commitment from every agency participating. Key objectives need to be set and exercise designs configured to test the corresponding uncertainties. Planning needs to ensure that the incident command structure has real time links with local and national government and civil society in order to ensure timely and transparent information flows. Experience shows that although individuals and separate cadres taking part are well versed in the techniques of CBRN response, yet when combined into an exercise and facing an unexpected CBRN incident particularly when the causative agent is initially unknown, surprises do happen. Such outturns and the lessons that were learned emphasise the importance of full-scale exercising. A number of principles and lessons learned about effective exercise design and performance became apparent in the publications reporting some of these exercises, and are reported here.

The WHO Guidance for mass gatherings is built on the five benchmarks used by the WHO to assess the risks posed by episodes of communicable disease:

- Outbreak with an unexpectedly high mortality or morbidity;
- Outbreak with potential international repercussions;
- Potential or actual international disease spread;
- Interference with international travel or trade;
- Outbreak in which international assistance is likely to be needed for disease control.

From the particular focus on CBRN incidents at a MG that is included in the Guidance, we here give special consideration to

- Triage and managing large numbers of cases
- Decontamination
- Mental health implications of CBRN events.

The objective of this Chapter in reporting this literature about past exercises and providing an overview of the WHO guidance, is to be a potential adjunct to the information and training provided in the EU-CBRN CoE projects. The choice of key considerations to be designed into an exercise will depend on national and regional CBRN risk mitigation policies and local infrastructure and conditions. **We reflect the thrust of the exercise literature and WHO Guidance by refraining from being prescriptive about the detailed design of exercises or the assignment of roles and tasks.**

Annexes included:

- **Annex 1.** Examples of published CBRN exercises

KEY TERMS

- **GHSAG:** Global Health Security Advisory Group
- **HPA:** Health Protection Agency (UK)
- **MG:** mass gathering, defined as more than 1,000 persons
- **Triage:** Assessment of casualties and allocation of priorities by the medical services at the scene or a receiving hospital. Also called: Sorting.
- **WHO:** World Health Organisation

A · INTRODUCTION: THE PARTICULAR PROBLEM OF CBRN EVENTS AT MASS GATHERINGS

First responders training on CBRN aspects is well established in training schedules provided through the EU-CBRN CoE initiative. Training often brings together participants from different disciplines such as police, armed forces, fire and rescue, and health, to build inter-agency cooperation and to explore novel strategies and technical capabilities. An example in the SEA region is Project 46,[1] which ran from 2015-2018, with one of the training events[2] reported from Brunei Darussalam in April 2018.

However, gatherings involving exceptionally large numbers of people could strain the planning and resources capabilities of many countries. Even when a host community's existing health and other support services are adequate to deal with the regular disease burden affecting its own population (including occasional outbreaks), the influx of large numbers of people, possibly culturally and linguistically diverse, could compromise the ability to detect a developing problem and carry out an effective response. If the gathering draws visitors from different nations, regions and cultures, the potential for increased risk of importation of infectious diseases creates additional challenges for CBRN risk mitigation.

World Health Organisation (WHO) guidance described below explains that the term mass gathering (MG) is usually defined as more than 1,000 persons even though much of the literature assumes gatherings of 25,000 or more. Most MGs will be known of long in advance, so a MG could attract mischief from people wanting to make political statements or highlight a particular cause. The large numbers of people attending MGs, and the extensive crowding and the strains on the local infrastructure, could make MGs particularly attractive as targets for CBRN attack The sheer scale of a MG also has significant implications for post-attack interventions by authorities, which could be much more difficult than for isolated events. Interventions fall into two groups:

- **physical interventions**: to determine the nature, locations and physical source of the CBRN harm; to control movements of crowds and segregate supposed victims, and to prevent panic from escalating to become uncontrollable;
- **medical interventions:** to determine the nature of the harm, and hence whether it could spread outside the site and over what timescale; to provide first aid, including decontamination of people and possessions.

There is a small body of literature reporting exercises that simulate CBRN incidents where there are large numbers of the public. Not surprisingly, given its sensitivity some of the materials are password protected. Another important source of information is from what the WHO has built on its experience of supporting past MGs: a detailed guidance tool for alert and response to health issues arising at mass gatherings. This includes the scenario of malicious CBRN action. Some of the problems reported and the lessons learned from these sources may have relevance for EU-CBRN CoE risk mitigation strategy; and may help to inform the case by case decisions as to what issues should be prioritised in planning a particular interagency training and exercising event or programme.

1 CBRN CoE, Project 46. 'Enhancement of CBRN capacities of South-East Asia in addressing CBRN risk mitigation concerning CBRN first response, biosafety and biosecurity, awareness raising and legal framework' FIIAPP, FORMIT, SACCO. http://www.cbrn-coe46.eu/.

2 Press release Project 46. https://eeas.europa.eu/sites/eeas/files/20180409_press_release_cbrn_coe.pdf.

This Chapter does not attempt to be prescriptive about the design of exercises or issues to be tested: we simply report this literature about past exercises and provide an overview of the WHO guidance, as a potential adjunct to the information and training provided in the EU-CBRN CoE projects.

B · HOW PREPAREDNESS FOR CBRN TERRORIST EVENTS EVOLVED

The terrorist attacks on New York and Washington DC on 9/11 2001 and the deliberate release of anthrax contaminated letters also in 2001, stimulated many countries to improve measures to identify and respond to future terrorist attacks that use CBRN agents. Countries talked openly about their new policies. In the United States (US), large workshops to consider the problems of health system surge capacities and state/federal level coordination are recorded.[3] There, the Federal Protective Service in the Department for Homeland Security responds to CBRNE threat and incidents; the CBRNE Program provides support to incident investigations, threat assessments, emergency operations, as well as evacuation support, mutual aid, and training assistance. In the United Kingdom (UK), all acute hospitals were instructed in October 2001 to revise their major incident plans so as to accommodate mass casualties. Then in May 2003, UK health services were reorganised to form a Health Protection Agency (HPA) which included response to terrorism among its objectives.[4] Within a year training in CBRN response had been set up in a range of UK government organisations and 'blue light' services, and the HPA had already run, or co-run, eight exercises.[5]

The period saw collaborative discussions between groups of countries and other bodies such as the European Commission and the WHO. Particularly productive were exercises, as table top or field simulations of CBRN attack scenarios. For example, at the 2004 expert level meeting of Biological Weapons Convention State Parties (see Chapter 7), a paper from two countries proposed a detailed plan for countries to work together to produce training material for mass casualty management. Some exercise reports in great detail are available on the Internet; others are password protected. Examples of exercises are described in **Annex 1**.

During this era, when lessons learned from interagency exercises were beginning to be reported, it is evident that a number of fundamental principles were being proposed and probably gaining acceptance. This published experience is worth considering. Mounting such exercises tends to be very resource intensive and demands a high level of commitment from every agency participating. Planning needs to ensure that the incident command structure has real time links with local and national government and civil society. The individuals and separate cadres taking part will be almost certainly be well versed in CBRN response, yet in combining into an inter-agency exercise facing an unexpected CBRN incident the very fact that surprises happened and lessons were learned emphasises the importance of this type of exercising. The principles about effective exercise design that were becoming apparent in the published projects, in no particular order of priority, include:

3 Biological threats and Terrorism: Assessing the science and response capabilities. Workshop summary (2002). Chapter 5: Assessing the capacity of the public health infrastructure. https://www.nap.edu/read/10290/chapter/7.

4 In 2013 the Health Protection Agency closed and became part of Public Health England.

5 HPA, Communicable Disease Surveillance Centre. Communicable Disease and Health Protection Quarterly Review: April to June 2004. Journal of Public Health Vol. 26, No. 4, p 398.

- Planning and exercising the coordination and sequencing of respective tasks of **security, medical intervention and epidemiological follow up of delayed cases** (and secondary cases if an infectious agent) is essential. This will test assumptions about the relationships of the various agencies. What will be the command structure at on the site, and locally and nationally? If security forces see themselves as in charge of an incident, what freedom will they allow to first responders and medical services? How will chains of custody of samples be removed from the site work?

- The realism of CBRN exercises – particularly for first responders – can be compromised if the participants are told in advance whether it is a C, B, R or N scenario they face. In the real world they probably won't know.

- Exercise scenarios need to be tailored to the region, to reflect particular needs and gaps in the region. Field exercises should reflect real-world conditions, and **use simulants or, for more advanced teams, live agents.** Evaluators should be independent of the 'players' in the exercise, i.e. with no role in planning or conduct.

- CBRN training programmes for first responders are obvious for **specialist** district or national teams, but there are also strong arguments to give CBRN training to **all** relevant first responders like the police, emergency response and rescue and diagnostic laboratory personnel. Personnel at municipal/local level are the most likely to be the first to be involved.

- Initial uncertainty about the exact nature of the CBRN agent means that personnel in a wide range of specialisation might need to be called on, and so should be built into a consultation/on-call network, or experts database This could include military units, industry, universities, public/animal/plant health laboratories, other specialist research laboratories, environmental control laboratories, as well as IT and communications specialists. Interactive networks with the lead international organisations should be set up with the responsible government agency : the WHO (for human health); World Organisation for Animal Health (OIE) (animal disease); Food and Agriculture Organisation (FAO) (plant disease); International Atomic Energy Agency (IAEA) (radiation harm); Organisation for the Prohibition of Chemical Weapons (OPCW) (chemical weapons incidents; International Committee of the Red Cross (ICRC), Interpol and relevant agencies of the United Nations for humanitarian aid

- Border guards and port/airport authorities might need to be alerted if there were risks of agent leaving the site by movement of people, animals, or contaminated items including vehicles.

- There should be a goal of linkages with neighbouring countries at political, operational command and working levels. To facilitate cooperation, some exercises could be conducted on a bilateral or regional basis. (For examples organised by Global Health Security Advisory Group[6] members see Annex 1).

6 A committee composed of high level representatives of the national health authorities for the G-8 block of countries.

- To avoid the spread of misinformation, mechanisms to provide timely and accurate information, including regular updates to key government officials, the local populations and the media need to be practised and regularly evaluated

- 'Lessons learned' from an exercise should be shared with all those concerned, communicated to their organisations, and any shortcomings focused on in subsequent exercising.

C · WHO GUIDANCE ON HEALTH RISK MITIGATION FOR MASS GATHERINGS

The Epidemic and Pandemic Alert and Response department of the WHO receives requests for technical support from countries organising large MGs (such as the Olympic Games, the Hajj,[7] and World Youth Days). As part of an accelerated programme to generate advice to countries on health response to deliberate use of biological agents,[8] the WHO developed a guidance document that built on 'lessons learned' at MGs[9] and so could prepare a country for the range of technical, operational and logistics problems that might be encountered.[10] Discussion at a workshop in May 2008 with attendees from over 30 countries was distilled into the guidance **Communicable disease alert and response for mass gatherings. Key considerations.**

This guidance aims to be relevant to the different types of mass gathering:

- spontaneous, e.g. a religious leader's funeral; or
- planned, whether recurrent events at different locations such as the Olympics, or recurrent events at the same location, such as the Hajj, or Wimbledon.

Its advice is built on the five benchmarks used by the WHO to assess the risks posed by episodes of communicable disease:

- Outbreak with an unexpectedly high mortality or morbidity;
- Outbreak with potential international repercussions;
- Potential or actual international disease spread;
- Interference with international travel or trade;
- Outbreak in which international assistance is likely to be needed for disease control.

7 The Hajj is the Muslim pilgrimage to Mecca which takes place in the last month of the year and which all Muslims are expected to make at least once during their lifetime if they can afford to do so. It is one of the Five Pillars of Islam.

8 WHO Preparedness for deliberate epidemics. Programme of work for the biennium 2004-2005. https://www.who.int/csr/resources/publications/deliberate/WHO_CDS_CSR_LYO_2004_8.pdf.

9 For example the 2004 Olympic Games in Athens. Mass gatherings and public health: the experience of the Athens 2004 Olympic Games. http://www.euro.who.int/__data/assets/pdf_file/0009/98415/E90712.pdf.

10 WHO. Communicable disease alert and response for mass gatherings. Key considerations. June 2008. https://www.who.int/csr/Mass_gatherings2.pdf.

Issues are covered in great detail (112 pages) and include risk assessment and management, surveillance and alert systems, outbreak alert and response, and in one chapter, **deliberate CBRN harm.**

The 112-pages document addressed in great detail key issues such as risk assessment and management, surveillance and alert systems and outbreak alert and response, including cross-cutting considerations (for example, communications) and psychological services during public health emergencies. One section (5.8) is dedicated to deliberate CBRN harm.

How the WHO guidance deals with deliberate CBRN attack

The WHO recommends proactive actions **before the MG,** to mitigate the effects of a deliberate CBRN attack:

- alerting public health and environmental surveillance services, and primary, secondary and tertiary medical care services, to be vigilant for the occurrence of unusual symptoms or patients or clusters of unusual illnesses, and to ensure that rapid reporting procedures are in place to alert central authorities;
- protocols are to be in place, and exercised, to provide medical support for rising numbers of patients with chronic or life-threatening conditions presenting to primary, secondary and tertiary medical care facilities. This may require the activation of additional medical facilities;
- procedures for providing at-risk but asymptomatic populations with prophylaxis[11] where available, and for post-exposure prophylaxis or mass treatment in dedicated centres or through medical facilities;
- bulk stockpiling of antidotes**.**

Planning should also allow for the possibility that large numbers of people may self-present to medical facilities after the event, in two categories:

- symptomatic (displaying symptoms), potentially infectious and/or contaminated victims who flee the incident, or think later on that they may have been exposed;
- "worried well" members of the public who go to medical facilities for treatment and/or reassurance.

There are detailed sections on:

- investigations of deliberate events during MGs;
- national planning and resource acquisition;
- planning for patient handling;
- decontamination, including the range of equipment, tents, vehicles, chemicals that ought

11 Prophylaxis means treatment given or action taken to prevent disease.

to be stockpiled. **Triage and managing large numbers of cases.** The standardisation of triage[12] procedures obviously is essential in efficient application of any medical care, but in a CBRN event where large numbers of people must be evaluated in 'field' settings, hospitals and critical care units, triage standardisation becomes critical. All medical staff who are first responders require familiarisation with triage procedures.

At a CBRN incident there may be very large numbers of exposed or potentially exposed people who must be processed without delay. In principle, processing areas may either be at the site or at nearby locations. This needs to be thought through because as a norm the management procedures for large numbers of people exposed to biological agents but not yet showing symptoms are not well-developed. The WHO also advises that border areas should develop plans for collaborative cross-border management of major events, including links between hospitals.

Decontamination becomes a significant burden when there is suspicion of a CBRN cause, as has been borne out in reports of field exercises. The WHO guidance also points to the logistical complication of an immediate suspicion of biological agent exposure that was combined with or preceded by a C, R or explosion event. Responders, clinic and medical staff and patients may need to be decontaminated. Even if an incident seems to be limited to the release of an infectious agent, until the exact nature of the agent has been confirmed the clothing of potentially infected casualties should be removed and discarded to reduce cross contamination; the inherent cultural problems are obvious. Only after this should casualties be decontaminated – in 'dirty areas' - and passed to clean areas during triage. In addition, responders need to adopt sterile procedures to reduce risk to themselves and the spread of infection. The implications for having to change the procedures and sequencing in triage once information about the type of harm begins to accumulate, are daunting. is that there could be significant additional pressure on resources; this stresses the need to allow for real-time flexibility as an incident unfolds.

As is usually the case during an incident, first responders and rescuers operate with very limited information. As the event unfolds and key information slowly trickles in, the response on the ground adopts appropriately or becomes fine-tuned to be effective. The priorities could change and continue to change as more information comes in. For example, the appropriate PPE and whether to treat on-site. In general, the highest level is worn by first responders initially, until the agent has been identified, which could allow for a scale-down or not. In case of no scaling down, the response may call for decontamination and treatment on-site which means additional resources: medical personnel will need to be in SCBA, separate mass decontamination tents/facilities for male and female, on-site treatment facilities and equipment, isolation chamber for those needed to be transported to hospitals and dedicated isolation rooms with negative pressure in hospitals, etc. Not many countries have containment chambers, on-site hospital tents, or that many SCBA suits, not to mention that people should be physically fit and trained to use SCBA, especially in hot climate. Strained resources.

Thus, it is important for countries to carry out these interagency exercises regularly and develop/fine-tune their own procedures with existing capacities and identify the gaps in resources and capabilities which need to be addressed in order to mount an effective response.

12 Triage is the assessment of casualties and allocation of priorities by the medical services at the scene or a receiving hospital. Also called: Sorting.

Mental health implications of CBRN events

This WHO guidance warns of an increased need for social and psychological support services if the incident is the result of biological and chemical attacks. By 2005, the WHO had already recognised this problem, particularly for low-income and middle-income countries, and published advice in the paper Mental Health of Populations Exposed to Biological and Chemical Weapons.[13] It recommends that health workers who conduct triage should be trained in the basics of assessing mental and neurological disorders, so as to minimise misdiagnosis and inappropriate treatment. It argues that historical accounts of chemical and biological attacks suggest that public panic is rare: public panic occurs only when there are inadequate exits in confined places (e.g. in stadiums) or perceptions of limited access to essential life-saving health services. This is not necessarily the view of other experts, who hold that the psychological consequences would likely be more severe than for a comparable 'natural' disaster. Posttraumatic stress disorder and other psychiatric disorders could affect the first responders and others present, as well as an expanding new category, virtual witnesses.

D · SUMMARY OF HEALTH RISK MITIGATION CONSIDERATIONS FOR CBRN ATTACKS OF MASS GATHERINGS

A short list of conclusions can be drawn from MG CBRN planning forums and exercises, and from the WHO guidance. Thankfully, to date, no MG has yet involved CBRN attacks:

- In case of a large scale B or R attack, a rapid diagnosis could be difficult but is crucial to limit the impact. For chemical injuries, first-aid may be quite effective once first responders work out the best treatment;
- In the absence of physical indicators that an attack has occurred, thus alerting security authorities, initial detection will most likely occur at the local public health level when individuals first present symptoms of disease. However, this may not be until days or even weeks after an infectious agent or radiological attack;
- Confusion will arise as to the identity of the disease ('flu or plague?). This underlines the importance of broad training and preparedness of health-care workers;
- Mass casualties arising as the immediate result of an attack could saturate hospital capacity. Thousands more people affected by contamination could require medical care in the geographic area. Military hospitals that are mobile units could be deployed to complement the reception capacities of civil hospitals;
- To avoid unnecessarily overloading a hospital there must be a gate keeper to hospital care that distinguishes between the hopeless, the worried well, and those for whom health care is appropriate. This is the triage. People who suffer from fear must be taken care of by their local doctors or other community medical services;

13 WHO. Mental Health of Populations Exposed to biological and Chemical Weapons. WHO/MSD/MER/05.1. https://www.who.int/mental_health/publications/populations_exposed_bio_chemical_weapons/en/.

- Medicines:
    - Which and what amount to be stored; some are perishable?
    - Who is responsible for their use? Safety of a vaccine may not be guaranteed (for example problems experienced by Gulf War soldiers).
    - How fast can stocks be mobilised?
    - What stocks can be expected from other countries?

- The longer an attack remains undetected, the greater the burden on the health care system in terms of the dying and dead;
- A number of health effects may show up in the medium to long term: chronic disease effects that are directly attributable to the agents used in the attack; and a range of rather vague health effects not directly attributable but nevertheless real;
- Medical or first responder staff may succumb initially if they are exposed before the source of harm is identified and PPE widely allocated.
- Long-term health effects could also affect health workers and other crisis responders. This will impact on the continuing capabilities of the health system;
- Of the potential types of CBRN terrorism, some forms of biological terrorism could impose the heaviest demands on the nation's public health and health care systems;
- For a contagious disease, it may be necessary to quarantine people who may have been exposed, as well as the relevant facilities and areas. Even for attacks with other types of agent, some restrictions to access and travel may be necessary. Lack of cooperation by the public may force authorities to proceed to compulsion, even with use of force. Failures in essential services and supplies could result in rioting and looting, difficult for overburdened police to deal with;
- With globalisation and modern transportation and the movement of people, the impact of a B or R attack is likely to be felt across borders. The radiological agent itself may rapidly cross borders under some meteorological conditions;
- Increasing integration of telecommunication and information networks makes it vital to prepare for their technical failure as well as to ensure information security and protection against disinformation.

ANNEX 1

EXAMPLES OF PUBLISHED CBRN EXERCISES

Exercise Magpie[14]
A simulated release of the nerve agent sarin in Newcastle Civic Centre, UK, 28 April 2004. Police contained the scene and fire and ambulance services set up decontamination units. 197 volunteer casualties were decontaminated at the Civic Centre site, divided among ambulant and non-ambulant casualties. Thirty casualties were taken to Newcastle General Hospital, which then implemented its emergency plan and set up its own decontamination procedures. Simulated 'worried well' members of the public presented either to doctor surgeries or to the accident and emergency unit of another hospital. The list of 'lessons learned' included:

- making roles and responsibilities of different agencies and individuals more explicit;
- developing new approaches to hot zone rescue;
- more inter-agency training;
- improving procedures for the decontamination of casualties;
- faster communication with the public.

Planning for a live casualty exercise involving decontamination at a hospital.[15] Oxford, UK, in November 2002. The exercise considered modifications to this large hospital's major incident plan in order to quickly manage contaminated mass casualties self-presenting to hospital. Actions involved securing the emergency department and hospital site, identifying suitable patient-holding and decontamination areas at and adjacent to the hospital site, and designing a new patient route from these areas to the Emergency Department and survivor reception areas within the hospital. A major conclusion was that the hospital needed to be managed by hospital staff and by all the emergency services as a secondary major incident site. The maximum acceptable level of disruption to the normal hospital functions was assessed.

Exercise GLOBAL MERCURY[16] was a command-post exercise involving the GHSAG nations plus the WHO and the European Commission. Conducted over a 56-hour period between 8 and 10 September 2003, it evaluated the communications protocols between and among GHSAG members in the face of an outbreak of an infectious disease. The scenario depicted an attack using fictitious self-inoculated terrorists to spread smallpox internationally to target countries.

The ORCHIDS project[17] received financial support from the European Commission via the Health Threats Strand of the Community Action in the Field of Public Health Work Plan for 2007; the project ended in 2011. Government health or defence agencies from four countries took part: the HPA in the UK; CRSSA[18]

14 Public Health England. Exercise Magpie – A simulated release of sarin in Newcastle Civic Centre. Chemical Hazards and Poisons Report From the Chemical Hazards and Poisons Division. September 2004. Page 27. http://www.npis.org/PHE/rep_Chapr2Sep2004.pdf.

15 Public Health England. Planning for a live casualty exercise involving decontamination at hospital. Chemical Hazards and Poisons Report From the Chemical Hazards and Poisons Division. September 2004. Page 29. http://www.npis.org/PHE/rep_Chapr2Sep2004.pdf.

16 US Department of State. Exercise Global Mercury: post exercise report. https://www.hsdl.org/?abstract&did=234582.

17 Evaluation and Optimisation of Emergency Mass Casualty Decontamination. http://www.orchidsproject.eu/index.html.

18 Centre Recherche Service Santé Armée.

in France; FMH in the Czech Republic; FOI[19] in Sweden. This project claimed to be the first to explore mass casualty decontamination from 'first principles'. As a result, evidence-based best practice guidelines were produced and disseminated to key stakeholders within the European Union (EU) and beyond. A range of issues were addressed, from applied toxicological research to mass casualty decontamination exercising and modelling. One of the review topics for mass casualty decontamination was 'A Systematic Review of the Needs of Vulnerable and Minority Groups in Emergency Decontamination', published in January 2010. Detailed reporting under ORCHIDS was password protected.

Exercise Eclipse[20] was as a table top exercise held on 26 and 27 October 2010. All 8 GHSAG member countries took part plus the European Commission and the WHO, with EU funding. The scenario was the covert placement of radioactive material in tester bottles at an international airport duty free shop. The exercise explored international communication in the early 'uncertainty' stages of response to a potential CBRN threat, to explore communication, coordination and collaboration at national, international and EU levels. The main issues identified were:

- players sought certainty during the 'uncertainty' phase, when no confirmed information was available. This may have slowed public message release;
- timely and transparent messages are required in the early uncertainty stage, even when there are no verifiable facts;
- domestic political pressure may circumvent the communicators need to control the message release timeline;
- communicators require access to and close liaison with technical experts to inform the public messages;
- social media should be exploited and new ways developed to utilise it;
- the transition from uncertainty to confirmation of an incident should be a managed and coordinated process.

Exercises in the Pirate Project.[21], [22] Carried out by the UK's HPA, Kings College London, and the German company DIALOGIK. There were two scenarios: a radiological source taped to the underneath of a table in a long distance train; and a suspicion that a terrorist organisation had deliberately infected themselves with smallpox virus and had managed to spread the disease. The results in the radiological scenario demonstrated that identifying and tackling key misperceptions among the public can be effective in altering behavioural intentions. However, in the smallpox scenario, a leaflet failed to change attitudes towards vaccination, illustrating the risks if publicity material is not designed and tested before needed in an emergency.

PROJECT 87: **Preparedness and Response for Mass Gatherings and other Health Threats in Central Asia (PRECA).** 42 months. EUR 3,500,000.

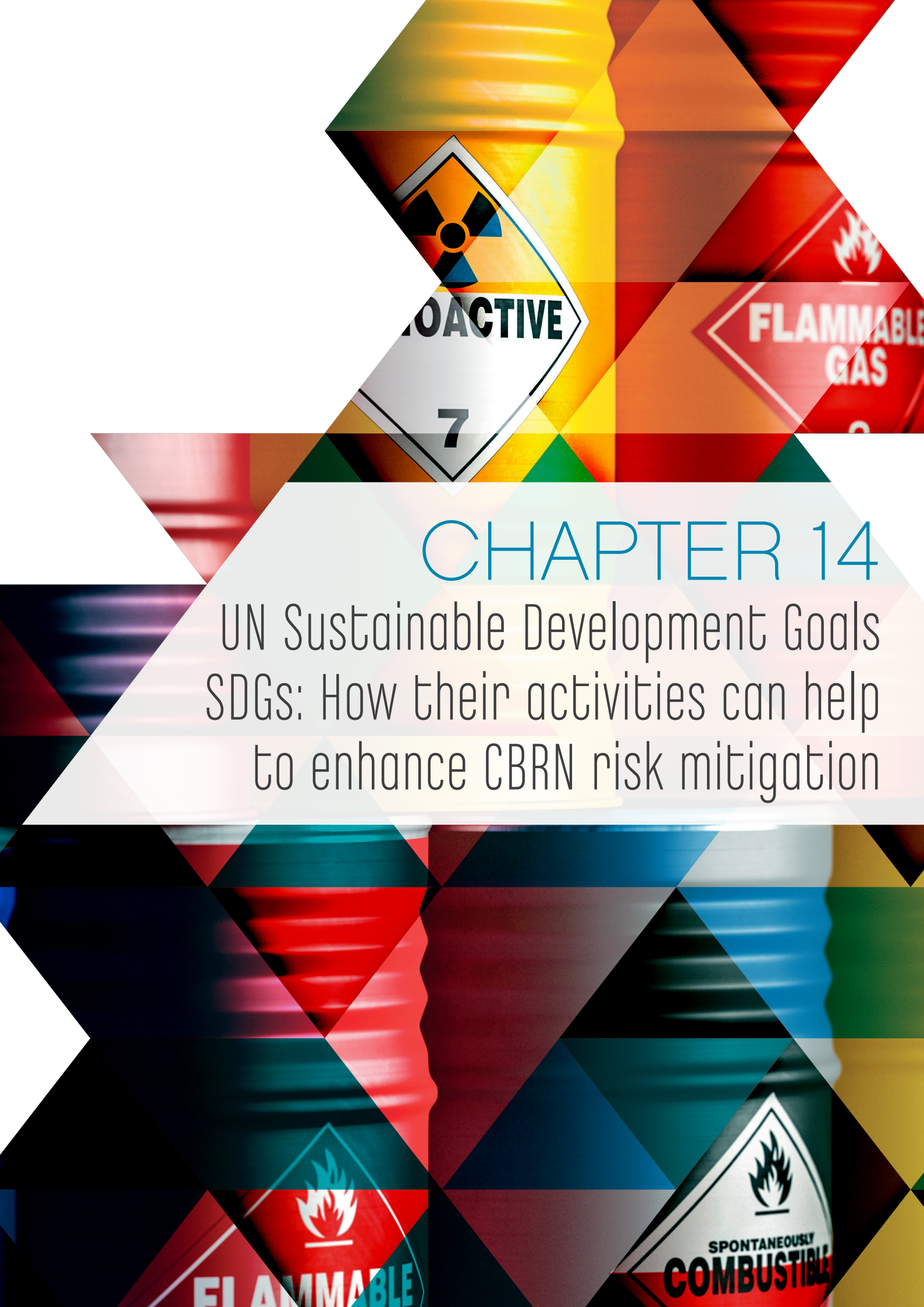
- COUNTRIES: Uzbekistan, Tajikistan, Kirghizstan, Pakistan, Afghanistan, Mongolia and Kazakhstan.

19 Swedish Defence Research Agency.

20 European Commission. Exercise Eclipse Final Report. https://ec.europa.eu/health/sites/health/files/preparedness_response/docs/eclipse_2010_frep_en.pdf.

21 HPA. Public Information Responses after Terrorist Events. The PIRATE project. http://www.pirateproject.eu/project.html.

22 Kings College London. The PIRATE project (JLS 2007 ISEC 563): Public Information and Responses to Terrorist Events. Short summary. http://www.pirateproject.eu/docs/JLS_2007_ISEC_563_PIRATE_short_summary.pdf.



CHAPTER 14

UN Sustainable Development Goals SDGs: How their activities can help to enhance CBRN risk mitigation

CHAPTER 14

UN SUSTAINABLE DEVELOPMENT GOALS SDGS: HOW THEIR ACTIVITIES CAN HELP TO ENHANCE CBRN RISK MITIGATION

This chapter examines two major strands of SDG activities that could be capitalised on by national and regional structures engaged in promoting and implementing CBRN risk migration objectives:

1. Reducing the risks from hazardous chemicals and wastes
2. Activities to promote human and animal health

We discuss three linked UN Conventions that have the common objective to protect human health and the environment from hazardous chemicals and wastes; cover some of the global facilitation arrangements for coordinating, financing and co-financing activities at country level; consider the actions in International Organisations that focus on CBRN risk mitigation (IAEA and OPCW), and initiatives being taken in the realm of human and animal health (WHO, FAO and OIE); and the commitment of the EU to SDGs and relevant ASEAN engagement.

SYNOPSIS

The United Nations (UN) General Assembly in 2000 adopted The Millennium Development Goals (MDGs) as eight international development goals for the year 2015. All 191 UN Member States and at least 22 international organizations committed to help achieve these MDGs:

- To eradicate extreme poverty and hunger
- To achieve universal primary education
- To promote gender equality and empower women
- To reduce child mortality
- To improve maternal health
- To combat HIV/AIDS, malaria, and other diseases
- To ensure environmental sustainability
- To develop a global partnership for development.

The UN Sustainable Development Goals (SDGs) succeeded the MDGs in 2016, announced in the **2030 Agenda for Sustainable Development** as a further global plan for "people, planet and prosperity". This sets 17 SDGs with 169 associated targets which seek to build on the MDGs[1] and complete what these did not achieve. Details may be seen in the UN SDG Knowledge Platform.[2] In the interactions of countries and regions over several of the SDG initiatives, there are direct

1 UN. Millennium Development Goals and beyond 2015. https://www.un.org/millenniumgoals/.

2 UN Sustainable Development Goals Knowledge Platform. Transforming our world: the 2030 Agenda for Sustainable Development. https://sustainabledevelopment.un.org/post2015/transformingourworld.

and indirect opportunities to strengthen risk aversion and crisis management strategies and infrastructure in CBRN areas: **chemical production and waste management; and guidance to multiagency planning and cooperation to avert crises directly or indirectly resulting from human and livestock disease.**

Understanding SDGs is important because taking full advantage of global initiatives under these various goals is likely to require government **ministries with traditionally separate missions to increasingly work together in coordinating and implementing** policies. In the context of CBRN risk mitigation, ministries with historic responsibilities for security, safety, industrial regulation, health, agriculture may need to find new ways to interact. Progress will also depend on unlocking the potential of the **private sector** including producer organisations, cooperatives, small and medium-sized enterprises (SME), and international corporations**.** The EU is committed to SDGs, including through support for security and sustainable development in partner countries.

This chapter examines two major strands of SDG activities that could be capitalised on by those national and regional structures engaged in promoting and implementing CBRN risk migration objectives:

- **Reducing the risks from hazardous chemicals and wastes.** The prevention of risks from poor management of chemical production and waste illustrates how programmes serving different SDGs can overlap. The sound management of chemicals and all wastes is a specific target under SDG 12 on Responsible Consumption and Production. Chemicals, waste and air quality are referred to under SDG 3 for Good Health and Well-being, SDG 6 for Clean Water and Sanitation, SDG 7 for Affordable and Clean Energy, SDG 11 for Sustainable Cities and Communities and SDG14 for Life Below Water. Given that chemicals and waste have the potential to adversely affect all aspects of development, their responsible management and thereby prevention of accidents and other crises is arguably relevant to the implementation of other SDGs.
- **Activities to promote human and animal health.** The principal goal here is SDG 3, to ensure healthy lives and promote well-being for all at all ages. The World Health Organisation (WHO) has noted that the SDGs considerably broadened the disease-specific health targets of the MDGs.[3] The UN organisations that cover animal health and production have also pledged to work together towards a more sustainable, responsible and efficient livestock production. (These are the OIE, the World Organisation for Animal Health; and the FAO, the Food and Agriculture Organisation).

The detail of this chapter considers three linked UN Conventions that have the common objective to protect human health and the environment from hazardous chemicals and wastes. We cover some of the global facilitation arrangements for coordinating, financing and co-financing activities at country level; two of these instruments now in their third decade are the UN Development Group (UNDG), and the Global Environment Facility (GEF). We consider the actions underway in international organisations that focus on CBRN risk mitigation, the OPCW and IAEA; the initiatives being taken in the realm of human and animal health by the WHO, OIE and FAO; and, of course, the commitment of the EU to SDGs, and various aspects of ASEAN work.

3 WHO Mental Health. https://www.who.int/mental_health/suicide-prevention/SDGs/en/.

KEY TERMS

- **ASEAN:** Association of Southeast Asian Nations
- **EU-CBRN CoE:** European Union Chemical Biological Radiological and Nuclear Risk Mitigation Centres of Excellence Initiative
- **EUGS:** EU Global Strategy on foreign and security policy
- **ICCM:** International Conference on Chemicals Management
- **IcSP:** (EU) Instrument contributing to Stability and Peace
- **FAO:** Food and Agriculture Organisation).
- **GEF:** Global Environment Facility
- **OIE:** World Organisation for Animal Health
- **PCB:** Polychlorinated biphenyl
- **POP:** Persistent organic pollutant
- **PRTRs:** Pollutant release and transfer registers
- **SAICM:** Strategic Approach to International Chemicals Management
- **UNDG:** UN Development Group
- **UNEP:** UN Environment Programme
- **WHO:** World Health Organisation

A · REDUCING THE RISKS FROM HAZARDOUS CHEMICALS AND WASTES

At the World Summit on Sustainable Development in 2002, governments identified the goal of "*achiev[ing] by 2020, that chemicals are used and produced in ways that lead to the minimization of significant adverse effects on human health and the environment*". That goal was adopted as part of the **Strategic Approach to International Chemicals Management SAICM** by the International Conference on Chemicals Management ICCM. The Conference ICCM4 in September 2015 endorsed "Overall Orientation and Guidance for Achieving the 2020 Goal" as a voluntary tool to help to prioritise efforts towards 2020**.** 2006.[4] **This guidance has six core activity** areas:

- Enhance the responsibility of stakeholders;
- Establish and strengthen national legislative and regulatory frameworks for chemicals and waste;
- Mainstream the sound management of chemicals and waste in the sustainable development agenda;
- Increase risk reduction and information sharing efforts on emerging policy issues;
- Promote information access;
- Assess progress towards the 2020 goal of minimizing the adverse effects of chemicals on human health and the environment.

The 11 basic elements of the Overall Orientation and Guidance have been listed in **Annex 1** to **Chapter 10.**

SAICM and SDG 12: Responsible Consumption and Production

SAICM views **t**he global chemical sector is a major economic factor, **and a key enabler for achieving sustainable development**. Chemicals and waste in the context of SDG 12 require a systematic approach throughout the life cycle of chemicals, as well as cooperation across actors and sectors throughout the supply chain, from producers to final consumers. Target 12.4[5] in particular was set for achievement by 2020, in alignment with the overall SAICM objective.[6] To guide the sound management of chemicals and wastes from 2020 onwards to 2030, and the measurement of progress, the SAICM secretariat prepared proposals for a March 2018 SAICM meeting. In the context of the 11 elements, detailed objectives, related milestones for SDG 12.4 and links to other SDGs were presented.[7]

Relevant Conventions and facilitation arrangements

Conventions on hazardous chemicals and waste. Three linked multilateral agreements[8] have the common objective of protecting human health and the environment from hazardous chemicals and wastes:

4 SAICM Document - 29 June 2015. http://www.saicm.org/Portals/12/Documents/OOG%20document%20English.pdf.

5 Target 12.4: By 2020, to achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment.

6 SAICM. http://www.saicm.org/SDG/tabid/7654/language/en-US/Default.aspx.

7 SAICM Proposal on objectives in support of the 2030 Agenda and related milestones. SAICM/IP.2/8. 9 January 2018. http://www.saicm.org/Portals/12/Documents/meetings/IP2/IP_2_8_OBJECTIVES-and-SDG.pdf.

8 UNITAR. Basel, Rotterdam and Stockholm Conventions. https://unitar.org/sustainable-development-goals/planet/our-portfolio/basel-rotterdam-stockholm-conventions.

- **The Basel Convention** on the Control of Transboundary Movements of Hazardous Wastes and their Disposal;
- **The Rotterdam Convention** on the Prior Informed Consent Procedure for certain hazardous Chemicals and Pesticides in international trade;
- **The Stockholm Convention** on Persistent Organic Pollutants (POPs). An important project is the Development of the Guidelines for updating of National Implementation Plans (NIPs) under the Stockholm Convention.[9]

The three Conventions are operated in a linked 'Synergies Process' designed to enhance coordination and cooperation between them, with a common Executive Secretary.[10] Meetings are held back-to back, with joint sessions on joint issues.[11]

The Global Environment Facility (GEF). The GEF was established on the eve of the 1992 Rio Earth Summit to help tackle global environmental problems. To date, it has provided over 17.9 billion US dollars in grants and mobilized an additional 93.2 billion dollars in co-financing more than 4500 projects in 170 countries. It has partnerships with 183 countries, international institutions, civil society organisations and the private sector.[12]

As an example of GEF funding support, Kenya received a grant for a project to assess how research and monitoring of chemicals under the Basel, Rotterdam and Stockholm Conventions can help to promote sound chemicals management in Kenya. The objective is to normalise sound chemicals management and to reduce unintentionally produced persistent organic pollutants from open burning of waste and thermal disposal of health care waste. This is a five year, 2016-2021, project implemented by national and county government agencies, civil society and the private sector.[13]

Three other Stockholm Convention projects[14] funded by GEF are:

- developing GEF proposals with countries to address various issues under the Convention including PCBs, unintentionally produced POPs, obsolete POPs pesticides, and new POPs;
- in cooperation with the United Nations Environmental Programme (UNEP)[15], a project to

9 UN Stockholm Convention. Protecting human health and the environment from persistent organic pollutants. Guidance for National Implementation Plans (NIPs) http://chm.pops.int/Implementation/NIPs/Guidance/tabid/2882/Default.aspx.

10 UN Basel, Rotterdam and Stockholm Conventions. Video of Executive Secretary of the Conventions warning of the effect of chemicals on life. SDG Studio, Geneva. 26 July 20. https://www.youtube.com/watch?v=hGsKpb3HUjM&feature=youtu.be.

11 UN. Secretariat of the Basel, Rotterdam and Stockholm Conventions. Synergies among the Basel, Rotterdam and Stockholm Conventions. 2017. http://www.brsmeas.org/Decisionmaking/Overview/SynergiesProcess/tabid/2615/language/en-US/Default.aspx.

12 Global Environment Facility. About us. https://www.thegef.org/about-us.

13 GEF. Workshop and hazardous chemicals research, monitoring, Pollutant Release and Transfer Register (PRTR). 31 SEPT-1ST OCTOBER, 2017. http://upops.environment.go.ke/downloads/PRTR%20WORKSHOP.pdf.

14 UNITAR. Basel, Rotterdam, Stockholm Conventions. https://unitar.org/sustainable-development-goals/planet/our-portfolio/basel-rotterdam-stockholm-conventions.

15 The United Nations Environment Programme.

implement fully operational PRTR[16] systems in Belarus, Cambodia, Ecuador, Kazakhstan, Moldova, and Peru, and showcase these systems as effective tools to report releases of POPs (2015-2018);

- in cooperation with UNEP, a project on "Continuing Regional Support for the POPs Global Monitoring Plan under the Stockholm Convention in the African Region, the Asian Region, the Latin American and Caribbean Region, and the Pacific Region".

UN Development Group (UNDG). The UNDG is a consortium of 32 UN agencies created by the UN Secretary General in 1997 to improve the effectiveness of UN development activities at the country level. It publishes a Reference Guide for mainstreaming the 2030 Agenda for Sustainable Development, to assist **UN country teams** in their work to help countries to adapt the global SDGs to national contexts. The 2017 edition is the third update.[17] The Reference Guide describes **eight practice areas** as opportunities for mainstreaming the 2030 Agenda and SDGs into national strategies, plans and planning processes. These practice areas all relate to the traditional plan-do-check cycle of strategic planning.

Five of the eight practice areas are particularly important to initiate in the early stages of mainstreaming:

- Raising Public Awareness;
- Applying Multi-stakeholder Approaches;
- Reviewing Plans and Adapting the SDGs to National Contexts;
- Creating Horizontal Policy Coherence; and
- Monitoring, Reporting and Accountability.

B · SDGS AND INTERNATIONAL ORGANISATIONS THAT FOCUS ON CBRN RISK MITIGATION

IAEA. The International Atomic Energy Agency

The IAEA, in line with its 'Atoms for Peace and Development' mandate, supports countries in their efforts to reach all the SDGs. Countries use nuclear science and technology to contribute to and meet their development objectives in areas including energy, human health, food production, water management and environmental protection. The use of these techniques contributes directly to nine of the 17 SDGs.[18] A technical meeting to review the IAEA's methodologies and analytical tools for Sustainable Energy Development took place on 11-14 June 2019 in Vienna, Austria.[19]

16 Pollutant release and transfer registers PRTRs are inventories of pollution from industrial sites and other sources.

17 UNDG. Mainstreaming the 2030 Agenda for sustainable development. https://undg.org/document/mainstreaming-the-2030-agenda-for-sustainable-development-reference-guide-for-un-country-teams/.

18 IAEA. Sustainable Development Goals (SDGs). https://www.iaea.org/about/overview/sustainable-development-goals.

19 IAEA. Technical Meeting to Review the IAEA's Methodologies and Analytical Tools for Sustainable Energy Development. https://www.iaea.org/events/evt1804658.

OPCW. The Organisation for the Prohibition of Chemical Weapons

States Parties of the CWC identified activities to help achieve the SDGs during the third meeting of the Forum on the Peaceful Uses of Chemistry, in The Hague on 23 October 2018. Panel discussions included: an overview of the SDGs; peaceful application of chemistry; chemical safety, security and sustainability; gender mainstreaming and building institutional synergies to promote international cooperation on SDGs. Participants included over 30 chemists, chemical engineers and academics, as well as government and industry officials from eighteen CWC State Parties including Indonesia, Malaysia, Myanmar and the Philippines.[20]

C · HEALTH ORIENTED INTERNATIONAL BODIES

WHO. The World Health Organisation

The WHO has noted that the SDGs considerably broadened the disease-specific health targets of the Millennium Development Goals (MDGs) for 2015.[21] SDG 3 aims to ensure healthy lives and promote well-being for all at all ages.

Eleven heads of the world's leading health and development organisations have committed to find new ways of working together to accelerate progress towards the SDGs. A final plan, the **Global Action Plan for Healthy Lives and Well-being for All,** was delivered in September 2019 at the UN General Assembly. The organisations that have already signed up are: Gavi, the Vaccine Alliance: the Global Fund to Fight AIDS Tuberculosis and Malaria; the Global Financing Facility; UNAIDS; UNDP; UNFPA; UNICEF; Unitaid; UN Women; the World Bank; the World Food Programme and the WHO.[22]

In a May 2017 report, the WHO Assistant DG for Health Systems and Innovation announced that "*WHO is working with countries to strengthen health information systems and to enable them to better track progress towards the Sustainable Development Goals.*" He described health related 2030 shortcomings needing to be addressed under SDG targets 3.1-3.19, and targets 1.2, 2.2, 7.1, 16.1 and 17.19.[23]

The WHO publishes an annual compilation of health statistics for its 194 Member States, as the World Health Statistics series. The latest edition, for 2017, focuses on the proposed health and health-related SDGs and on 21 SDG targets, with 35 indicators, and also data on life expectancy.[24] The report shows improvements that countries have made in collecting statistics and monitoring progress towards the SDGs.

20 OPCW News. OPCW to Further Enhance Contributions to United Nations' Sustainable Development Goals. 26 OCTOBER 2018. https://www.opcw.org/media-centre/news/2018/10/opcw-further-enhance-contributions-united-nations-sustainable-development.

21 WHO Mental Health. https://www.who.int/mental_health/suicide-prevention/SDGs/en/.

22 WHO. Global health organizations commit to new ways of working together for greater impact. https://www.who.int/news-room/detail/16-10-2018-global-health-organizations-commit-to-new-ways-of-working-together-for-greater-impact.

23 WHO. Almost half of all deaths now have a recorded cause, WHO data show. https://www.who.int/en/news-room/detail/17-05-2017-almost-half-of-all-deaths-now-have-a-recorded-cause-who-data-show.

24 WHO. World Health Statistics 2017: Monitoring health for the SDGs. https://www.who.int/gho/publications/world_health_statistics/2017/en/.

OIE. The World Organisation for Animal Health

At the 10th Global Forum for Food and Agriculture on 20 January, 2018, in Berlin, Germany, sixty nine Agriculture Ministers asked the DGs of the OIE and FAO to work together to shape the future of a more sustainable, responsible and efficient livestock production. To improve animal health and welfare, four principal areas of work were identified: disease prevention and control; animal welfare management; fight against antimicrobial resistance; and capacity building. The FAO, OIE and International Livestock Research Institute (ILRI) were asked to collaboratively promote international consultation on sustainable, responsible and efficient livestock production systems, and the development of good practices - based on integrated assessments, intergovernmental processes and multi-stakeholder consultations.[25]

FAO. The Food and Agriculture Organisation of the UN

The FAO in 2018 published a guide "Transforming Food and Agriculture to achieve the SDGs: 20 interconnected actions to guide decision-makers". While not intended as a standard, the Guide offers decision-makers a possible route towards SDG implementation. It complements the process outlined in the UNDG Reference Guide on Mainstreaming the 2030 Agenda for Sustainable Development, which offers a common platform for SDG work at country level.[26]

D · EU COMMITMENT TO SDGS

The EU's External Action is taken forward by the EU Global Strategy on foreign and security policy EUGS[27] In its engagement in world affairs, the EU promotes a joined-up approach, bringing together all available instruments from the EU institutions and Member States, to work towards a more peaceful and prosperous world.[28] Since 2012, the EU has published successive policy statements in support of the SDGs.[29] A Commission press release of 30 January 2019 announced the launch of a forward-looking debate on sustainable development.[30] The Commission publishes an annual report of its outreach support under the geographic and thematic programmes.[31]

IcSP

The Instrument contributing to Stability and Peace (IcSP) is the EU's main financing instrument supporting security initiatives and peace-building activities in partner countries. It entered into force in 2014, replacing the Instrument for Stability (IfS) and several other instruments that focused on drugs, landmines, uprooted people, crisis management, rehabilitation and reconstruction. The CBRN

25 OIE. Agriculture Ministers support OIE commitment to shape the future of livestock. http://www.oie.int/en/for-the-media/press-releases/detail/article/agriculture-ministers-support-oie-commitment-to-shape-the-future-of-livestock/.

26 FAO. Transforming Food and Agriculture to achieve the SDGs. http://www.fao.org/3/I9900EN/i9900en.pdf.

27 EEAS. EU Global Strategy. https://eeas.europa.eu/topics/eu-global-strategy_en.

28 EC. Commission Staff Working Document. Annual Report on the implementation of the European Union's instruments for financing external actions in 2017. Brussels, 31.1.2019 SWD(2019) 12 final. Part 1/2. https://www.eu.dk/samling/20191/kommissionsforslag/kom(2019)0037/kommissionsforslag/1551997/2008294.pdf.

29 EC. Stepping up support for security and sustainable development in partner countries. Brussels, 7 December 2017. http://europa.eu/rapid/press-release_IP-17-5125_en.htm.

30 European Commission. A Sustainable Europe by 2030. https://ec.europa.eu/commission/publications/reflection-paper-towards-sustainable-europe-2030_en.

31 EC. International Cooperation and Development. Annual Reports. https://ec.europa.eu/europeaid/annual-reports_en

CoE initiative is financed through the IcSP.[32] In 2017, the IcSP was amended to include Capacity Building in support of Security and Development (CBSD), as a means to improve the EU's support to security and sustainable development in partner countries. CBSD will allow assistance to military forces performing certain development and human security-related tasks. This could include advice and technical cooperation, and provision of equipment and infrastructure improvements such as IT-systems, protective gear, and facilities related to health or training.[33]

E · ASEAN AND SDGS

ASEAN–EU linkages

The European Union has expressed its commitment to deepening its relationship with ASEAN. In 2017, the strategic focus of EU-ASEAN cooperation was demonstrated through the launch of a ministerial High-Level Dialogue on SDGs, in Bangkok. According to the published *Blue Book 2018, EU –ASEAN Cooperation*,[34] EU cooperation with ASEAN continues to grow. For 2014-2020, bilateral development cooperation with individual ASEAN Member States includes more than EUR 3 billion pledged to lower-middle income ASEAN countries such as Cambodia, Lao PDR, Myanmar, Vietnam and the Philippines. EU-ASEAN development cooperation impacts on three areas:

- Regional integration;
- Regional programmes with a specific thematic focus;
- Bilateral assistance to ASEAN Member States.

Among the EUR 255 million of commitments for the current period are EUR 10 million to support the ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management (AHA Centre). Approximately EUR 20 million have been already allocated to CBRN CoE support in Southeast Asia. The EU-ASEAN Migration and Border Management Programme II, implemented by INTERPOL, is supporting capacity building of ASEAN Member States in addressing the challenges of trans-national crime, and conducting a feasibility study of visa liberalisation in ASEAN.

Bilateral cooperation with Individual ASEAN Member States is also being used to strengthen ASEAN-EU development cooperation. Increasingly, the EU is working with Malaysia in areas falling under the EU Common Foreign and Security Policy. These include maritime security, export control, and CBRN risk. Under the Migration EU Expertise II facility, European experts are also providing training on improved border management practices and procedures.

32 EC. International Cooperation and Development. The Instrument contributing to Stability and Peace (IcSP). https://ec.europa.eu/europeaid/sectors/human-rights-and-governance/peace-and-security/instrument-contributing-stability-and-peace_en.

33 EC. Stepping up support for security and sustainable development in partner countries. Brussels, 7 December 2017. http://europa.eu/rapid/press-release_IP-17-5125_en.htm.

34 European External Action Service. Blue Book 2018. EU-ASEAN Cooperation. https://eeas.europa.eu/sites/eeas/files/blue_book_2018_lowres_0.pdf.

ASEAN – UN linkages

At the ASEAN-UN Ministerial Meeting at the UN in New York, on 28 September 2018, ASEAN and the UN reaffirmed the importance of further strengthening their Comprehensive Partnership towards the fulfilment of **the ASEAN Community Vision 2025 and 2030 Agenda for Sustainable Development** in a complementary manner.[35] (There are UN offices in each CBRN CoE SEA country). Views were exchanged on regional and international issues of concern included sustainable development and disaster management.

As an example of national process, the first Voluntary National Review implementation of the 2030 Agenda for Sustainable Development of Lao PDR was published and presented at the High-Level Political Forum by the Government in 2018. The Lao Government has continued to localize the SDG indicators to ensure that they are relevant to the national context. The Government endorsed 238 SDG indicators during the National SDG Steering Committee Meeting held on 11 June 2019. Of the 238 indicators agreed, 136 were either 'adapted' for the region or 'additional'. Goals directly relevant to CBRN risk mitigation were 3.3, 3.9. 6.3 and 12.4.[36]

35 ASEAN. ASEAN, UN move forward in achieving Vision 2025 and SDGs. https://asean.org/asean-un-move-forward-achieving-vision-2025-sdgs/.

36 Lao People's Democratic Republic. National Round Table Process. SDG Indicators. https://rtm.org.la/sdgs/sdg-indicators/.

NATURAL DISASTERS: CATEGORIES

GEOPHYSICAL

A hazard originating from solid earth. This term is used interchangeably with the term geological hazard.

HYDROLOGICAL

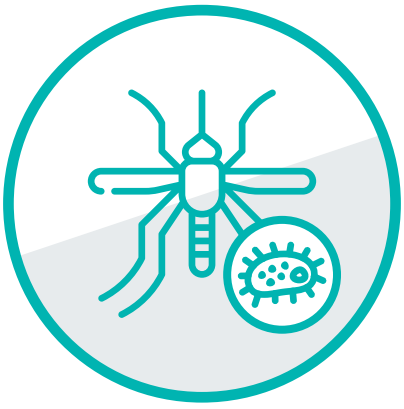
A hazard caused by the occurrence, movement, and distribution of surface and subsurface freshwater and saltwater.

METEOROLOGICAL

A hazard caused by short-lived, micro- to meso-scale extreme weather and atmospheric conditions that last from minutes to days.

CLIMATOLOGICAL

A hazard caused by long-lived, meso- to macro-scale atmospheric processes ranging from intra-seasonal to multi-decadal climate variability.



BIOLOGICAL

A hazard caused by the exposure to living organisms and/or their toxic substances (e.g. venom, mold) or vector-borne diseases that they may carry. Examples are venomous wildlife and insects, poisonous plants, algae blooms, and mosquitoes carrying disease-causing agents such as parasites, bacteria, or viruses (e.g., malaria).

EXTRATERRESTRIAL

A hazard caused by asteroids, meteoroids, and comets as they pass near- earth, enter the Earth's atmosphere, and/or strike the Earth, or changes in inter planetary conditions that effect the Earth's magnetosphere, ionosphere, and thermosphere.

Definitions taken from Integrated Research on Disaster Risk. (2014). "Peril Classification and Hazard Glossary (IRDR DATA Publication No. 1)." Beijing: Integrated Research on Disaster Risk.

TROPICAL CYCLONE

Tropical cyclones are officially ranked on several very different scales, depending on where they are located and which agencies are tracking them. Storms that form around the United States in either the North Atlantic or the Northeast Pacific are classified using the Saffir-Simpson Hurricane Scale, which uses the Category 1-5 rankings.

In the Western Pacific, the US military's Joint Typhoon Warning Center (JTWC) uses a scale that includes the Super Typhoon label. The Japanese Meteorological Agency (JMA) and the Regional Specialized Meteorological Center (RSMC) in Tokyo also have their own scale.

In other parts of the world, tropical cyclones are classified using even more different scales by the RSMC in India, the RSMC in Fiji, Météo-France forecast center on La Reunion, the Australian Bureau of Meteorology, etc.

TYPHOON: CATEGORIES

SUPER TYPHOON

The equivalent of a Category 4 or 5 hurricane, meaning it has maximum sustained winds of 241KMH or more. It is basically a really intense typhoon, with the ability to produce high storm surges and torrential downpours, in addition to powerful winds.

STORM SURGE

An abnormal rise in sea level generated by a tropical cyclone or other intense storms.

A tropical cyclone originates over tropical or subtropical waters. It is characterised by a warm-core, non-frontal synoptic-scale cyclone with a low pressure centre, spiral rain bands and strong winds.
Depending on their location, tropical cyclones are referred to as hurricanes (Atlantic, Northeast Pacific), typhoons (Northwest Pacific), or cyclones (South Pacific and Indian Ocean).

The Southeast Asia Region is frequently visited by typhoons. Super Typhoon Haiyan, also known as Super Typhoon Yolanda, made landfall in the Philippines on Nov. 8, 2013, as a Category 5 storm. It laid waste to the Visayas group of islands, the country's central region and home to 17 million people. Haiyan was the most powerful storm in 2013 and one of the most powerful typhoons of all time. With wind speeds sustained at more than 241 KMH, Haiyan was classified as a super typhoon. However, its massive storm surge was even more destructive. Local officials estimated that Tacloban City on the island of Leyte was 90% destroyed. The typhoon's fury affected more than 14 million people across 44 provinces, displacing 4.1 million people, killing more than 6,000 people and leaving 1,800 missing. The overall damage was estimated at $5.8 billion USD.

EARTHQUAKES

Sudden movement of a block of the Earth's crust along a geological fault and associated ground shaking.

Two of the biggest archipelagoes in Southeast Asia – Indonesia and the Philippines have frequent earthquakes and have the highest number of active volcanoes in the region, as these countries are within the so-called Pacific Ring of Fire.

The Ring of Fire, also called the Circum-Pacific Belt or Pacific Ring of Fire, is a long horseshoe-shaped seismically active belt of earthquake epicentres, volcanoes, and tectonic plate boundaries that fringes the Pacific basin. For much of its 40,000-km (24,900-mile) length, the belt follows chains of island arcs such as Tonga and New Hebrides, the Indonesian archipelago, the Philippines, Japan, the Kuril Islands, and the Aleutians, as well as other arc-shaped geomorphic features, such as the western coast of North America and the Andes Mountains.

EARTHQUAKES: RING OF FIRE

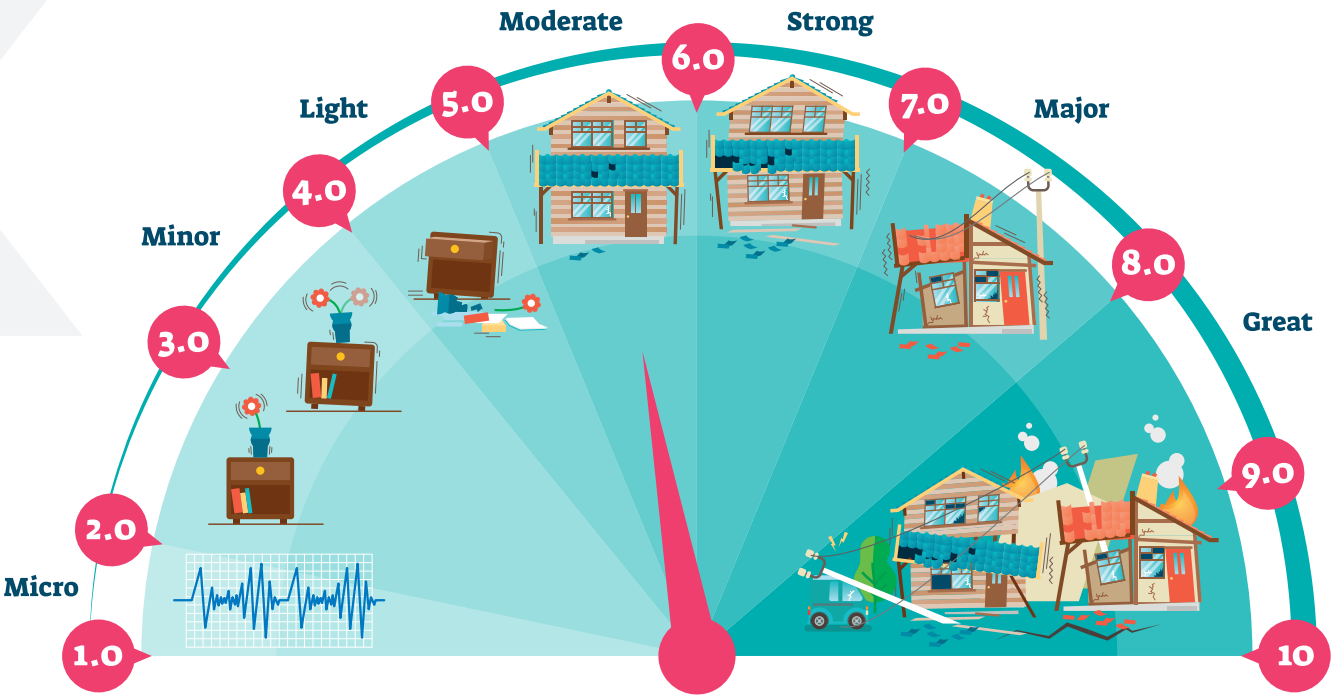
The area encircling the Pacific Ocean is called the "Ring of Fire," because its edges mark a circle of high volcanic and seismic activity (earthquakes). Most of the active volcanoes on Earth are located on this circumference. On the periphery of the Pacific Ocean, the edge of the Pacific Continental Plate is expanding in the seabed, and is hitting the North American Plate, the Nazca Plate, the Eurasian Plate, and other plates, causing the margins of the plates to collide, buckle, and compress, causing earthquakes and volcanoes.

EARTHQUAKES: MAGNITUDE AND INTENSITY

The magnitude is a number that characterizes the relative size of an earthquake. Magnitude is based on a measurement of the maximum motion recorded by a seismograph. Local magnitude (ML), commonly referred to as "Richter magnitude", is most commonly used.

The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded by seismographs. On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. For example, a magnitude 5.3 might be computed for a moderate earthquake, and a strong earthquake might be rated as magnitude 6.3. Because of the logarithmic basis of the scale, each whole number increase in magnitude represents a tenfold increase in measured amplitude; as an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

The intensity is a number describing the severity of an earthquake in terms of its effects on the earth's surface and on humans and their structures.



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TSUNAMI

A series of waves (with long wavelengths when traveling across the deep ocean) that are generated by a displacement of massive amounts of water through underwater earthquakes, volcanic eruptions or landslides. Tsunami waves travel at very high speed across the ocean but as they begin to reach shallow water they slow down and the wave grows steeper.

VOLCANIC ACTIVITY

A type of volcanic event near an opening/vent in the Earth's surface including volcanic eruptions of lava, ash, hot vapour, gas, and pyroclastic material.

Volcanoes are associated with the Circum-Pacific Belt throughout its length; for this reason it is called the "Ring of Fire." A series of deep ocean troughs frame the belt on the oceanic side, and continental landmasses lie behind. Most of the world's earthquakes, the overwhelming majority of the world's strongest earthquakes, and approximately 75 percent of the world's volcanoes occur within the Ring of Fire. (See Section on Earthquake)

FLASH FLOOD

Heavy or excessive rainfall in a short period of time that produce immediate runoff, creating flooding conditions within minutes or a few hours during or after the rainfall.

EVACUATION AND WHAT TO BRING (GRAB-BAGS)

ESSENTIAL ITEMS	USAGE
Torchlight without batteries	In case of power outage and when evacuating in the dark.
Batteries	In case of power outage and when evacuating in the dark.
Essential personal medication	For any existing medical condition of yours and your family, e.g. asthma, heart problems etc.
Waterproof folder containing photocopies of important documents	For administrative purposes should the original documents be destroyed in the fire.
Whistle	To call for help or alert others; shouting may be tiring, ineffective and may even cause you to inhale dangerous amounts of smoke and dust in some cases.
First aid kit	To treat any minor injuries.
Childcare supplies and other special care items	To meet the needs of any special individuals in the family, e.g. infants.
N95 Mask	To protect you and your family from excessive exposure to from pollutants and air-borne infections.

Reference: Table from Singapore Civil Defence Force, "Civil Defence Emergency Handbook", 8th Edition. 2016. Accessible at https://www.scdf.gov.sg/docs/default-source/scdf-library/publications/publications/5372-scdf-emergency-handbook(eng)_edited_11_6_2019.pdf.

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