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United Nations
Interregional Crime and Justice
Research Institute

A Prosecutor's Guide to **Chemical and Biological Crimes**



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INTERNATIONAL
ASSOCIATION OF
PROSECUTORS

A PROSECUTOR'S GUIDE TO CHEMICAL AND BIOLOGICAL CRIMES



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United Nations
Interregional Crime and Justice
Research Institute

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A Prosecutor's Guide to **Chemical and Biological Crimes**

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Foreword



The world we currently live in is complex and ever changing. Criminal entities are responding to evolving threat landscapes and advancing technology with ease, presenting a multitude of challenges to those who investigate and prosecute crime. Particularly challenging crimes involve the deliberate acquisition and use of hazardous chemical and biological agents to cause harm to humans, animals, the environment, or to disrupt our way of life.

Chemical and biological agents have often been used deliberately to harm human beings and the surrounding environment. For example, the world was shocked by the deliberate use of mustard gas on civilians in the town of Halabja in northern Iraq in the 1980s, repeated in Damascus some 25 years later; the deliberate dispersal of nerve agent Sarin in the Tokyo subway by the domestic cult group Aum Shinrikyo in 1995; and the deliberate distribution of letters containing biological anthrax spores sent to individuals in the United States in 2001. Between 2013 and 2017, we again experienced the deliberate use of chemical weapons on civilian targets in Iraq and Syria, impacting the civilian population, and in 2017, the deliberate use of toxic chemicals at the Kuala Lumpur international airport, followed one year later

by the use of another chemical agent in the United Kingdom. These cases confirm the need to increase awareness and skills related to the investigation and prosecution of chemical and biological crimes.

Multi-agency coordination and cooperation is essential for the successful investigation and prosecution of these criminal cases. The chemical, biological, radiological and nuclear (CBRN) world is full of technical and scientific terminology, procedures, and regulations. Prosecution teams need an increased appreciation of the challenges and greater insight into the key considerations related to CBRN crimes.

UNICRI, in close cooperation with its international partners and stakeholders, has identified the need to advance guidance in this field. To this end, the Institute brought together international and regional subject matter experts with relevant experience in the CBRN domain as well as senior prosecutors and trial attorneys, to develop this first edition of the Prosecutors Guide to Chemical and Biological Crimes.

This Guide aims to provide police, prosecutors, and relevant investigative agencies with guidance to support the successful prosecution of incidents involving the deliberate acquisition, stockpiling, production, transfer, or use of a chemical or biological agent. It is a non-binding high-level guidance document with considerations across key elements associated with the deliberate use of chemical and biological agents and toxins and the impact of these elements on the prosecutorial process. This guidance builds foundational awareness from which additional phases, including practical training for prosecutors, can be developed and implemented.

We are thankful to the European Commission for funding the production of this Guide within the framework of the European Union Chemical, Biological, Radiological and Nuclear Centres of Excellence Initiative (EU CBRN CoE). The request to produce such guidance came as a result of implementing two projects in Southeast and Eastern Europe aimed to enhance the CBRN forensic capabilities of its partner countries. We are committed to listening carefully to the needs and priorities of our Member States and addressing them through the development of sustainable programs, including the delivery of theoretical content, tailored training, educational videos, and e-learning platforms.

We are confident that this Guide will provide opportunities for strengthening the knowledge, systems, and frameworks from which we strive to support investigative agencies and prosecutorial teams in their quest for justice.

Antonia Marie De Meo
UNICRI Director

Introduction



Global risk reports draw attention to the ever-changing threat landscape both natural and deliberate in scope. Changes in political history, technology, and social networks, have facilitated the abilities of individuals and criminal networks to operate, procure funding and develop capabilities at a rapid pace. Technological advances have increased the efficiencies of information management, communication, and intelligence. To increase impact, violence or social cause, criminals have, and may continue to, explore tools which may include chemical or biological weapons.

The deliberate and malicious use of chemical or biological agents within a civilian environment, requires planning, organisation, communications, and may involve interactions with several entities, potentially across a number of regions and countries. These types of crimes are complicated by the dual-use nature of equipment and industries, and by the ease of acquisition for a number of high-risk chemicals, biological pathogens and toxins.

Successfully managing this type of threat requires effective and efficient intelligence-gathering, investigation, and prosecution. This relies heavily on the identification of key agencies, their roles and responsibilities, escalation pathways and information

sharing protocols. It is important to acknowledge the various inter-agency dependencies, such as those that exist between major crime investigative teams and forensics services, and the need for increased awareness and experience in detecting, investigating, and reporting triggers and indicators of chemical and biological threats that may be linked to criminal activity.

Early identification by investigating officers of indicators of chemical and biological crimes, requires an understanding of their core characteristics and how they might be manipulated to cause harm. The protection and preservation of evidence and rapid assessment is also paramount to successful prosecution as such evidence can be transitory or easily damaged. In addition, the evidence itself can be harmful, posing challenges for response teams, given the nature of these infectious or toxic agents.

Early notification of the potential presence of a biological or chemical crime will afford the prosecution team valuable foresight to achieve success. Early interaction with the prosecution team can ensure the elements of each offence are obtained, supporting evidence secured, and intelligence gathered, to assist in preventing future incidents of this nature.

Fundamental to early identification of such crimes is the understanding of the lifecycle of a biological or chemical crime; this can assist the prosecutor to focus on key moments within the lifecycle to prove knowledge, planning, capability, possession, transportation and if required dissemination.

Crucial to successful prosecution is also the interoperability between national policing bodies, intelligence agencies, and the prosecutorial teams. Strengthening cooperation among these

national bodies will increase the likelihood that perpetrators of such crimes may be prosecuted along any point of the chemical or biological crime lifecycle.

Due to the nature and complexity of these crimes, it is likely that outreach and assistance from international bodies will be required. This may be due to the requirements for expert advice, international investigative support, specialist laboratory analysis, or provision of resources. Strengthening awareness of the roles and resources that international bodies such as, INTERPOL, EUROPOL, EUROJUST, OPCW, UN Organisations, IAP and the EU CBRN Centres of Excellence may provide timely support.

Strengthening the cooperation between police and prosecution agencies and expanding awareness and knowledge in relation to chemical and biological threats will provide a strong basis for prosecutorial success.

01. **Purpose**

By comparison to other major complex crime, the investigation and prosecution of incidents involving the deliberate misuse of chemical and biological materials and agents is considered infrequent. However, the threat to acquire, produce and disseminate these hazardous materials to cause harm, has not wavered. Lack of sufficient awareness and experience by both investigative agencies and prosecutorial teams has resulted, in some cases, in the loss of critical evidence required for successful prosecution of identified perpetrators.

The purpose of this document is to provide police and civil prosecutors, and relevant investigative

agencies, with guidance to support the successful prosecution of incidents involving the deliberate use of a chemical or biological agent.

The guidebook aims to provide awareness and insight into the current and emerging challenges related to the investigation and prosecution of such crimes.

02. Scope

This document provides high-level insights and considerations across key elements, associated the deliberate acquisition, production, storage and use of chemical and biological agents and toxins, for nefarious use or misuse, and the impact of these elements on the prosecutorial process.

The publication assumes that an investigation has been initiated and that there is sufficient evidence of intent to cause harm through the deliberate acquisition or misuse of a chemical or biological agent. While the guide is intended primarily for prosecutors, the nature of their work crosses over with some elements of the police or other agency's investigation and therefore some elements of the investigation by those agencies is mentioned.

States requiring guidance on other types of crimes which may be linked to chemical or biological materials, such as (theft and fraud), are encouraged to refer to the published references provided in the Appendix.



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Challenges of

Chemical and Biological Agents

01

CHAPTER ONE

01

Key Focus Area

Basic overview of chemical and biological agent characteristics

02

Interaction required between health, security, and legal agencies

03

The challenges of dual use industries and technology

The impacts of the accidental or intentional release of biological and chemical materials, through industrial accidents, environmental disasters, and individual negligence, crime, and terrorism have been experienced all over the world. Naturally occurring outbreaks and emerging diseases have caused significant impacts to human life, trade, transport and tourism and the global economy, and been the focus of a number of global initiatives.

This chapter aims to provide a basic overview of the unique characteristics and behaviours associated with high-risk chemical and biological agents and the factors that may influence the investigation and prosecution of such crimes.

The deliberate misuse of chemical and biological material to cause harm, damage, or destruction, to people, animals, property, or the environment, generates unique and complex challenges to investigative and prosecutorial bodies.

Perpetrators may be individuals, groups or state actors. They may be motivated by different political, religious, cultural, social, or financial agendas, and each actor(s) intent and capability to conduct such a crime will be determined by the level of technical knowledge, equipment and sophistication in planning and execution.

Advances in technology have served the global population well in recent years with the rapid development of medical, material and social technology, however, this guide will also highlight that such technologies can also be appropriated for nefarious purposes or 'dual use'.

It is strongly recommended that any legal entity seeking to prosecute perpetrators of such crimes has some specialist knowledge

related to chemical and biological crimes including an understanding of how they could be sourced, adapted, and potentially used as a weapon. In addition, a deeper understanding of how national legislation may be linked to certain elements of such crimes is essential.

The complexity of such crimes is influenced by several factors many of which pose great challenges to their successful prosecution. This chapter aims to draw focus to some of these challenges.

Chemical and Biological

Agent Characteristics

01. Chemicals A hazardous chemical is a material substance or compound that poses a health or physical hazard due to its toxicity levels, sensitising, corrosiveness, incapacitating, oxidative, water reactive, flammable, explosive, psychometric and pharmaceutical characteristics. Chemicals vary greatly in their level of toxicity, degree of symptoms and level of danger depending on the chemical composition, state, and concentration.

Chemicals can be in the form of a solid, liquid or gas, with exposure to gases and aerosols of particular concern.

02. Toxic Industrial Chemicals Toxic Industrial Chemicals (TICs) are legitimately manufactured, stored, transported and used throughout the world. While thousands of chemicals provide numerous industrial benefits, many are classified as hazardous and require specific

and safe handling, transportation, and storage to reduce the risk of serious health or environmental impacts.

These industrial type chemicals can be in a gaseous, liquid or solid state. They can be classified as carcinogens, reproductive hazards, corrosives, or may affect blood or lung function. In addition, many of these chemicals have hazardous physical properties which may result in the chemical being, flammable, combustible, reactive or explosive.

The classification and regulation requirements surrounding hazardous chemicals are described in the Dangerous Goods Acts and Regulations implemented by government nations. Examples include, the Economic Commission for Europe, Recommendations on the transport of Dangerous Goods: Model Regulations and the International Carriage of Dangerous Goods by Road and Waterways and Rail. In addition, the International Air Transport Association (IATA) participates in the development of the International Civil Aviation Organisation (ICAO) Technical instructions on transporting dangerous goods by air.

A chemical warfare agent (CWA) is a toxic chemical and their precursors, munitions, and dissemination devices, specially designed to cause death or other harm through the toxic properties of those chemicals.:

03. Chemical Warfare Agents

- Nerve agents
(examples: Tabun, Sarin, Soman, VX)
- Blister agents (examples: Sulfur Mustard, Nitrogen Mustard, Lewisite)
- Choking agents (examples: Phosgene, Diphosgene, Chlorine, Chloropicrin)
- Blood agents (examples: Hydrogen cyanide, Arsine)

Exposure to chemical warfare agents generally results in rapid onset of signs and symptoms, with the exception of mustard gas exposure which has delayed onset of symptoms. The timing and nature of symptoms will be determined based on the chemical properties, the concentration of the chemical and exposure time.

04. Chemicals of Security Concern

The Chemical Weapons Convention, known as the 'Convention on the Prohibition of the Development, Production, Stockpiling and use of Chemical Weapons and on their Destruction', came into effect in 1997. The Convention requires States parties to adopt laws that prohibit individuals, companies, or groups, from undertaking any activity prohibited by the Convention on their territory. States parties to the Convention are also required to establish a National Authority to implement the provisions of the Chemical Weapons Convention by facilitating inspections, implementation of national legislative and administrative functions."



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The ability to halt the acquisition and use of high-risk chemicals commences at the national level through active and effective collaboration and interaction between a range of authorities. The following table displays some examples of relevant agencies and their potential roles.

Table 1:
**GOVERNMENT AND INDUSTRY AGENCIES LINKED
TO CHEMICAL PROTECTION.**

01. Military

Prohibit CWA's.

Review weapons and warfare tactics.

Monitor and seize old military stocks.

Provide CBRN Defense response teams.

02. Police

Monitor triggers from industry or individuals.

Enforce national laws and regulations.

Specialist response teams.

03. Criminal Justice System

Establish laws that protects against risks and threats.

Set legal precedents.

Prosecute violations.

04. Customs & Chemical Industry

Restrict movement of scheduled chemicals.

Monitor supply, consumption and transfer of chemicals.

Liaise with industry groups.

05. Government

Provide governance frameworks.

Facilitate OPCW inspections.

Protect restricted information.

Cooperates with other States parties to reduce proliferation.

Key Considerations for Chemical agents:

▶ Synthetic compounds, pure or mixtures

▶ May require acquisition of chemicals and chemical precursors and equipment including, personal protective equipment, to produce required quantities

▶ Exposure through dermal (mucus membranes ocular), inhalation, ingestion, or injection

▶ Rapid onset of symptoms (examples include, coughing, salivation, convulsions, blurred vision, possible skin irritation)

▶ Not transmissible (unless through secondary exposure via contaminated people or materials)

▶ Chemicals range in toxicity levels whose impact is dependent on concentration, quantity, exposure time and other characteristics

05. Categories of Chemical

High risk chemicals presenting a risk to national security, through their inappropriate or illegal acquisition, production, or use, fall into these main categories:

- Toxic Industrial Chemicals (TIC's)
- Chemical Warfare Agents (CWA)
- CWA Precursors
- Explosive Precursors
- Other chemicals of concern (example: fentanyl)




The following tables provide a representative short list of chemicals that pose immediate health, environmental and economic impacts through exposure or release, with potential for long term consequences. Risks associated with the exposure to chemicals is directly proportional to the toxicity of the agent and duration of exposure. The US National Institute for Occupational Safety and Health (NIOSH) provides a category of chemicals whose exposure is likely to cause death or immediate or delayed permanent adverse health effects as 'immediately dangerous to life or health' (IDLH).

It is important to note that the presentation of chemical and biological material including, form, particle size and colour, will be dependent on the

production materials, additives and methodology utilised. In some cases, these qualities may be purposefully altered by the perpetrator, creating challenges for investigating bodies.

Therefore, the characteristics, colours and forms presented in the following tables are a guide.

Table 2:
EXAMPLES OF TOXIC INDUSTRIAL CHEMICALS

Toxic Industrial Chemicals		
Common Chemical Name	Properties	Toxicity (IDLH) ppm (parts per million)
Ammonia	Colourless, corrosive liquid with pungent odour	300 ppm 
Chlorine	Greenish-yellow gas at room temperature, suffocating odour	10 ppm 
Formaldehyde	Flammable, colourless gas at room temperature, pungent, irritating odour, soluble in water	20 ppm 

Hydrogen sulfide

Flammable, colourless gas at room temperature, corrosive, explosive, soluble in water

100 ppm



Organophosphate insecticides

Used primarily within the agricultural industry. Solids and liquids, several highly toxic.

Varying toxicity. Impacting nervous system.

Table 3:
EXAMPLES OF CHEMICAL WARFARE AGENTS

Chemical Warfare Agents

Common Chemical Name	Properties	Toxicity	Persistence
Nerve agent (e.g. Sarin and VX)	Liquid or solid at room temperature, low odour levels, vapour is heavier than air.	LD ₅₀ ~0.07-25 mg/kg; LCt ₅₀ ~15-70 mg·min/m ³	Ranges from volatile to persistent
Blister Agent (e.g. Sulfur Mustard)	Oily liquid, with colour varying from colourless to yellow to brown. Colourless vapour. Garlic/onion odour.	LD ₅₀ ~10-100 mg/kg; LCt ₅₀ ~900-3000 mg·min/m ³	Generally persistent

Blood agent (e.g. hydrogen cyanide)	Flammable, colourless gas. Has a rotten egg odour. Is heavier than air.	LD ₅₀ ~100 mg/kg; LCt ₅₀ ~5000 mg·min/m ³	Usually volatile in gaseous form, more persistent in solid form
Choking agents (e.g. Phosgene)	White to pale yellow gas at room temperature. Corrosive and highly toxic.	LD ₅₀ ~800 mg/kg; LCt ₅₀ ~3000-6000 mg·min/m ³	Volatile

Figures obtained from www.cdc.gov/niosh

Table 4:
EXAMPLES OF CHEMICAL PRECURSORS OF CONCERN

Chemical Precursors		
Common Chemical Name	CAS No.	Potential Misuse
Phosphorus oxychloride	(10025-87-3)	Explosives / CWA
Methylphosphonyl difluoride (DF)	(676-99-3)	Synthesis of sarin and soman (nerve agents)

Potassium cyanide

(151-50-8)

Precursor explosives,
CWA precursor

Thiodiglycol

(111-48-8)

Synthesis of mustard

Note: a CAS Registry Numbers (Cas RN® or CAS Number) is universally used to provide a unique numerical identifier assigned by the Chemical Abstracts Services for every chemical substance described in open scientific literature. For further examples and chemical compositions refer to Appendix.

Other chemicals of concern

**Common Chemical
Name****CAS No.****Characteristics and
Usage**

Fentanyl

(437-38-7)

Odorless solid.
Pain medication, respira-
tory depressant, anaes-
thesia

SELECTED IMAGES OF TOXIC CHEMICALS:



Lewisite- amber coloured liquid



VX- orange coloured liquid



GB- clear colourless liquid



Mustard- pale yellow coloured liquid

06. Biological Agents

A biological agent is a living organism, or product from a living organism, including, fungi, bacteria, viruses, and biological toxins. While a number of these biological organisms can be beneficial to our bodies and the environment, a number of bacteria, biological toxins, and all viruses cause disease. Disease causing microorganisms are called pathogens.

Unlike chemical warfare agents, biological pathogens can be found in the environment within natural reservoirs including animals, soil, and water, with a number of high-risk pathogens considered endemic, 'a disease that is always present in a certain population or geographic region'. This means that the presence of certain bacteria or viruses may be found in the environment forming normal background level for that geographic area.

In addition to natural environmental reservoirs, several infectious diseases are zoonotic, meaning they can pass from an animal host to humans, often manifesting as a more severe illness within the human population. Zoonotic diseases are responsible for many emerging pathogens, with the emergence of novel viruses such as, Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS), creating new outbreaks, epidemics and pandemics leaving the vulnerable human population at risk of serious illness or death.

While a natural outbreak can be devastating to the community, the planned deliberate release of biological pathogens and toxins has the potential to cause significant impacts to human and animal health, the environment, and the economy. It is important to consider that not only can these pathogens be selected and utilised based on their natural morphology, but they may also be subject to genetic engineering, 'the artificial manipulation, modification, and recombination of genetic material in order to modify an organism's characteristics', such modification may include, changes to organism virulence, transmissibility, antibiotic resistance and target host.

In addition to the recognition and identification of unusual disease outbreaks, microbial forensics and determination of such manipulation may be one trigger for identifying a biological incident as accidental, natural or deliberate.

Key Considerations for Biological agents:

▶ Living organisms from varying sources (plants, soil, water, animal hosts, humans, laboratory samples)

▶ Can be endemic in certain countries (naturally found in that location in high levels)

▶ Requires acquisition of biological material and growth mediums to produce required quantities (some require living host to reproduce)

▶ Virulence, infectious dose and lethal dose are dependent on biological agent (fungi, virus, bacteria, toxin)

▶ May be produced or enhanced through synthetic biology

▶ Some infections can be transmitted from person to person, animal to person, or animal to animal (e.g., respiratory viruses)

▶ Exposure through direct contact with mucus membranes, inhalation, injection, or ingestion

▶ Many high-risk pathogens impact plants and animals (agroterrorism)

▶ Delayed onset of symptoms (depending on incubation period, infectious dose, or biological toxin concentration)

▶ Many high-risk pathogens are zoonotic (transmitted from animal to human)

07.
Biological
Agents of
Security
Concern

Biological agents of concern are pathogenic biological agents or highly toxic substances from a biological source. A number of these high-risk pathogens and toxins are now bound by national regulations and legislation, which aim to regulate the secure storage, possession, use and transport of security sensitive biological agents, to minimise the risk of use for terrorism or criminal purposes. For recognised States Parties, such regulatory schemes assist to build on a country's obligations under the Biological and Toxins Weapon Convention and the UN Security Council Resolution 1540.

Such regulatory schemes require all entities and facilities handling described agents to comply with regulations and overarching legislation such as the National Health Security Act, the Biological Security Acts and the Aviation and Transport Acts.

Each country will determine what category or tier level each pathogen and toxin is classified as, with majority of lists identifying security sensitive biological pathogens as Category A or Tier 1 pathogens.¹² These pathogens are the highest level of security concern based on level of interest by individuals and criminal groups, their characteristics, feasibility, such as ease of production and dissemination, and the impact of their use. In particular, these pathogens usually

1. <https://emergency.cdc.gov/agent/agentlist-category.asp>

2. <https://www1.health.gov.au/internet/main/publishing.nsf/Content/ssba.htm#list>

have a higher degree of morbidity and mortality as well as a high level of transmissibility, and treatment is usually limited.

Table 5:
EXAMPLE OF BIOLOGICAL AGENTS OF CONCERN

Bacteria			
Scientific Name	Disease	Characteristics	Source
<i>Bacillus anthracis</i>	Anthrax	Zoonotic, can produce bacterial spores that remain dormant, responds to antibiotics prior to release of bacterial toxins. Incubation 2-5 days. Not directly transmitted person to person.	Infected hooved animals, soil. Laboratory research facilities.
<i>Yersinia pestis</i>	Plague	Zoonotic, very small infectious dose. Treated with antibiotics in early stages of disease. Can lead to pneumonia. Incubation 2-6 days. Pneumonic plague can be transmitted person to person.	Infected rodents and fleas. Laboratory research facilities.

<i>Francisella Tularensis</i>	Tularaemia, Rabbit fever	Zoonotic, small infectious dose, treated with antibiotics. Incubation 1-21 days. Not directly transmitted person to person.	Ticks, rabbits, deer fly. Laboratory research facilities.
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Viruses

Scientific Name	Disease	Characteristics	Source
Variola virus	Smallpox	Human Orthopoxvirus, small infectious dose 10-100 particles. Inhalation or direct skin contact. Highly transmissible between humans. Vaccine available for some military and civilian use. Supportive care.	Research stocks in two nominated laboratories- USA and Russia. Last known case in humans was in 1978. The WHO declared smallpox eradicated in 1980.

Ebola virus	Ebola	Filovirus, small infectious dose, with large fatality rate. Transmitted between humans via direct contact with infected bodily fluids. Incubation 2-21 days. Vaccination available in high-risk countries. Supportive care.	Unknown: Animal source (bats as potential intermediate host). Laboratory research facilities.
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Viral hemorrhagic fever viruses	Marburg Lassa	Filo virus, small infectious dose, with large fatality rate. Transmitted between humans via direct contact with infected bodily fluids. Incubation 2-7 days. Supportive care only.	African fruit bat. Animal host (monkeys).
--	------------------	--	--

Rinderpest virusRinderpest
(in cattle)

Considered deadliest cattle disease in history. Recovered animals had lifelong immunity.

Incubation 3-15 days.

Effective vaccine.

Animal disease only/ agricultural concern).

Recently eradicated virus causing disease in cattle and other ruminants.

Laboratories worldwide maintain stock cultures.

Foot and mouth disease virusFoot and Mouth Disease
(FMD)

Viral disease in livestock.

Incubation 2-14 days.

Effective vaccine.

Hooved animals, soil, environment.

(animal disease only/ agricultural concern).

Laboratory/ research facility.

Biological Toxins

Common Name	Characteristics.	Source
Botulinum toxin	<p>Neurotoxin produced by bacteria.</p> <p>LD50 1 ng/kg (toxic amount is therefore dependant on body weight of person).</p> <p>Requires supportive therapy, unable to be treated with antibiotics.</p> <p>Intoxication dependant on concentration and route of exposure.</p> <p>Average time to symptoms hours- days.</p>	<p><i>Clostridium botulinum</i> bacteria; environmental microorganism.</p> <p>Pharmaceutical Botox.</p>
Ricin	<p>Toxin produced by Castor bean plant. Supportive therapy only.</p> <p>Intoxication dependant on concentration and route of exposure.</p> <p>Average time to symptoms hours to days.</p>	<p>Castor bean plant/ seeds extraction.</p> <p>May be purified using laboratory methods.</p>

Abrin

Toxin produced by rosary pea plant. Intoxication dependent on concentration and route of exposure. Average time to symptoms hours to days.

Rosary pea plant; jequirity pea plant seeds/extraction. May be purified using more advanced laboratory methods.

SELECTED IMAGES OF BIOLOGICAL PATHOGENS AND TOXINS:



A petri dish culture of *Bacillus anthracis* (Anthrax)



Caster bean seeds from which Ricin is extracted

Location and Delivery Mechanism

The impact of a deliberate release of a chemical or biological agent depends on a number of variables related to the location, form and mechanism of dispersion as well on the unique characteristics of the agent, such as volatility and persistence. These variables can provide linkages to the perpetrator's intention, intellectual and physical capabilities, and sophistication of equipment.

Announced and Open Use of a Chemical or Biological Agents

Description: An open type of incident which appears as an obvious criminal act. Initiates response by emergency services to an identified scene. Results in activation of specialist response and investigative teams.

The aim is to contain the threat, reduce impacts, and prevent further attacks.

Chemical examples: Release of toxic chemicals resulting in immediate signs and symptoms. Sabotage at chemical production facilities for TIC's.

Biological examples: Suspect package with announced threat or indicator of biological exposure.

Unannounced or Hidden Use of a Chemical or Biological Agents

Description: An incident which is disguised or hidden, and which may include, delayed onset of signs and symptoms. May be detected initially through the public health system, or environmental agencies post notification of or discovery of crime scene evidence.

As time has passed since release or criminal act, the extent and geographic distribution of the crime scene is relatively unknown.

Activation of responding agencies and investigative teams is delayed.

Chemical examples: Chemical agents with delayed onset of symptoms, concealed chemicals, environmental contamination, slow release of chemicals into soil or water systems resulting in dead animals or damaged crops.

Biological examples: Food contamination and release of high-risk pathogens (human, animal, or plant), via aerosol, whose incubation times allow for delayed detection, signs and symptoms. (Likely identified through public health system after symptoms appear).

Regardless of the overt or covert nature of the crime and methodology of release (explosives device, handheld deployment, aerosol generator), the characteristics of the selected agent including, particle size, density, volatility, and viability, will be crit-

ical considerations for investigating bodies as the investigation and prosecution proceed.

The location of the release will be a critical factor in assessing the likely severity, in terms of potential human exposure, geographic size of potential crime scene, and decontamination requirements.

The release of hazardous chemical and biological substances in an indoor setting may be affected by several factors. The following provides some examples for consideration.

There are numerous scientific studies related to the calculation and potential distribution of chemical and biological threat agents indoors. These studies have indicated that indoor release of a chemical or biological materials may result in higher exposure than the same release outdoors. This is due to the fact that indoor spaces have a confined area, lower air volume and limited ventilation with potential for close contact occupancy. Indoor release does not have outdoor environment factors, such as wind that may dilute the concentration or disperse a threat plume.

01. **Indoor release**

The flow of air through the building

Air conditioning flow and HVAC systems, including temperature control.

Open doors and windows.

The configuration and size building footprint and nature of its contents

Single storey versus multiple levels.

Open floor space versus separate offices.

Hard surfaces and materials versus soft furnishing and carpet.

Human movement throughout the building post release

Common areas and movement of people during the release.

Cross contamination of items as people move items from an area of high contamination to low contamination.

People closest to the point of release of high concentrations of the chemical or biological material may be at increased risk of exposure and illness.

These factors may contribute to the potential impacts of a deliberate release including, distribution and spread of the material, the level of environmental contamination, and estimated levels of exposure. The following diagram provides an example of factors that influence an indoor release.

Graphic 1: INDOOR RELEASE AND FLOW OF AIR CONSIDERATIONS

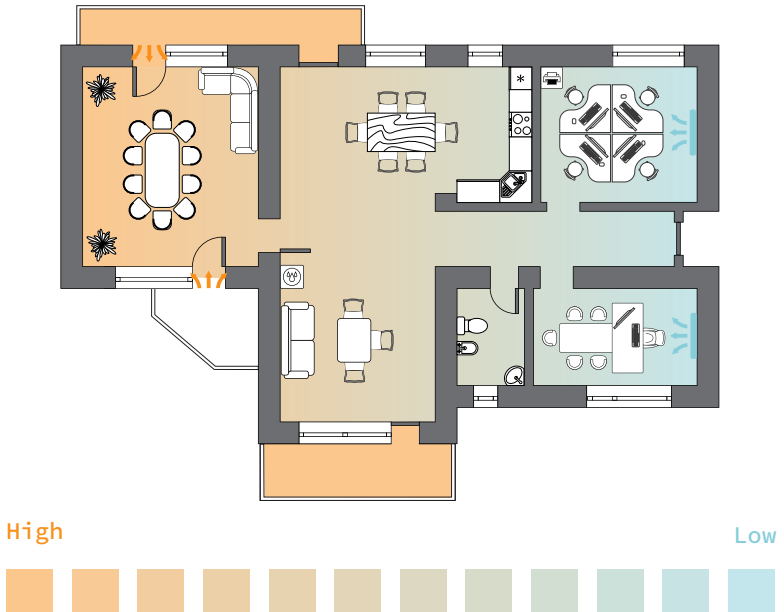


Image UNICRI | Hazardous particles released from an initial air-conditioning unit release moves through the office area. Particle concentration moves from HIGH to LOW varying depending on office configuration and human movement.

By comparison, the release of a chemical or biological substance in an outdoor setting poses different risks and challenges to the investigative bodies and can be influenced by the following factors.

02. Outdoor release

The topography of the landscape

Open fields versus city landscapes.

The gradient of the land, presence and concentration of flora, presence and size of buildings, will result in air flow and ambient temperature changes.

The amount and concentration of active or viable material during and post dispersion

The potential impact of an outdoor release will be influenced by the amount of active chemical or viable biological substance that is successfully disseminated. This amount may dramatically degrade post release as they are exposed to the elements.

The meteorological conditions

Aerosolised particles, liquids and gases can all be affected by ambient conditions including weather, air temperature, humidity, wind speed and direction.

Regardless of the location of release, the risks associated with exposure and potential harm from that exposure will depend on a number of variables, including but not limited to, the con-

centration of the agent in the environment, the size of respirable particles, the length of time the particles are airborne, the amount of time a person is exposed to the particles, the persistence of the agent in the environment and the risk of secondary post release aerosolisation.

Graphic 2:
OUTDOOR RELEASE AND TOPOGRAPHY
CONSIDERATIONS



Image UNICRI | Aerosolised release of hazardous particles move through an urban environment. Particle concentration and viability varies depending on topographical changes, weather conditions, and human movement.

Health and Security Interface

Regardless of the type of agent or nature of the chemical or biological crime, the investigation and prosecution process will require interaction and coordination between the investigative bodies and public health agencies. Whether overt release or covert, pre-crime or post-incident, the need to acquire and share information between organisations will be invaluable to the building of a case for prosecution.

Response to recent epidemics of Ebola virus disease in 2014 and Zika virus in 2016, saw the activation of significant regional and public health resources to identify outbreaks, contain the spread and treat those infected. The 2014 Ebola outbreak was the first time this viral haemorrhagic fever spread outside the endemic areas of West Africa. This event increased cultural disparity, speculation, and fear, and saw a significant increase in social disorder.

The Zika epidemic of 2015/16 saw widespread transmission of the virus in the Americas, Puerto Rico and the U.S. Virgin Islands. This outbreak coincided with the 2016 Olympic Games in Rio and resulted in levels of social disruption and fear. These natural outbreaks required the mobilisation of several law enforcement and security agencies, to maintain public safety and order, and support a variety of public health operations.

The deliberate use of chemical weapons in Syria and Iraq, between 2013 and 2017, required the activation and deployment of security forces (law enforcement, military), and public health officials (local health agencies and response teams from the World Health Organisation), as part of the investigations.

More recently, the 2019 COVID-19 pandemic has again seen the deployment of law enforcement and security services at border crossings, quarantine facilities, and to assist with the enforcement of public health and social measures aimed to contain the spread.

These incidents have demonstrated the need for greater inter-agency connectivity, increased awareness of roles and responsibilities, and the benefits that each can provide for public health, public safety and security.

The World Health Organisation established the Biorisks and Health Security Protection Unit, who, as part of their programme, provide capacity building opportunities and guidance to assist Member States in managing health and security sectors interface, whether natural accidental or deliberate in nature.

The deliberate use of chemical and biological agents impacts the health and safety of people and animals. Early collaboration between public and animal health, security and legal teams can provide an opportunity for the identification of risks and mitigation strategies. A deeper understanding of the roles and responsibilities of each entity can ensure that critical evidence is preserved, data and information is shared, and challenges discussed, across each phase of the investigative lifecycle. Strengthening these interactions prior to an event, will strengthen response and potential prosecutorial success to such crimes. Several types of entities have a cognisant role to play in the health security interface (figure in the next page). Public health, animal health entities, veterinarians, and laboratories play an important role in health. Security related entities include law enforcement and the military. Representatives from each of these disciplines will work together in incidents involving chemical and biological materials.

Health and Security Interface Entities

Public Health

Military / Civil Defence

Law Enforcement

Veterinarian Associations

Laboratories

Dual Use Industries and Advancing Technologies

One of the core challenges surrounding the deliberate misuse of chemical and biological agents is the ease of acquisition of some of the materials and equipment required to produce, transport, store and disseminate these threat agents.

Many of the items are dual use in nature and can be found within legitimate industries, such as chemical production plants, micro-breweries, pharmaceutical, agricultural and farming industries. These legitimate industries are linked to thousands of legitimate supply chains and have access to a range of dual use equipment.

Dual use equipment is defined as: materials and equipment with legitimate application and use, that can also be used nefariously. This includes the potential for equipment and technologies de-

veloped for commercial or civilian use to be used for the development and application of military components related to weapons of mass destruction or their means of delivery.

For example, the same biological agents and equipment used in the production of antibiotics and vaccines could be misused to alter and increase a biological pathogens transmissibility or antibiotic resistance.

As for chemical agents, the same chemical used in the production of agricultural pesticides could be misused as a chemical precursor for a potential nerve agent.

The difficulty with limiting access of certain equipment and some chemicals, used across both biological and chemical production, is that many are easily acquired from legitimate facilities including pharmacies, hardware stores and gardening and agricultural stores.

In addition to dual use industries there are also institutes, universities and agencies undertaking research across a number of high-risk chemical and biological materials. Such research provides insight into the characteristics, properties and behaviours of these materials, effective treatments, personal protective equipment, and defensive counter measures.

Dual use research of concern (DURC) is defined as “life sciences research that, based on current understanding, can be reasonably anticipated to provide knowledge, information, products, or technologies that could be directly misapplied to pose a significant threat with broad potential consequences to public health and safety, agricultural crops and other plants, animals, the environment, materiel, or national security.”

This dual use aspect causes significant challenges regarding legitimate use in industry, research, and education as well as providing control measures to prevent misuse.

Recognition of and distinguishing between deliberate versus accidental misuse are particularly challenging as frequently the only difference is intent. This can be particularly challenging when an incident is thought to arise in a legitimate setting, such as a laboratory or pharmaceutical production facility.

Investigators and prosecutors should build a baseline with a full understanding of these dual use challenges, to realize the potential for misuse, thereby identifying the relevant intelligence needed to build a case against the potential perpetrators.

The following examples are described:

- Synthetic Biology
- Materials Science
- Digital Technology

The rapidly growing industry and services associated with new technologies provide many benefits but may enable criminal activities.

The following provides insight into some examples of dual use materials, equipment, and industries.

01. Synthetic Biology

The scientific field of Synthetic Biology or Syn-Bio is the application of engineering principles to biology. This rapidly expanding field brings together multiple disciplines across biological sciences, computer science, engineering, and social science. It aims to utilise biological organisms to produce or synthesise new biological components, devices and biological systems through the design and alteration of DNA- components.

This rapidly expanding technology has a wide range of applications across food, agriculture, health and manufacturing.

Recent applications of such technology include development of enhanced plant proteins for inclusion into plant-based meat replacement products; engineering to improve resistance to plant disease and improve crop yield, reducing land space and use of synthetic fertilisers and insecticides.



Gene Editing Platforms

Gene editing technology enabling specific genes to be switched on and off. Can be applied to living organisms.

Examples include CRISPR-Cas associated nucleases (CRISPR-Cas).

Transcription activator-like effector Nucleases (TALENs).

Zinc-finger Nucleases (ZFNs).



Molecular Engineering

Using technology to manufacture molecules.

Develop microelectronics.

Immunotherapy for oncology and autoimmune therapies.

Creation of antigen probes.



Biotechnology

Harnesses cellular and biomolecular processes to develop technologies and products.

Examples of use include, medical treatments, food preservation and flavouring, biodegradable products.

Dual Use Concerns

The ability to distinguish between permitted and prohibited activities is difficult. The same techniques used to gain insight and understanding into fundamental life processes have the potential to be utilised to manipulate and alter biological agents and related products, potentially masked under the legal framework such as scientific research. This dual use dilemma has triggered several national and international bodies to identify legitimate life research and technological applications.

Examples of potential misuse of applications include:

- Ability to render a vaccine ineffective;
- Bioengineering of microorganisms to enhance transmissibility;
- Confer resistance to therapeutically beneficial antibiotics or antivirals;
- Alter the host range of a pathogen;
- Enhance or enable weaponization of a biological pathogen or toxin.

02. Materials Science

Materials science is the combination of disciplines including, engineering, chemistry, information technology, manufacturing, and electronics. It provides innovation and development of new materials to provide advantages over traditional materials performance, quality, cost, or application. Advances in materials science has not only sped up the pace of industrial development, but it has also improved the quality of lives and influenced social development. When combined with material science, additive manufacturing, specifically 3-dimensional (3D) printing enable reproducible manufacture of equipment and various components.

For example, the evolution and advancement of 3D printing has seen the production of essential machine parts and fabrication of componentry into different materials (e.g., replacing metal with plastics), enabling replacement of critical parts and transport of potentially contrabanded items across borders more easily.

Remote-controlled vehicles such as aerial drones, land, and water vehicles, are available in a variety of options in terms of size, payload, range, and associated sensors and cameras. These devices have legitimate use in farming, advertising, surveillance, environmental monitoring, and security services. Many of these devices have been utilised by investigative agencies to monitor and detect changes in the threat environment.

Nanotechnology and robotics have seen significant advancement and application within the engineering, space, and medical industries, utilising nanotechnology to deliver targeted medications and robotics to conduct microsurgeries and perform tasks in restrictive environments. The increased application of such technology enhanced the accessibility of the parts and broaden the applications of their use by a wide range of industries and professions.

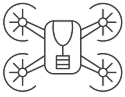
The challenge for investigative agencies and prosecutions teams is that the rate of material advancement has not been proportional to the rate of legislative changes, with many jurisdictions falling behind in the regulation and control of their use.



3D Printing

3D printing or additive manufacturing includes processes that deposit, join or solidify a three dimensional object through the layering of plastics, liquids or fused powders.

Portable and accessible).



Unmanned Aircraft Systems

Utilising UAS, such as drones, to perform surveillance and reconnaissance functions including swarming drones.

Applying sensors and detection devices for real-time monitoring.

Conducting aerial photography, digital mapping, monitoring crops/ animals.



Industrial Devices

Development of robotics.

Nanotechnology.

CBRN detection technologies.

Dual Use Concerns

The advancement of material technology has seen improvements in manufacturing, production, security, and medical industries. The likes of 3D printing, robotics and unmanned aerial devices has revolutionised materials science, reducing costs associated with manufacturing, increasing supply chain options, opening new production lines, and providing new platforms for intelligence and information gathering.

Yet, these technologies continue to present challenges to the agencies responsible for monitoring and regulating the legal acquisition and use of such technologies. The following provide some examples of potential misuse:

- The use of unmanned aerial systems (UASs) or Remote-Controlled Vehicles (RCVs)'s by perpetrators to conduct surveillance.
- Use of drones to disseminate chemical or biological materials.
- Combination improvised explosive device (IEDs), as seen recently in use by terrorists' groups acquiring and weaponizing commercially available drones with small IEDs to conduct attacks.
- 3D printing may provide opportunity for replication of componentry for weaponization of agents (e.g., microreactors that can synthesize chemicals).
- 3D printing weapons (maybe be used to protect clandestine laboratories or storage facilities).

03. Digital Technology Advancement

The advancement of digital communication has grown exponentially over the past 20 years. The provision of the Internet has allowed access to information at rapid speed and seen the connectivity of devices through the Internet of Things (IoT). It has expanded communication platforms, and created new outlets and options for virtual, live, and integrated communication, including the expansion of both media and social media applications.

Most individuals utilise the surface web, allowing to navigate systems, platforms, applications, send messages and emails, manage funds and make transactions. This makes up approximately 4% of the Internet. Most of the remainder is made up of the deep web, where commercial transactions take place in a more secure environment; electronic health records, email and chat messages, and audios and videos. The remaining small percentage is called the dark web (or dark net). This is a place on the Internet that can only be accessed with specific software, configurations, and authorisations, with activity difficult to identify and trace.

The advancement of sensors, software and other material technologies has resulted in the ability to connect devices and systems and exchange data over the Internet. This connectivity extends to the application of Artificial Intelligence (AI) which is linked to both machine learning and big data.

IT Infrastructure



Internet of Things (IoT) providing connectivity to digital systems and platforms.

Real-time access to information.

Access to deep web and the darknet.

Utilising alternate currencies (Bitcoin).

Artificial Intelligence



AI systems designed by humans that act in the physical or digital worlds by anticipating and interpreting the environment as data to achieve a goal.

Communication Platforms



Multiple social media platforms for real-time sharing of information, images.

Secured applications enabling sharing of confidential information, locations and resources.

Dual Use Concerns

Today's online world presents a myriad of possibilities for its misuse for malicious purposes related to chemical and biological crimes. The advancement of digital technology has enabled criminal groups to communicate, acquire information and materials, to recruit new members, and infiltrate digital systems for valuable data more easily.

The anonymous sharing of qualitative and quantitative data among individuals and groups on the darknet requires investigative agencies to have a deeper understanding of the potential triggers for investigation, and the development of key words and algorithms that can be applied to darknet.

The increase in secured online mobile applications and IT Infrastructure provides perpetrators with anonymous methods for monitoring the environment and preparing for crimes; online recruitment of new members; and access to valuable information and resources.

For this reason, it is necessary to build an understanding of current and emerging digital technologies and the risks and challenges they present to the investigation and prosecution of chemical and biological crimes.

- Planning and implementing the crime/attack by the use of communication apps, gaming platforms, and steganography apps.
- Use of bitcoin or other cryptocurrencies for illegal transactions.

The impact of the above-mentioned threats on individual processes within an investigation may be significant, as they force investigative agencies to continually monitor advancements and adopt changes in modus operandi. The rate of technological advancement is outpacing the rate of investigative flexibility and capability, requiring continued resourcing to ensure adequate financial and technology counter measures.

Dual-Use Monitoring

The deliberate use of chemical and biological agents to cause harm brings into question the dual-use nature of equipment and industries and the role in protecting nations from their misuse. Yet regulation and development of national policy is difficult to formulate to balance technological, human, and economic advances and potential risk to national and international security.

Three key challenges arise when considering the regulation of dual-use goods.

- **Dual-use goods have legitimate uses.** (Chlorine for example is an affordable commercial product with wide industry application. However, it can also be used as a chemical weapon).
- **Identification and classification of dual-use products can be difficult.** Assessment of the goods and determination of their use and legal and regulatory implications may require specialised knowledge.
- **The context in relation to the goods receipt or intended use.** The assessment of the information

related to the import or export of the materials and a goods may require expertise, to identify triggers and indicators of a regulatory breach.

Despite these challenges, governments and international bodies have sought to provide guidance and regulation, with jurisdictions committing to efforts to reduce risks and counter proliferation of chemical and biological weapons.

Dual-use goods are primarily regulated through an export control regime. These regimes assist countries to fulfil their obligations under the Chemical and Biological weapons Conventions and the UN Security Council Resolution 1540.

Most jurisdictions including, the European Union, the United Kingdom, Australia, the United States, and some countries of Asia, have proscribed dual-use goods that require prior authorisations and/ or licensing requirements. Goods and equipment are separated into several control lists and are regularly reviewed to ensure inclusion of advancing technology. An example of this was the recent inclusion, by the European Commission, of cyber-surveillance technologies to the expanded definition of dual-use items.

The effectiveness of any regulatory scheme is dependent on the provision of effective monitoring, enforcement and sanctions.

Control of trade or supply of such goods includes the requirements for specific information, licenses, prohibition of certain quantities and identification of sanctioned countries.

Global sanctions are influenced by the United Nations Security Council and implemented into domestic law. Some jurisdictions

also impose their own sanctions programs. Monitoring them may involve an international, regional or national party.

One example of an international monitoring regime is the Australia Group (AG). Initiated in 1985, the Australia Group is an informal forum of countries, including members of the EU, whose principal objective is to use licensing measures to ensure that exports of certain chemicals, biological agents, and dual-use chemical and biological manufacturing and equipment, do not contribute to the spread of chemical or biological weapons. Australia is the Secretariat of the Group, and all participants are States parties to both the Biological Weapons Convention (BWC) and the Chemical Weapons Convention (CWC). Participants of the Australia Group seek to enhance and harmonize national licenses and controls, with the primary objective to ensure the transfer of chemical and biological materials and equipment do not contribute to the proliferation of chemical and biological weapons.

All AG participants agree to require licenses for the export of the following categories:

- Chemical weapon precursors;
- Dual-use chemical manufacturing facilities and equipment and related technology and software;

04. International Level Regimes

- Human and animal pathogens and toxins;
- Plant pathogens; and
- Dual-use biological equipment and related technology and software



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AUSTRALIA GROUP COMMON CONTROL LISTS CATEGORIES

Chemical Weapons Precursors

Chemical Facilities, Equipment,
Technology, Software

Biological Equipment, Technology
and Software

Plant Pathogens

Human and Animal Pathogens
and Toxins

Whether through the Australia Group or another regime, the overarching objective to reduce the risk of entities supplying or contributing to the inadvertent supply of dual-use materials, equipment, technology, or software, for use in the manufacture of chemical and biological agents, should be in the best interest of governments, commercial entities, and research institutes.

05. World Customs Organisation

The World Customs Organisation (WCO) is an independent intergovernmental organisation with headquarters located in Belgium. The increasing occurrence and continued threat of terrorism and cross-border organised crime, requires enhancement of border control strategies and international cooperation. The WCO aims to enhance the effectiveness of Customs administration, for its 183 Customs administrators across the globe, by providing advice, regulatory process, and control monitoring. The WCO has established several initiatives which seeks to provide valuable information relative to the customs consignment.

For example, the Container Security Initiative, seeks to acquire and monitor export information related to the processing of good within shipping containers. The WCO Unique Consignment Reference (URC) provides an integrated tracing number which can be linked to transactions and transport data and the WCO's Revised Kyoto Convention requires all goods to be subject to Customs control. Statutory and regulatory provisions relating to the implementation, export, movement, or storage of goods, subject to regulations made by the Customs authorities under their statutory powers combine to increase the capability to monitor and manage compliance with Customs law.

06. Regional Level Regimes

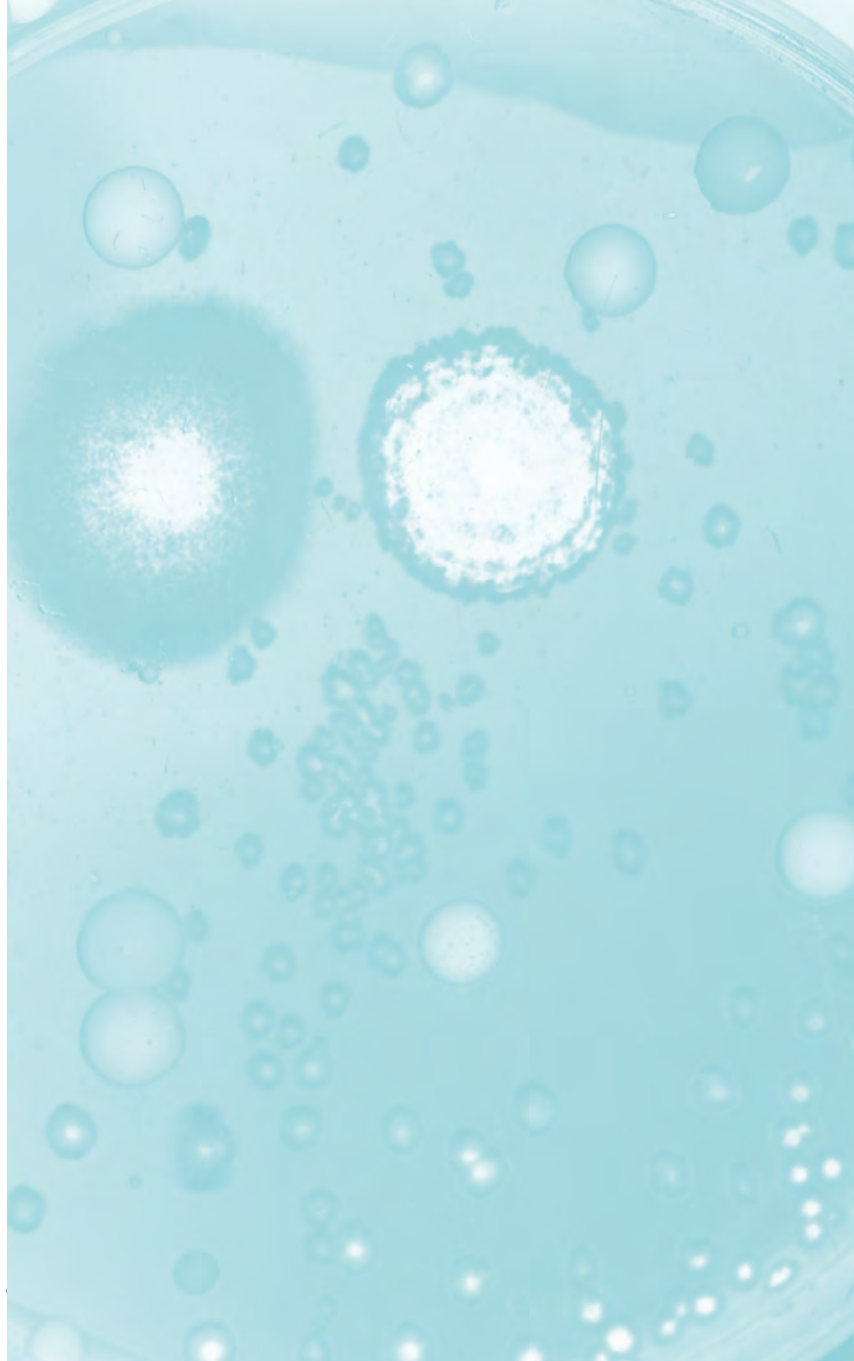
In support of, and in parallel to, international conventions and the role played by the Australia Group, is the European Union's Export Control Regime. This regulation aims to provide guidance and authorisations to Member States in relation to exports, licenses and prohibitions. The EU export control system was set up in the 1990's under the Regulation (EC) No 3381/94, with a number of subsequent amendments to strengthen the regime in light of technological advancements. One such amendment, Regulation (EU) 2021/821, of the European Parliament and of the Council, which replaces (EU) 428/2009 sets up a union regime for the control of exports, brokering, technical assistance, transit, and transfer of dual-use items that came into force September 2021. The regulation also includes a clause related to 'non-listed' items, which could be used, for examples, for military purposes, either partially or entirely.

The Regulation aims to ensure that in the area of dual-use items, the Union and its Members States take into account all relevant international obligations and commitments, relevant sanctions, national foreign and security policies, human rights and intended end-use and risk of diversion.

The following table lists the ten categories of agreed dual-use items subject to effective controls when exported from or in transit through the European Union, that can be delivered to a third country because of brokering services provide by or established in the Union. These categories include materials and agents other than chemical and biological agents.

EUROPEAN COMMISSION REGULATION CONTROL LIST CATEGORIES

- ▶ Nuclear Materials, Facilities and Equipment
- ▶ Special Material and related equipment
- ▶ Materials processing
- ▶ Electronics
- ▶ Computers
- ▶ Telecommunications
- ▶ Marine
- ▶ Navigation and avionics
- ▶ Aerospace and propulsion
- ▶ Sensors and lasers





Chemical and Biological

Lifecycle and Legal Variance

02

CHAPTER TWO

01

02

Key Focus Area

Basic overview of the lifecycle of chemical and biological crimes.

Legislative variance and potential categories.

Every crime has a particular lifecycle, from the preparation to the implementation. Understanding these elements within the context of a chemical or biological crime will enhance awareness and recognition of trigger points. Each element of a chemical or biological crime contains various triggers and indicators pertaining to the deliberate misuse of these agents and associated materials. The initiation of the prosecution process relies on early identification and notification by responding investigating agencies. Raising awareness about the early indicators may lead to the preservation and collection of evidence which may support the successful and timely activation of the prosecutorial process.

Prosecutors as well as police and intelligence agencies urgently need to understand the actions of perpetrators, which can serve as alarm triggers as well as evidence for the prosecution process.

- Understanding the lifecycle of such crimes and the possibility of early recognition, notification, and involvement of prosecutors.
- Awareness about the types of evidence that can be linked to each process.
- Understanding the potential categories of crimes related to chemical and biological threat agents and the legal framework.
- Building awareness about the legal variance that exists and challenges for prosecuting international crimes.

Lifecycle of Chemical and Biological Crimes

The motivations, motives and intent of the perpetrators are as varied as the potential targets, materials and methodologies of the chemical or biological crimes. The deliberate use of these agents can be linked to individuals, groups, or sophisticated networks; and they can be driven by political, religious, social and financial motivations, targeting individuals, groups, geographic areas or countries.

Yet the lifecycle of those crimes passes through four key phases namely: planning; acquisition and production; storage and transport; and dissemination. The primary responsibility of any law enforcement, security, intelligence agency is to disrupt activities within the cycle as early as possible. Being able to understand what information or intelligence is being supplied, gives the opportunity to recognise a possible future crime; identify the elements of an offence and prosecute before, not after the event. Understanding the lifecycle and the related activities will enable investigative bodies and prosecutors to identify triggers and react with efficiency, with the aim protect people, property, and assets.

Figure 1.
Basic lifecycle of Chemical and Biological Crimes



01. Planning

One of the fundamental challenges to law enforcement, environmental agencies and prosecutors investigating potential crimes involving chemical or biological agents, is the need to ascertain whether there is intent to cause harm. The identification of the criminal intent may begin in the early planning stages.

The planning stage may provide evidence of an underlying ideology, political motivation, personal vendetta, or social cause. There may be evidence of an identified target and an expressed will to acquire, produce and utilise a particular chemical or biological material for no other explanation than criminal activity.

Identification of such evidence may be summarised into the following headings:

1. Target Identification and Surveillance

The perpetrator may conduct surveillance on possible target sites or individuals to determine the targets suitability for an attack, and identify the vulnerabilities which can be exploited, the timing and the execution options.

The following target vulnerabilities may be identified and assessed by criminal groups:

- Human resources skills and practice.
- Existing evacuation and security protocols.

- Existing IT systems.
- Existing surveillance measures (CCTV, anti-drone systems, alarms, and security guards).
- Observation of routine procedures of the individual or organisation (e.g., mass gathering events, and individuals' daily routine).
- Buildings and infrastructures (access - passive entrance barriers vulnerabilities, exit places - fire extinguish systems, air conditioning or heating systems, water, electricity, and gas supply)

Surveillance on a target may be undertaken over days, weeks or months or years. Evidence of surveillance may be in the form of photographs, video footage from hidden or overt cameras or from drones, physical or digital documents, mobile phone records and personal conversations.

2. Selection of the Chemical or Biological Agents

Selection of the chemical or biological material used by the perpetrator will be dependent on numerous factors, some of which may include:

- Purpose of the attack (motive, targeted/ mass dissemination, overt/ covert).

- Ease of acquisition.
- Dissemination capability (noting inhalation being a highly dangerous form of transmission).
- Characteristics of the material (timeline to symptoms, transmissibility, resulting symptoms, and likely casualties).
- Treatment options.
- Storage and transport requirements (room temperature or cold storage).

The following provides a brief comparison of agents' characteristics which may influence selection and planning options.

Chemicals

Often immediate signs and symptoms.

Limited treatment options.

Licences and restrictions on a range of precursor chemicals.

May require a more sophisticated production process.

Can be inhaled, skin contact or ingested.

Bacteria or Virus

Some pathogens are available in nature and can cause outbreaks.

Can reproduce from small amounts.

Limited treatments for some.

Only some are transmitted person-to-person.

Can form respirable particles (spore size for example).

Can be inhaled, ingested or injected.

Biological Toxins

Can be obtained from certain bacteria (botox).

Can be extracted from some plants (Ricin and Abrin).

Plants readily available.

May not aerosolise.

Symptoms and rapid onset dependant on concentration and exposure amount.

Not contagious between people.

Can be ingested, injected or inhaled.

3. Communication Between Offenders

The deliberate use of chemical or biological materials requires a series of actions that may be orchestrated utilising a number of adversaries or individuals unaware of the true intention. While the execution of the crime may be conducted by a single entity, communication between offenders, accessories, or innocent intermediates, can provide valuable evidence to the nature, target, timing, and complexity of the crime.

Potential sources of communication evidence may include:

- Face to face communication (captured through witnesses, undercover operations, police/ agency interviews).
- Paper documents (obtained under lawful warrants, searches, and physical evidence from crime scenes).
- Electronic and digital evidence (including emails, mobile phone calls, social media, and online undercover operations).
- Delivery of messages by remote controlled vehicles.

Noting that communications are increasingly being undertaken within the darknet or through the utilization of various encrypted communication platforms.

4. Plan Development

One of the fundamental stages of the planning phase is the development of the perpetrators modus operandi. The following are examples of potential planning activities which may inform the actions and methodology of the perpetrator.

Acquisition of the agents or precursor materials (legal limitations, licencing or import triggers).

- Acquisition of methodology through online or material resources.
- Access to information including research data.
- Outreach to identified specialists, scientists, or technical expertise.
- Research of target location, infrastructure, and surrounding environment.
- Maps, diagrams, and video surveillance of production site or dissemination target.
- Financing of the elements of the attack.

Across all these subareas of planning, due consideration should be given to the areas of national legislation which may be applied and to the activation of the investigative and prosecutorial

process, through which prevention of an attack and protection of people, animals and the environment may occur.

Acquisition describes the process of obtaining the chemical and biological materials (chemical precursors and pure substances, or biological pathogens and toxins) from their natural or man-made source, as well as the acquisition of equipment and materials to support the lifecycle of the crime.

Some biological agents can be produced using rudimentary or improvised equipment. These agents may be impure; however, they may still be in quantities that can cause harm. Other biological agents and most chemical agents require higher technical expertise, more sophisticated equipment, and specialised precursors.

For example, ricin toxin can be extracted from a plant using crude methods and improvised equipment. While still toxic, ricin produced in this manner is much less pure than toxin produced using more sophisticated techniques and therefore larger quantities may be required to achieve the same operational objectives. The production scene will look different depending on the level of sophistication.

Level of expertise is pertinent and is important to note that theoretical knowledge and technical

02. Acquisition and Production

expertise are not equivalent. An individual with a good mentor and relevant training may not necessarily have formal science training but could possess relevant knowledge to produce an agent. This is more likely with biological agents but can also apply to the production of some chemical agents. Open-source scientific publications and the Internet are valuable resources to the scientific community but can also be exploited by perpetrators to fill in gaps in knowledge.

The type of agent acquired will depend on adversary surveillance and desired outcome. Further, adversary capabilities, expertise, accessibility to relevant infrastructure (equipment) and agent will also play a significant role on which agent to produce or acquire. The type of agent selected may depend on the type of outcome desired. For example, biological materials do not cause symptoms immediately; therefore, adversaries seeking immediate effects may possibly choose a fast-acting chemical agent.

Acquisition of Agents

- Purchase materials directly from a legitimate store or black market from criminal network (legally or illegally).
- Purchase materials indirectly via Internet (surface, deep or dark web) in a legal or illegal way.

- Theft or illegal purchase from legitimate facility- research or industry (chemical industries, universities, public health and animal laboratories, and military facilities).
- Theft of threat agent material from transportation vehicle.
- From illegal waste landfills or abandoned facilities.
- Collected from nature (endemic areas, outbreaks).
- Acquisition of simulants by any means mentioned above needed for testing purposes.
- Acquisition of chemicals needed for neutralisation process in case the weaponised chemical agent is dispersed accidentally in the production, weaponization and testing phase.
- Acquisition of chemicals needed for decontamination of personnel and tools.
- Acquisition of antidotes or pharmaceutical treatment in case of contamination during the production, weaponization, testing and dissemination phase.

Acquisition of Production, Weaponization or Transport Equipment Including, Detection Devices and Personal Protective Equipment (PPE):

- Purchase new laboratory equipment and PPE from a legitimate store or black market (legally or illegally).
- Purchase second-hand laboratory equipment via the Internet (surface, deep or dark web).
- Improvisation (or repurposing) of legitimate equipment.
- Theft of laboratory items, detection equipment and PPE.
- Obtaining dual-use equipment, products, or devices (legitimate use and licences).
- Utilising legitimate equipment after hours (insider threat or unauthorised access).
- Theft of vehicles for transportation purposes.
- Hide, disguise, and smuggle materials and equipment.

Production of Agents

Chemical and biological agent production usually occurs through a systematic continuum of activities. Material and precursor acquisition; production in sufficient quantities; and weaponization to successfully disseminate to susceptible target hosts are typical steps in the continuum. However, not all steps are required for production of all agents. An adversary may choose to conduct certain production steps in different locations. For these reasons it is necessary to consider the totality of the circumstances, evaluate everything at the scene, and consider intelligence gathered during investigation to identify and differentiate activities. Equipment, reagents, and supplies may provide clues to the type of material or materials being produced, potential medical countermeasures and response tactics, and other valuable insight may be gained from clues at the production site.

Agent production is dependent on the type of material being produced. Precursors, specific reagents, equipment including personal protective equipment, and relevant infrastructure are required for CB agent production.

Some chemical agents require precursor materials that are controlled by the CWC, such as Schedule I precursors used to produce nerve agents such as sarin. Toxic industrial chemicals (TICs), such as chlorine, are produced by indus-

try; theft or sabotage of a production site may meet the perpetrators' objective.

Seed stock of microorganisms, appropriate growth medium and conditions, as well as equipment and relevant infrastructure are required to produce biological agents. Microorganisms and plants that produce biological toxins may be obtained from the environment, human and animal infectious disease outbreaks, and from various facilities such as laboratories.

Biological Agent Production

While it is possible to improvise certain aspects of microorganism production, bacteria and viruses require specific growth conditions, and certain types of reagents, supplies, and equipment. Regardless of the microorganism being produced, sterility must be maintained at every step to prevent contamination and overgrowth of undesired organisms.

Biological agents produced using synthetic biology require more specialised knowledge and additional equipment and supplies. Equipment, reagents, and supplies will vary, depending on the agent being produced, and expertise of the adversary.

Regardless of the microorganism being produced, all require equipment to provide appropriate growth conditions and personal protection. Although, equipment may vary in size and com-

plexity ranging in size from small and portable to industrial scale, it may perform equally.

Equipment necessary to produce microorganisms may include the following:

- Climate controlled growth chamber (incubator, fermenter, bioreactor).
- Animals, animal cells, and eggs for virus production.
- Equipment to replicate and reproduce the agent.
- Equipment to separate agent from growth medium (centrifuge).
- Agent confirmation and viability equipment.

Chemical Agent Production

The production of most chemical agents requires specialised equipment, chemicals precursors, PPE, and expertise. Some chemical agents are more difficult to produce than others, and some are more hazardous to manipulate than others.

Most chemical warfare agents are not readily available as single products, and therefore must be synthesized (i.e., produced). Depending on the agent and quantities desired, chemical pro-

duction equipment can vary from improvised equipment to basic chemistry lab glassware and equipment to specialized industrial scale equipment. Regardless of the quantities that would be produced, there are several categories of equipment that would likely be needed.

These include:

- Reaction vessel/chamber (such as a round bottom flask - small scale) or large volume reaction vessel (large scale).
- Purification equipment.
- Transfer equipment (depending on reaction vessel/purification needed).
- Analysis tools (to ensure the desired compound was synthesized/isolated).

Infrastructure Requirements

It should be noted that many synthetic procedures are multi-step and require the transfer and/or purification of intermediate products. It is here where the proper PPE and operating procedures become very important, although not always utilised. At the end, any final product must be stored appropriately, both to protect the user but also to prevent degradation or decomposition.

Typical production sites would have access to a reliable infrastructure including power, water,

appropriate ventilation, and mechanisms for climate control. Suitable locations may include:

- Specialised or specific containers or storage materials for transport and storage of chemical or biological agents.
- Rented property including hotel rooms.
- Permanent residence such as a house or an apartment.
- Abandoned industrial, health care facilities or old laboratories.
- Legitimate facilities where oversight of access may not be appropriately monitored.

The production set up will be dependent on the level of expertise, knowledge and sophistication of the equipment and technique. The following provides some examples of the production process and layout.

- Personal Protective Equipment (PPE) including gloves, gowns, or coveralls, respirators, or filtered masks.
- Clandestine laboratory comprised of improvised equipment or equipment typical of a legitimate laboratory.

- Access to legitimate laboratory after hours.
- Condensation and separation equipment (to aid in agent purification).
- Filtration and desiccation equipment (to aid in agent production).
- Preparing the desired form (liquid, powder, gas, aerosol).
- Provision of additives to alter agent characteristics.
- Preparation of the delivery device or dissemination vector.
- Use of explosive devices.
- Agent or systems testing (on animals or the environment).

03. Storage and Transporta- tion

During some stage along the crime lifecycle, there will be a need to store equipment, consumables and various chemical and/or biological materials. Storage of such materials will likely be planned, to preserve the quality, viability, and characteristics of the materials. This may include the need for temperature-controlled environments including refrigeration, freezing, cooling or humidity control. The process of adequately

securing, storing, and transporting chemical and biological substances, requires an understanding of their physical properties and interactions.

Some chemicals require specialised storage containers due to their chemical properties. A range of storage devices and containers exist, suitable for chemicals that may be flammable, explosive, corrosive, oxidative, toxic or water reactive. In addition, several production processes may require specialist gases. Ventilation would be an important factor as well as cooling where there are volatile or explosive precursors.

Biological materials, including liquid and gel cultural media, requires refrigeration to preserve purity and reduce environmental contamination. Standard refrigerators, freezers and airconditioned environments could be utilised. Special freezing conditions including, cryogenic freezers may be acquired for longer-term storage of biological samples.

Transportation of the final product is a highly dangerous task posing additional challenges and risks to the perpetrator. Chemical and biological agents may be transported as a final product or separate components ready to be mixed at the place of dissemination. The transport of such materials may require the products to be protected from heat, light, aerosolization and friction. In addition, the perpetrator may require

personal protective equipment such as gloves, masks, and coveralls and antibiotic prophylaxis for some bacterial agents.

The type of transportation taken by the perpetrator will be also dependent on the risk factors associated with the final product, quantity, and availability of transportation options.

Indicators related to this element of the lifecycle include, storage facility leases, purchase or rent of specific storage equipment, excessive electricity bills (potentially linked to heating or cooling costs), and closed-circuit television (CCTV) linked to storage locations or on route transportation.

04. Dissemination

The release, dissemination or dispersion of chemical and biological agents towards a target may occur in the form of a gas, liquid or solid. Chemical and biological agents enter a host through one or more routes of exposure. Chemicals can enter hosts through inhalation, ingestion, punctures, direct contact with mucous membranes, or by absorption. Biological agents enter hosts through the same routes of exposure, except absorption; biological materials cannot penetrate intact skin.

Certain quantities are required for toxicity, infection, or death; therefore, dissemination must ensure that every target host receives an appropriate dose by the appropriate route of exposure, while maintaining agent viability. These require-

ments must be factored into the weapon equation to achieve operational objectives.

Aerosols may impact a greater geographic area and expose a greater number of people to the hazardous material. Aerosols can be both small droplets of liquid and powder when solids are used.

On the other hand, the chemical properties of the chemical agent will influence how long a chemical persists in the environment once released and how likely it would be to stay in the air or fall to the ground. These all influence the level of potential exposure through aerosols and skin contact.

Once produced, chemical and biological materials may be disseminated either by relying on the chemical and physical properties of the agents or via some type of dispersal device or method.

Some examples include:

- Explosives / IEDs (may destroy the agent).
- Military munitions / ammunition (may destroy the agent).
- Agricultural spraying systems.
- Unmanned vehicles/ Drones.

- Standard mail.
- Food and water.

While this section discusses the lifecycle of the crime the following section describes the need to understand the categories under which the crime itself may be placed and therefore a deeper appreciation for the legislation that may be linked to the crime.

Categories of Chemical and Biological Crimes

The deliberate use of chemical and biological materials to cause harm poses several challenges to the investigative and persecutorial processes.

Such crimes may be conducted by a variety of entities including but not limited to, individuals, organised crime groups, state sponsored bodies, individuals or a group, with politically motivated or extremist views and may be linked to current or emerging terrorist organisations.

The nature, impact and complexity of such crimes will be dependent on the intentions of the perpetrator, the material of choice and the target.

While motive is the reasoning behind why a person or group chooses to engage in criminal conduct, their intention describes their conscious objective or purpose to engage in an act that the law forbids, or to bring about an unlawful result. Intent may

then allow for categories of crime to be linked to existing laws as described under relevant legal frameworks.

The following categories provide an example of how chemical and biological crimes may be grouped when considerations related to these factors are analysed. It is important to then identify relevant legislation that may support the prosecution of such crimes.



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Table 1:
Category Examples

Category	Explanation	Potential Intent of the Perpetrator
Crimes against human health	Offences that cause immediate or long-term adverse health effects including illness, ailment, or death. The intention to cause such effects will rely on the collection of environmental and medical evidence and various communications.	Cause illness or death of people (including mass casualty event or incapacitation).
Crimes against environment and livestock	Offences that cause detrimental impact to land, water or air quality, crops, and livestock. These acts may have potential secondary effect on humans.	Sabotage land, crops, or livelihood, discarded illegal waste, (cause illness to animals/ livestock).
Crimes against public security and safety	Offences that jeopardise or destroy the ability of people to feel safe and protected within their communities.	Cause fear and social disruption to public order (including targeted crime to minority groups).

Crimes against consumers, businesses, and property

Offences that affect the legitimate rights of a consumer, operation of a legal business, or damage or destruction of personal or commercial property.

Sabotage a business (including damage/destroy consumer confidence, damage, and destroy property).

Crimes against national security and governments

National security relates to territorial security and state security – all crimes against state system and governments, against peace/stability with intention to disrupt the state system and state economy.

Damage critical infrastructures, influence religious or social cause, damage political relations or jeopardise national security.

Noting that categories presented include examples of crime typologies that may be linked to criminal intent. However, laws pertaining to the crimes committed may extend across more than one category and encompass other laws including but not limited to human rights laws, fraud, planning of a terrorist act, illegal acquisition, storage, or transport and, illegal production or dissemination of chemical or biological material.

Legislative Variance

The successful prosecution of a deliberate act involving the use of a chemical or biological material is achieved when the legal framework under which it is governed, provides adequate authority through legislation to investigate and prepare prosecution against all phases of the crime lifecycle, in accordance with human rights standards.

While legislation varies across countries, early detection and activation of a case can assist to prevent chemical and biological crimes. Early intervention requires the support of an adequate national legislation. Consideration should be given to the legislation that identifies the following elements as potential or actual crimes:

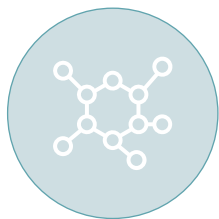
- Encouraging or assisting a crime, incitement, attempting to commit an offence and conspiracy to commit it.
- Planning a criminal act.
- Breach of regulatory or industry civil and criminal penalties.
- Deliberately contaminated soil, water or air ways with chemical or biological material that may cause harm.
- Finance operations linked to the deliberate use of chemical or biological materials/agents.
- Illegally acquired security sensitive chemicals or biological materials.

- Inappropriate storage and use of restricted chemicals or security sensitive biological agents outside an approved holding facility.

The legislation that enables investigative bodies to commence proceedings against a suspect or identified perpetrator varies. While many states are parties to the overarching conventions namely, CWC and BCW, and the UN Security Regulation 1540, the categories under which certain crimes are defined may be described differently across different nations, and multiple laws may be applicable for prosecution at the various phases of the crime.

Nations should also consider if they in fact have the necessary legislation in place for prosecuting such crimes, and whether national legislation requires suitable strengthening to support successful prosecution.

The following graphic provides examples of legislative categories found within some Member States. Specific examples of acts and legislations relative to these categories can be found in the Appendix.



Biological Security
Laws



Export and Trade
Laws



Environmental
Laws



Counter Terrorism
Laws



Criminal or Penal
Code



Chemical Security
Laws



Environmental
Acts



Occupational
Health and Safety
Laws



National Security
Law

- 01. Scenario Examples** Review the following example scenarios and consider the legislative categories that would apply within your jurisdiction.

Scenario 1

Police and hazmat teams (or hazardous materials teams) respond to the international airport terminal, as reports of a chemical attack are received. Three people display signs and symptoms including, shortness of breath, excessive salivation, and watery eyes, and one man is

convulsing. Medical teams wearing personal protective equipment treat the victims and the airport is evacuated.

Initial responding teams locate a bag that appears to contain suspect materials including liquid samples and documents related to chemicals. Preliminary screening for toxic gases and chemicals indicates the presence of a nerve agent at the location. Police identify a suspect on CCTV and detain him for questioning. The suspect admits being in possession of a chemical agent, with intent to transport. He is not a citizen of your country.

Questions for consideration:

- 1. Under what laws will the man initially be detained?*
- 2. Does the preliminary test indicating a nerve agent influence the laws under which the man may be charged?*
- 3. Can this test be used in evidence or are additional samples required?*
- 4. What legal considerations are impacted by his citizenship status?*
- 5. What if the suspect admits the accidental release of the chemical agents claiming that he was only transporting them to a third party?*

Scenario 2

Police are informed of suspicious behaviour at a government pharmaceutical facility. A person of interest is reported to have entered the facility out of hours, with CCTV capturing an image of the man in possession of laboratory equipment. Police enquiries lead to a search of the man's premises, during which they discover several items identified as stolen property.

In addition to these items, police locate data on the man's laptop which relates to requests to purchase vials of high-risk biological agents including, *Bacillus anthracis* and *Botulinum toxin*. The email trail indicates that samples have been sent and received by the man in the past 14 days. During a police interview, the man admits to the purchase of the security sensitive biological agents with intent to use the material in a planned local attack.

The man is a citizen and resident of your country, he has no known affiliations with terrorist or right-wing groups.

Questions for consideration:

- 1. What national legislation pertains to the acquisition and possession of biological agents?*
- 2. Does the data located on the laptop support any additional charges?*

3. What legislation or regulations are in place to protect access to dual-use industries and equipment in your country?

Scenario 3

Local environmental and veterinarian authorities respond to an outbreak of Swine Flu in a large pig population. The outbreak is spreading erratically, and rumours spread regarding the possible links to organised crime. A known criminal gang uses drones to disseminate the virus across several farms, infecting large meat stocks and initiating a spike in pork meat prices as stocks plummet.

Police identify and arrest two local people in connection with the drone attacks. One admits to deliberately spreading contaminated material using drones. The other admits their intention is to illegally smuggle pigs across provinces to sell the meat and profit from increased prices.

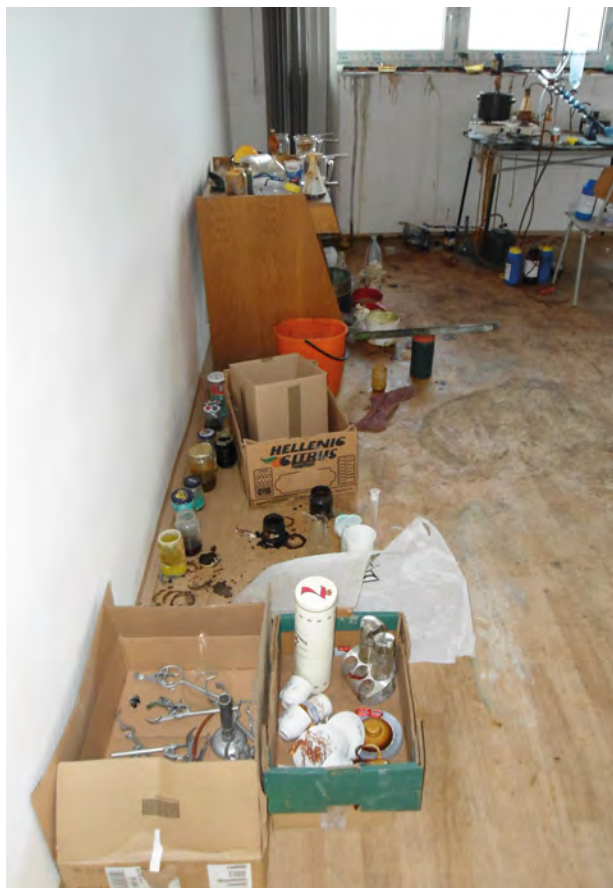
Note: Swine Flu is a type A influenza virus causing outbreaks in pigs. Some variants can be transferred to humans. Swine flu is endemic in some parts of the world and is not considered a Category A or B pathogen on most national high-risk list.

Questions for consideration:

1. What national legislation pertains to the deliberate use of this animal pathogen?

2. Does the intention of the perpetrators influence the legislation under which they will be potentially charged?

3. What environmental laws will be included in the case for prosecution?



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Summary of Evidence

As investigative and prosecution teams will be required to work closely to identify, collect and preserve evidence pertaining to a particular phase or multiple phases across the chemical or biological crime lifecycle. The following table presents some examples which may be relevant to these types of crime.

Table 2:
Examples of Potential Evidence Linked to Chemical or Biological Crime Phases

Phase	Potential Source of Evidence
Planning	Computer evidence
	Documents, reports, articles
	Intercept of communications
	Surveillance (may link to intelligence leads)
	Travel (planned and completed)
	Evidence linking to intent (links to organised crime/terrorism/motive to harm-damage people/property)
	Facility infiltration (laboratories, hospitals/ clinics, industries)
	Breach of insider (sharing of data/ research, out of hours access, bribery)

Acquisition and Production

Computer evidence of research or outreach to third party suppliers

Evidence of purchase- receipts, electronic transactions, delivers

Witness statements

Closed Circuit TV (CCTV)

Intercept of communications

Bank statements

Acquiring samples /precursor chemicals/
Personal Protective Equipment (PPE), prophylactic treatments, detection tools and devices, and production equipment

Acquisition of human assets

Form of material (crystals, powder, liquid, and gas)

Identification and/or confiscation of production equipment (improvised, crude or sophisticated)

Evidence of testing during production (animals, eggs, and environmental contamination)

Enhancement products/ additives

Storage and Transport

Long term rental of offsite storage facility

Short term rental of house or unit

Stolen vehicles

Fake names associated with vehicle rentals

Evidence related to acquisition or storage equipment (freezers, refrigerators, chemical storage containers)

Digital or physical evidence of purchases related to storage or transport items

Dissemination

Environmental contamination from release

Infected animals/humans

Reported illness that correlate to agent characteristics

Dissemination device

Evidence of dissemination preparation/purchase receipts or acquisition of specific dissemination equipment

Discovery of Personal Protective Equipment

Discovery of dissemination devices

Environmental sampling indicating presence of chemical or biological material by comparing with baseline results obtained from a non-contaminated sample

Noting: witness statements could be collected across any or all of these phases as part of a brief of evidence.



Investigative Intelligence

03

CHAPTER THREE

01

02

03

04

Key Focus Area

Monitoring of current threats

Describe the differences between information and intelligence

Pre-incident planning and multi-agency collaboration

Considerations for handling and sharing intelligence information

The collection and processing of forensic evidence plays an important role in the criminal justice system by examining physical and trace evidence in support of investigations and subsequent prosecution. The use of intelligence and information during the investigation is just as important. In order for the prosecutors to be able to access investigative intelligence, it is important for pre-planning to start at the earliest opportunity.

Critical to this will be:

- Understanding what intelligence is and how it can be used.
- The national legislation that determines the means by which intelligence and information is collected and shared.
- Who owns the intelligence and how is it controlled?
- The need to build trusted networks and agree on intelligence sharing protocols.
- Role of intelligence during prosecution.
- Determination of investigative priorities and the balance between collecting intelligence and actual evidence.

Monitoring Current Threats

The threat landscape changes on a regular basis. The visibility of threat groups may increase or diminish over time but reduced public visibility does not mean zero threat. Accordingly, it is important for law enforcement agencies to monitor current threats and give consideration as to how such threats can be eliminated, mitigated or responded to.

The amount of information posted electronically is dramatically increasing and can assist in monitoring threats and criminal behaviour. Monitoring of social media can help track online behaviour and social commentary, which may provide indicators relating to the prevention or response to a potential chemical or biological crime. Obviously, social media is merely one source of information and the collected information needs to be appropriately weighted.

There are many sources within the global community who can provide reliable information regarding new and emerging technologies and methods being developed in the field of chemical and biological research. These organisations and institutions can also provide a good overview of recent incidents report and possible future trends in the nefarious use of such materials by individuals, groups, or States parties. The following websites are a useful resource:

- www.opcw.org (the Organisation for the Prohibition of Chemical Weapons is an international organisation with a focus on chemical disarmament and non-proliferation).
- <https://www.un.org/disarmament/biological-weapons> (this website will take you to the Implementation

Support Unit, that operates with a focus on biological weapons).

- www.nti.org (the Nuclear Threat Initiative has expanded its area of interest to include biological and radiological materials as well as cyber threats. A closer examination of their home page also discloses information on chemical threats).
- www.chathamhouse.org (Chatham House is the home of the international think tank, the Royal Institute of International Affairs. They cover many complex policy issues including global threats. Searches can be made by region as well as by subject of interest).
- <https://www.un.org/en/sc/1540/> (the UN Resolution 1540 of 2005 obliges States, inter alia, to refrain from supporting by any means non-State actors from developing, acquiring, manufacturing, possessing, transporting, transferring, or using nuclear, chemical or biological weapons and their means of delivery).

Further to the above, international news sources can also provide a good overview of what is currently occurring around the world. Incidents where chemical or biological material have been involved are often reported quickly and widely. Consideration should be given to the fact that news outlets are not subject to the rules of police, military, and others. There can be a tendency to exaggerate or overreact. Information from news sources should always be verified through a reliable source before being acted upon.

Threats can also come from many different sources. The three main sources are as follows:

Threat Source

Nature of Threat

State Actor

Considered the most serious threat because many countries have significant resources and expertise to create a chemical or biological weapon. The Chemical Weapons Convention and the Biological Weapons Convention were created to dramatically reduce this threat, but there are still some 'rogue' states that are of concern, for example, the chemical attacks in Iraq in the 1980's were considered deliberate acts by the State.

Terrorism/Or- ganised Crime

Previous investigations have uncovered the intentions of some terrorist or organised crime groups to use chemical or biological weapons. Such groups may not have the access to funding or expertise but could aspire to achieve this. For example, ISIS were seen to use Chlorine gas tanks as part of the attack strategy in Iraq in 2015 and criminal gangs in West Africa stolen vials of Ebola infected blood. Furthermore, the impact of the COVID-19 pandemic has widely illustrated the chaos and harm that such materials can cause.

Lone Actor

In recent decades there have been numerous occasions where individuals have planned some form of an attack using chemical and/or biological material. This has included the purchase of materials on the dark net. Often such individuals have little knowledge of such materials and their potential to cause harm.

Types of Intelligence

Two common over utilised and sometimes mis-used terms regarding this form of evidence is the difference between 'information' and 'intelligence'.

Information is the raw data obtained by an individual or law enforcement agency or intelligence organisation. It can be a simple open-source newspaper article, observations made during site visit, the spoken word of a human source. This material is raw, unverified, unevaluated and it would be rare that action on this material would occur. With the collection of information, the context must be validated and verified. The information must be added value to the investigation. Collaboration to the observations or comments made must be obtained. The analysis of raw information produces a product called 'intelligence'.

In some circumstances, the collection of a large amount of information can generate data which must be protectively marked. This will usually be because the resulting data highlight an overall conclusion which should not be publicly available. This type of information must be protectively marked and handled accordingly.

Intelligence is often generated by police and other government agencies such as the military and/or national security agencies. Intelligence is evaluated data that has been processed

01. Information versus Intelligence

through an intelligence cycle to produce that final data. This intelligence cycle includes planning to obtain supporting information, its evaluation, organisation of information, analysing, dissemination and feedback. The intelligence product produced allows for informed decision making and action to occur. Intelligence sources can come from many methods, but common ones are intelligence from humans (HUMINT), open sources such as news media (OSINT) and from technical sources (TECHINT).

The protective marking of all intelligence is essential. This will be outlined later in this chapter.

02. **Open-** **source** **Intelligence** **(OSINT)**

Intelligence is available on a daily basis from many different sources, but when researching such sources for reliable information or intelligence, it is critical that such data are corroborated before being used, preferably from other trusted sources.

The following table provides some examples of OSINT and the challenges you may face when assessing it.

Open Source OSINT

Consideration

Internet Search Engines

Consider the same search on different search engines such as Safari, MS Edge, Google, Firefox etc. Usually, different search engines will display different results. Check the authenticity of web addresses and make comparisons with other official sites such as government ministries.

Social Media

This can be a useful source to find information about individuals, but any data found should be treated with caution. Information such as a LinkedIn profile will have been generated by the individual themselves and can often be found to be inaccurate.

Online Maps

Check markings to see if maps are to scale. Maps and aerial images can be a useful verification tool.

Online Communities

Chat rooms etc. can be a useful source of intelligence, but again, users have the freedom to fabricate what they say without consequences.

Documents, Images and Video online

The source of this form of intelligence needs to be checked with the originator/author. Some sites such as Wikipedia have been known to be easily hacked and facts have been turned into inaccurate statements. Academic research can provide useful data but should be verified with the originating source and academic community where possible.

Personal Data Searches

Consider the legal requirements for accessing personal identifiable information. If the personal data is publicly available then it is probably not subject to legislation as the individual would have given permission, but this should be checked.

**Government
Records**

This is a more reliable source of open-source intelligence as you will be able to verify with the source by a different means (such as phone or email) to confirm the data.

News Media

Different news media outlets have different standards of reporting, from practical and factual to hysterical and fantasy. Prosecutors should be aware of reliable sources in your region and of any political bias they may have.

It is important to understand that by drawing several pieces of open-source material together, it is likely that you will end up producing a piece of information that will need to be protectively marked. If this is the case, any information should be protectively marked in accordance with your national guidelines.

**03.
Covert
Intelligence**

This is a form of data that needs to be evaluated with considerable care. Covert intelligence will have varying levels of secrecy depending on how the intelligence has been gathered. There are various sources for this type of intelligence: see the following table.

Source

Consideration

Covert Human Intelligence (HUMINT)

Commonly referred to as 'informants', HUMINT is the most delicate form of intelligence as it is paramount that the person who provides the intelligence and the method used to find such intelligence have to be protected.

Obtained during covert operations through technical surveillance measures

It is important that the methods used to gain such intelligence, such as police surveillance, listening devices or other technical measures, are not disclosed to others. Noting in some jurisdictions, there may be full disclosure, unless it is a state secret.

Obtained during offender interviews

This is similar to HUMINT, in that a suspect may disclose intelligence about other persons involved during an interview. In some circumstances there will be a need to protect that person as a witness rather than a suspect.

Note: covert intelligence is normally gathered by intelligence agencies, law enforcement or the military.

04. Other types of Intelligence

Source	Consideration
Cyber or digital network intelligence (CYBINT or DNINT)	Monitoring of communications, identification of key words which may be linked to chemical or biological crime.
Financial Intelligence (FININT)	Monitoring of financial transactions that can lead to support the investigation of a crime planning or committing.
Technical intelligence (TECHINT)	Technical intelligence, or TECHINT, is intelligence relating to the technical abilities of an enemy. It does not fall under just one of the four major branches of intelligence; rather, TECHINT includes elements of measurement and signals intelligence (MASINT).
Measurement and Signature Intelligence (MASINT)	Measurement and signature intelligence (MASINT) is a technical branch of intelligence gathering, which serves to detect, track, identify or describe the distinctive characteristics (signatures) of fixed or dynamic target sources. This often includes radar intelligence, acoustic intelligence, nuclear intelligence, and chemical and biological intelligence. MASINT is defined as scientific and technical intelligence derived from the analysis of data obtained from sensing instruments for the purpose of identifying any distinctive features associated with the source, emitter or sender, to facilitate the latter's measurement and identification.

The Intelligence Cycle

The traditional Intelligence cycle is the fundamental cycle of intelligence processing in a civilian or military intelligence agency or in law enforcement as a closed path consisting of repeating nodes. The stages of the intelligence cycle include the issuance of requirements by decision makers, collection, processing, analysis, and publication of intelligence. The circuit is completed when decision makers provide feedback and revised requirements. The intelligence cycle is also called the Intelligence Process.



Planning and Direction: The figure below, shows how the intelligence cycle works. The starting point is with planning and direction. The direction of the investigation should be clearly stated by the most senior decision maker in the process. In criminal investigations this will usually be the Senior Investigating Officer.

Collection: A clear plan should be communicated for the collection of all available intelligence. Consideration should be given to all forms of intelligence as previously listed. The collection and recording of intelligence gathered is critical, so that this can be clearly communicated during the investigation and any subsequent prosecution.

Processing: Once the collection plan is executed and information arrives, it is processed for exploitation. This involves the translation of raw intelligence materials, evaluation of relevance and reliability, and collation of the raw intelligence in preparation for exploitation.

Analysis: Analysis establishes the significance and implications of processed intelligence, integrates it by combining disparate pieces of information to identify collateral information and patterns, then interprets the significance of any newly developed knowledge.

Dissemination: Finished intelligence products take many forms depending on the needs of the decision maker and reporting requirements. The level of urgency of various types of intelligence is typically established by an intelligence organization or community. For example, an indications and warning (I&W) bulletin would require higher precedence than an annual report.

Feedback: The intelligence cycle is a loop; feedback is received from the decision maker and revised requirements issued.

For each phase in the cycle there will be certain triggers for prosecutors that indicate intent to cause harm and/or destruction. This will assist in the early identification of offences being committed by perpetrators. Prosecutors and the investigating agencies need to have a close relationship and be in a position to share potentially critical evidence and intelligence, early in the investigative process.

Prosecutors must establish a good rapport with law enforcement agencies and have a good understanding of the nefarious use of chemical and biological materials. This will encourage law enforcement and intelligence agencies to notify prosecutors at the earliest opportunity, so that prosecutors can make judgements and provide guidance on:

- At which point to intervene.
- Offences which are deemed most appropriate for consideration in the case.
- Points to prove for each offence.
- Key evidence identification.
- Uniformity of evidence collection, recording and handling.
- Differences between what is normally found in the environment and what is unusual.

05. Pre-Incident Planning

For an effective prosecution to take place, all agencies that could potentially be involved in an investigation and/or prosecution should work together so that they may fully understand each other's abilities and restrictions. A crime involving biological or chemical materials will require a joint investigation usually including the following agencies:

Agency	Role Considerations
Law Enforcement	Law enforcement may be the first to identify trigger points of such crimes and in many cases are the first to notify prosecutors. Prosecutors should aim to build a relationship with Senior Investigating Officers so that they know what to expect from each other.
State Security Agencies	In some countries, the state security agencies have the legal competence to investigate high-profile cases. This may result in coordination between them and prosecutors' teams.
Customs / Border Force	Prosecutors need to gain knowledge on the working practices of Customs/ Border staff and their techniques to detect and seize chemical and biological materials.
Forensic Institutes	Where can traditional evidence (physical and trace) be analysed? Does the case require specialised analytical services?
Judiciary	What are the procedures within the judiciary with regards to the presentation of sensitive intelligence that should not be disclosed in open court?

Health	There can be many challenges relating to data sharing. Patient identity and disclosure of medical history must be agreed.
Water	If water sources have been contaminated, how can this be evidenced? What are the implications for the wider community? How can such agencies contribute towards evidence gathering?
Energy	If chemical and/or biological material has been released into the environment, what are the implications for energy suppliers? Do contingency plans need to be in place?
Science	Where can prosecutors source subject matter experts who can advise on the implications of a planned or occurring incident? Are identified scientists suitably qualified to provide evidence as Subject Matter Experts?
Agriculture	What impacts might the chemical or biological pathogen have on animals or livestock? Is it a zoonotic disease? What kind of mitigating actions need to be considered to prevent damage to the food supply-chain?
Environment	How badly can the environment be affected by a planned or deliberate release? How does this impact the wider community, agriculture, and primary industries?
Local Authority	Usually, the Local Authority will be the main communicator between law enforcement and the general public. How much detail can be communicated? What impact will such communications have on the general public?
National Government (including Ministries)	Senior policy makers and politicians will need to make decisions on key elements that may affect the public. The information provided to them needs to be carefully considered to ensure public safety whilst not compromising key evidence and the whole investigation.
Other Emergency Services	The Fire and Ambulance services will almost always be required to respond to incidents of this nature or be on standby to be able to assist. The evidence they supply through statements can be key.

It is recommended that a joint committee of leaders from the above agencies is formed as an intelligence working group. They should meet at least twice a year to map each agencies roles and ensure there is a clear understanding of each other's powers and restrictions in the event of a joint investigation. The following challenges should be discussed and resolved:

- Which agency should be the lead agency at the start of an incident/investigation?
- At which point should a different agency take the lead dependent upon a change in circumstances?
- Law enforcement should assume the lead if a criminal offence is suspected.
- Which agencies should form the strategic command group? (This group will be the one that considers developments and implications on each day of the investigation and make decisions based upon a joint agreement)
- How will intelligence be shared?
- How will intelligence be controlled?

All agencies must work together in an effective manner. The most effective way to achieve this

is to meet regularly and practise together by way of exercises, whether the exercises are real time or conducted as a Tabletop Exercise (TTX). Remember, intelligence must only be shared with those who need to know about it and have the necessary security clearances. Any breaches of such controls should be an offence.

Data Sharing Agreements

As part of the preparation prior to an incident where chemical or biological materials are used, prosecutors should establish clear agreements with those agencies where they may need to exchange information or intelligence. Such agreements must consider International Legislation such as the European General Data Protection Regulations 2016. One way of achieving this is through the development of a 'Memorandum of Understanding' (MoU) between agencies and prosecutors.

The development of a MoU as part of preplanning will allow all persons involved to have a clear understanding of the law governing data sharing and how each agency intends to conduct data sharing with other agencies. This can also be a useful method when sharing information or intelligence with other countries. Quite often these types of crime are cross border crimes and may include several countries, all with different standards of data sharing. The standard with the most vigorous measures is the one that should be utilised.

A Memorandum of Understanding can be a simple agreement between agencies and countries. There needs to be a clear

definition of each other's roles and responsibilities and a list of expectations, of what each agency expects from the other. The MoU should have a title and be reviewed annually.

In addition, Mutual Legal Assistance (MLA) treaties and conventions often contain provisions for the spontaneous exchange of information that can be relied upon by parties that are signatories. For example, see Article 18 of the United Nations Convention Against Transnational Organised Crime (UNTOC).

Sharing of information can also be facilitated through Joint Investigative Team (JITs). JITs comprise of a legal agreement between competent authorities of two or more States for the purpose of carrying out criminal investigations. Made up of prosecutors and law enforcement authorities as well as judges

Intelligence Sharing

There are likely to be strict rules that apply to the sharing of covert and human intelligence sources. Further consideration must be given as to how that intelligence can be used without disclosing how the intelligence was obtained or who provided the intelligence.

There are several steps that must be considered when considering the use of intelligence:

- How sensitive is the intelligence?
- Who can be authorised to view the intelligence?
- Who and what agencies can the intelligence be shared with?

- Are there laws that govern the disclosure of intelligence?

To assist you in making these decisions you will need to implement a system to protectively mark such intelligence and set the vetting requirements of persons who may have access to the different classes of protective marking.

All sensitive information should be protectively marked while all forms of intelligence must be protectively marked. This will provide a clear indication as to who may have access to it. Are there rules governing the protective marking of intelligence in your country/region? Access is usually granted depending upon the vetting level of an individual. The following is a suggested standard and it is recommended that Prosecutors seek to establish a table of equivalence across the countries they are working with and agencies involved.

The following table provides a summary of popular classifications.

01. A Guide to Protective Markings

Classification	Description
Not Protectively Marked	This marking on a document makes it clear that there are no restrictions on who may see it. Sometimes a collection of Not Protectively Marked information put together can become sensitive. In the event of this, a high classification should be considered.

Restricted

To avoid the disclosure of information or intelligence beyond a restricted group. This could be all company employees or to be shared with trusted persons outside an organisation. The information or intelligence is 'Restricted' because there is a need to have some form of control on it. This may be to keep the information or intelligence away from competitors or the media.

Confidential

This is a higher level of control. Persons given access need to have some form of basic vetting check. Information or intelligence with this marking may be restricted to being shared with a specific department or other small group of people. Disclosure of this type of information or intelligence could cause reputational harm, embarrassment or disclose details you do not want others to know.

Secret

Very sensitive information or intelligence that justifies heightened protective measures to defend against determined and highly capable threat actors. For example, where compromise could seriously damage military capabilities, international relations or the investigation of serious organised crime. This form of information or intelligence should only be provided to a small number of people who have enhanced vetting.

Top Secret

The most sensitive information requiring the highest levels of protection from the most serious threats. For example, where compromise could cause widespread loss of life or threatens the security or economic wellbeing of the country or other nations. HUMINT is often marked as Top Secret to provide protection to the sources that has provided it. Only those people who have an advanced level of vetting should have access to this information or intelligence. Those people should be recorded as having access and held to account if the information or intelligence is compromised in any way.

02. Vetting

Vetting is a formal process, where individuals, agencies or organisations background is investigated to ensure that any joint activity will not compromise the reputation of the original individual, agency, investigation, or prosecution. Persons employed as government prosecutors who have been identified as suitably skilled to prosecute chemical and biological crimes will need to carry the highest level of vetting approval possible, to ensure they can effectively communicate with investigators and intelligence agencies. It is up to individual countries to establish what that level of vetting should be and how it can be achieved.

The following provides a general guide:

Level	Requirement
None	Although there are no specific vetting requirements, those having access to restricted information or intelligence should be known to the issuing source. They could be staff or established and well-known contacts.
Basic	Basic checks should take the form of a police record check and for the individual to provide evidence of who they are, such as photo identification, proof of address, proof of earnings and other basic measures. This information should be verified against public records.

Enhanced

An enhanced check requires more information to build upon a basic check. This could include an interview, checking financial records and other measures. The aim is to ensure that the person is psychologically stable, has a reliable lifestyle and is not open to bribery or blackmail. These checks should be made at least every 5 years.

Advanced

This is the top level of vetting and should be a comprehensive and regular process. All the above measures should be taken as well as a comprehensive questionnaire and interview to consider all aspects of the subject being vetted. Ideally, this should be an ongoing process to maintain data about the individuals' welfare and personal circumstances.

The following table provides a summary of security considerations relative to the protective marking and level of vetting required.

Protective Marking	Vetting Level	Security Considerations
Not Protectively Marked	None	No security considerations.
Restricted	None	Hardcopy and electronic documents should be held under basic security conditions such as in a locked office or one computer with a good firewall.

Confidential	Basic	As above but kept in a locked cupboard in a locked office with encryption on computers and only held on restricted use computers that are password protected.
Secret	Enhanced	Must be retained under strict security conditions. Hard copy documents should be held in a file with a list of those who have accessed the data. Computers should have enhanced security measures and not be accessible from outside the organisation with ownership.
Top Secret	Advanced	If held on computer, this should be a standalone computer without access to the Internet, Wi-Fi etc. Documents should be encrypted, and password protected, allowing for an audit trail of who have had access. Hard copies are not ideal and need to be managed carefully to ensure only those with authorisation have access.

Most countries will have rules regarding the disclosure of evidence to the accused and their legal defence team. When the evidence includes sensitive intelligence, consideration must be given as to what benefits will come about by disclosing such intelligence, against the possible harm that could be done to how the intelligence was obtained, who obtained it, and national security issues deriving from the disclosure.

03. Disclosure

National security is often used as an exemption from disclosure laws, but this will usually be tested by the defence. Prosecutors need to be aware and briefed on the specifics of disclosure laws and the tests that are made in relation to exemptions in the interest of public safety.

As an example, in September 2015 the Court of Justice of the EU ruled that information about the volume of hazardous chemical substances being manufactured or imported posed a security/environmental risk. The Court ruled against the disclosure of such information.

Disclosure extends beyond evidence to any material generated during an investigation that may have some bearing on any offence under investigation or any person being investigated or on the surrounding circumstances.

Disclosure regimes will vary between jurisdictions but ordinarily require the prosecution to provide the defence with copies of, or access to, any material which might reasonably be considered capable of undermining the case for the prosecution against the accused, or of assisting the case for the accused, and which has not previously been disclosed. Prosecutors shall disclose to the accused relevant prejudicial and beneficial information as soon as reasonably possible, in accordance with the law or the requirements of a fair trial.

Disclosure issues are usually resolved by the trial court, either through preliminary applications or during the course of the trial. Disclosure issues are often critical in cases involving highly sensitive information and intelligence. If a fair trial cannot take place without disclosure of such material or cannot be remedied by either formal admissions, amending the charges or presenting the case in a different way to ensure fairness, the prosecutor cannot continue with the case.

In some jurisdictions (e.g., the U.K.) the consequences of non-disclosure are severe and may result in a stay of proceedings as an abuse of process, the exclusion of material evidence, a successful appeal or a costs order against the prosecution.

Some systems permit an application to the trial judge (with or without the defence present) to withhold material from the defence because there is a real risk of serious prejudice to an important public interest. Generally, if the court decides or, without an application, the prosecutor is satisfied that a fair trial cannot take place without disclosure, the case cannot continue.

Freedom of Information

Freedom of information laws allow access by the general public to data held by national governments and other public bodies such as state and local governments. The emergence of freedom of information legislation is usually associated as a response to the need for authorities to be open and transparent. In some countries this is referred to as an access to information Act or similar. Freedom of information and data protection legislation ordinarily include exemptions for data relating to the commission, or alleged commission, of an offence and the investigation and prosecution of such offences.

This type of legislation establishes a “right-to-know” process by which requests are made for government-held information, to be received freely or at minimal cost, barring standard exceptions such as national security and sub-judice (or under trial), whereby the information is relevant to an ongoing investigation or legal action such as a prosecution. Governments are typically bound by a duty to publish and promote openness. In many countries there are constitutional guarantees for the right of access to information, but these are usually unused if specific support legislation does not exist. Additionally, the United Nations has a target to ensure public access to information and the protection of fundamental freedoms to ensure accountability.

As an example, Georgia has a ‘Law of Freedom of Information’ regarding information whereby a member of the public has a ‘right to know’. There are common exemptions to such information such as a refusal on the grounds of national security or where a legal action is pending.

Personal Data

Within Europe, the General Data Protection Regulation 2016 (GDPR) sets a standard regarding the use and security of personal data. This means any data that can identify an individual including e mail address, images and other contact details. There are four objectives to protecting personal data:

- **Accountability** - The person holding another's personal data is accountable for all compliance issues and must be able to demonstrate this.
- **Lawful** - If personal data of another person is to be shared it must be conducted on a lawful basis and often with the persons permission (there are exceptions to this).
- **Fairness** - This means that the data holder should only share the data of other persons in ways they'd reasonably expect. For example, if you have got their data through means that are misleading, then everything you do after that (whether you think it is lawful or not) is unlikely to be 'fair'.
- **Security** - The data holder is responsible for ensuring that personal data is held securely and ensure it does not get lost, stolen, or damaged.

Data Protection

The requirements for data protection will vary between countries. All intelligence must be protected, but this is of paramount importance when handling evidence and intelligence during the prosecution of an incident. Security measures will be dependent upon the nature of the data.


Electronic Data: In the case of electronic data, advice from a cyber security expert should be sought. As a basic requirement, data should be encrypted and maintained with a level of protection commensurate with the sensitivity of the data. The most sensitive data should not be retained on any computers that can be accessed via the Internet. Backup copies should be maintained on a secured hard drive that is kept in a good quality safe.

If less sensitive data is stored on a computer that is connected to the Internet, a high-quality Firewall is essential. This will need to be regularly updated as will anti-virus software and the computer operating system.

Hard Copy Data: Hard copy data is often more vulnerable than electronic data. All documents should be protectively marked and staff who have access should be provided with document handling instructions, so that they are fully aware of their obligations to protect such data. Where sensitive hard copy data is in frequent use, it is normal for there to be a requirement to lock documents away in a designated secure location with controlled and logged access. This is often supported by a 'clear desk' policy whereby employees are required to keep their desk clear of documents when they are not present.

Case Examples

The following cases represent examples of real-life incidents involving chemical and biological materials and agents. These case examples aim to provide insight into the nature of the confirmed crimes, the investigative intelligence and information that led to the discovery, the types of evidence that were crucial to establishing a case for prosecution, and the challenges that were faced.

Case Title: Suspicious Storage of Chemicals		
Year of Investigation: 2018	Country of origin: Georgia Region/State: Tbilisi	
Incident Summary: <p>A warehouse owner reported to local police suspicious behaviour and potential storage of hazardous materials within a storage facility. The area was cordoned off and the Police CBRN Incidents Response Service and Emergency Management Agency conducted an initial inspection.</p> <p>Due to the potential hazardous environment, the team initial entry was conducted wearing Level B personal protective equipment (self-contained breathing apparatus), and chemical detectors were utilised.</p> <p>Handheld detectors provided preliminary identification of a number of chemicals including, acids, organic solvents, and cyanide salts.</p> <p>Dead rats, firearms and ammunition were also located. The police forensic and investigative teams were then activated.</p>		

Investigative Intelligence:

- Initial tip off to local police.
- The suspect identified through storage facility records.
- The suspect had no prior convictions.
- He did have a legitimate business related to the manufacture of jewellery and did hold a license to buy and store chemicals.
- He also had a license to manufacture and repair weapons.

Keys Points of Evidence:

- Unattended storage (close to populated area, and bad storage conditions).
- Leakage of chemical substances, hazardous to the environment and exposure of substances to people.
- The various chemical provided insight into potential hazards. For example, high risk of formation of Hydrogen cyanide (HCN) - reaction of CN salt with acid.
- HCN is considered a valuable precursor to many chemical compounds including polymers and pharmaceuticals.

Challenges:

- Risk identification and assessment on-site in the initial phase of the investigation.
- The suspect had legitimate licences to hold a number of the chemicals.
- The scene required coordination and oversight by various agencies including the Ministry of Environmental Protection and Agriculture, and the Ministry of Health.
- Limited knowledge of the national laws related to the storage of hazardous substances (Law of Georgia about hazardous chemicals - articles 32, 33, 34).

Outcomes:

- Violation of the procedures for handling environmentally hazardous substances. Criminal Code of Georgia, Law of Georgia on Hazardous Chemicals. Article 288 – Violation of the procedures for handling environmentally hazardous substances or waste.
- License to buy and store chemicals were suspended.
- License to manufacture and repair weapons were suspended
- The person was fined.
- **Case was closed.**



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Case Title:

Mercury Operation



Year of
Investigation:
February-March 2018

Country of origin:
Republic of Moldova
Region/State:
Balti

Level:
Regional National

Incident Summary:

The Criminal Investigation (CI) body of Moldova identified a criminal gang and commenced an investigation into the illegal acquisition, storage, and transport of a hazardous toxic chemicals, namely mercury. It was believed that the members of the criminal group were acting between 2016-2018, in accordance with a well-determined plan with the intent to financially benefit from the assets. These crimes occurred within the municipality of Balti, Moldova.

The items were subsequently located within a warehouse under the name of a legitimate business "Electrotechnical" SA. The presence of the mercury breached established rules pertaining to the storage and transportation of chemical and poisonous substances.

The Criminal Investigation body commenced an undercover operation to obtain evidence of acquisition and sale of the mercury. During the operation a significant amount of mercury was located, and the warehouse secured.

The identified perpetrators were charged under national Acts related to hazardous products and substances and specific health and safety rules, including the Rule on the Control of Transboundary Movements of Hazardous Waste and their Disposal, List A-1030 and the Basel Convention.

Investigative Intelligence:

- Initial information in relation to the criminal gang was received from the Security and Intelligence Service (SIS).
- Special Investigative Measures used to gather information and intelligence included: identification of the subscriber, visual surveillance and documentation using GPS technical methods and means, undercover investigation, control acquisition, wiretapping and recording of communications or images.

Keys Points of Evidence:

- Information gathered indicated the coordination of activities by a criminal group, including person of interest.
- Several containers located within the warehouse were located and according to Judicial expert reports No nr.34/12/1-R-1518 contained 6508 grams of mercury.
- During the undercover operation the identified perpetrators, in breach of established Rules, stored and subsequently transmitted several containers to the undercover investigator.
- Judicial expert reports No 34/12/1-R-866 of 15.03.2018 and No 34/12/1-R-1201 of 22.05.2018 indicated that the containers held 1283 grams of mercury.
- Mercury is classified as a poisonous chemical substance.

Challenges:


- The problem of the acquisition of control, which would ensure that the health of the persons involved, and the environment are protected.
- Lack of a competent body (de facto) that would ensure the storage of mercury substances.
- The absence of a body responsible for the subsequent safe disposal of these substances and/or the possible confiscation by the State.

Outcomes:

- As a result of the criminal investigation, persons within the identified criminal group were arrested and charged in relation to the storage and disposal of mercury contrary to the established rules.
- The criminal case was sent to the court with the indictment.
- The six persons involved were convicted for committing the offense set forth in Article 224 para. (1) of the Criminal Code and for creating an imminent danger to public health and the environment.
- Additional laws pertaining to the case included, Articles 6, 8, 11 and 12 of the Law on the regime of hazardous products and substances no. 1236 of 03.07.1997, Article 20, Article 25 of Law on waste no. 209 of 29.07.2016, Article 1 of the Government Decision no. 637 of 27 May 2003, approving the Rule on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, list "A-1030" and the Basel Convention.



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Case Title: Operation Cury “Dimethylmercury and Abrin”		
Year of Investigation: 2018	Country of origin: Czech Republic Region/State: Uherské Hradiště	
<p>Incident Summary:</p> <ul style="list-style-type: none"> • In 2017, the perpetrator M.H. unsuccessfully attempted to acquire dimethylmercury via the darknet. • Between February and March 2018, he attempted to acquire C4 plastic explosive via the darknet. Again, unsuccessful, he turned his attention to the biological toxin abrin. • Finally, he negotiated with a darknet seller to buy 100 grams of dimethylmercury and 200 milligrams of abrin. These ampoules were hidden inside small toys and a clock for distribution to the buyer. • The investigation involved the security forces of the Czech Republic in cooperation with the U.S. Federal Bureau of Investigation (FBI). • The perpetrator was detained and several ampoules with the inscription dimethylmercury and abrin were seized. However, laboratory testing confirmed the substances sent to the preparatory by the seller were counterfeit. • The investigation for prosecution focused on the illegal acquisition of the chemical and biological agents. • A clear motive for these acts was not established. • M.H. was convicted under § 21 par. 1 - § 284 of the Criminal Code for the attempted crime of possession of narcotics, psychotropic substances, and poison. (Refer to legislation below) 		

Investigative Intelligence:

- The investigation initiated due to established intelligence links between the US FBI and the Czech Police. The FBI intercepted communication between the buyer and seller and shared this intelligence which initiated collaborative investigations.
- Two main departments of the Czech police National Centre for the Combating of Organised Crime were involved, namely, the Cyber Department and the Counterterrorism and Extremism department (Firearms and Hazardous Material Unit).
- Interagency information was shared in the framework of international cooperation between U.S. FBI and Czech police.

Keys Points of Evidence:

- This proactive investigation was only possible due to ongoing surveillance of darknet sites and the identification of suspicious behaviour on darknet coming from a Czech IP address.
- The chemical and biological materials in question are restricted or prohibited items.
- Communications between the perpetrator and seller included knowledge of the toxicity of the substance, referring to the appropriate concentration of the biological toxin, per kg of body weight. Communication implied intent to cause harm rather than exploit profitability.

Challenges:

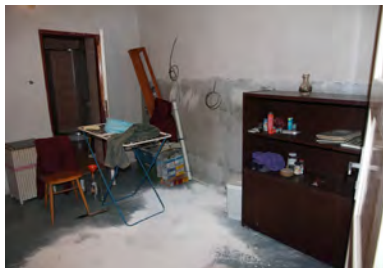
- Conducting cybercrime through the darknet, a platform that enables perpetrators to remain anonymous and untraceable and is always advancing with new and emerging information and technologies (ICT) that challenge the investigative process.
- Use of dark web platforms, cryptocurrency, fake names, and encrypted messaging apps.
- Collection and management of digital evidence and appropriate chain of custody.

- Linking acquisition to motive and intent. The perpetrator was never found in possession of illegal substances; however, the substances were counterfeit.
- Logistics and time to prepare all necessary detection devices (ability to confirm identify and safe handling of materials upon intercept) prior the package arriving in the Czech Republic.
- The coordination of parallel investigations undertaken by CZ Police and FBI.

Outcomes:

- The court did not agree with the prosecution's conviction (intent to profit from sale of dangerous substance). The prosecutor based the hypothesis on the allegations of a witness claiming the perpetrator had gambling habit and financial debts. It was also claimed the perpetrator intended to kidnap an acquaintance and subsequently blackmail his parents and demand a ransom.
- While claims were unsubstantiated with credible evidence, the court considered a possible motive of intent to cause harm.
- M.H. was convicted under § 21 par. 1 - § 284 of the Criminal Code for the attempted crime of possession of narcotics, psychotropic substances, and poisons, and according to § 21 par. 1 - § 272 par. 1 for the attempted crime of public menace. As no intention or motive could be proven, the perpetrator could not be convicted of other crimes, such as attempted murder or even terrorism





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Case Title:

Foot and Mouth Disease Outbreak



Year of Investigation:
July 2007

Country of origin:
United Kingdom
Region/State:
Surrey, England

Case category:
Biological

Incident Summary:

- A sudden and unexpected outbreak of Foot and Mouth disease (FMD), a severe, highly contagious viral disease of livestock, occurred during the European summer months of 2007.
- The index case was close to the biological institute conducting research on FMD.
- Manufacturer of the FMD vaccine was co-located at the same site.
- Initially not considered a natural occurrence due to the time of year and location.
- Police took initial lead of the investigation because of the possibility of a deliberate or negligent act.
- Other agencies engaged to assist in evidence gathering including veterinarians and Public Health.

Investigative Intelligence:

- Location indicated probable source from nearby area.
- Rumours of disgruntled staff.
- Strong initial concern that the incident could be either deliberate or accidental as this biological pathogen is devastating to the meat and milk industries and national and international trade.

Keys Points of Evidence:

- Previous natural outbreaks of FMD occurred during winter months but not during summer.
- FMD virus struggles to survive in sunlight.
- Building work at the animal research facility was initially considered as contributing to the outbreak.
- The spread and distribution of the virus was not the same as previously seen.
- A fractured effluent pipe found near the building works contained live FMD virus upon testing.

Challenges:


- Different agencies had different skills. Police led the initial investigation with little understanding of the pathogen, biological incidents, and their implications.
- A team of specialists was required to interpret analytical data being gathered by police and others.
- While the Health and Safety Executive (HSE), a UK Government body, was well equipped to investigate the outbreak from a health and safety point of view, they did not have experience in collecting evidence which may form part of a legal investigation.
- Challenges with information sharing between agencies and access to certain data was also noted in the post incident review.

Outcomes:

- A lengthy and extensive investigation found that an effluent pipe on site had ruptured.
- Building works were also taking place in the area of the ruptured pipe.
- While the investigation sort to identify a motive, no motive was confirmed.
- Conclusion was that traffic from site of ruptured pipe the most likely cause of the spread of disease.
- Cost of the outbreak is estimated to be £48.3 million.



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Case Title: Case of Hydrogen Cyanide		
Year of Investigation: 2016	Country of origin: Slovakia Region/State: Ruzomberok	
<p>Incident Summary:</p> <ul style="list-style-type: none"> ▪ Suspicious behaviour in the old school building was recorded by residents and reported to the local police. The local police undertook an initial assessment, identifying a clandestine laboratory. ▪ An on-site investigation was conducted by national police (Enviro/CBRN unit within the Bureau of criminal police) in cooperation with the Control Chemical Laboratory of the Civil Protection. ▪ Large quantities of hazardous chemicals were present. ▪ The perpetrator was subsequently arrested on the basis of evidence and witnesses' testimony and legally convicted by the court for illegal and production and possession of chemicals. (See below for related legislation). 		
<p>Investigative Intelligence:</p> <ul style="list-style-type: none"> ▪ Police tip off related to unusual behaviour of a person accessing a building that was under reconstruction. ▪ Identification of a clandestine laboratory and/or hazardous materials by initial responding police. ▪ Hydrogen cyanide was a by-product of the chemical processes being undertaken by the perpetrator. ▪ Suspect admitted to selling jewellery on the darknet. 		

Keys Points of Evidence:

- Several dangerous chemicals found at the crime scene including, hydrogen cyanide (2 litres in two glass bottles), lead dioxide, strong acids and hydroxides and laboratory equipment contaminated with illegal chemicals.
- Statement obtained from the suspect included admission of intention to use chemicals in connection to an illegal jewellery production. He claimed no intention to cause harm to humans or animals or the environment.
- No direct evidence linked to purchases was located, however, the perpetrator admitted the acquisition of these chemicals and intent to sell on the darknet. The perpetrator did not intent to cause harm to humans or the environment.
- The production of hydrogen cyanide was a by-product of the method utilised and not an intentional production.

Challenges:

- Risk identification and assessment on-site at initial phase of the investigation.
- Crime scene investigation under hazardous conditions took several hours: at least 2 litres of hydrogen cyanide, where the hazard was at the level of 4000 ppm in the fractionation column. A lethal concentration zone extended 10-15 meters around the site with a dangerous concentration zone extending to 25-50 metres around the site.

Outcomes:

- 85 dangerous and illegal laboratory items were confiscated.
- The prosecutor charged the offender with 'Illegal production and possession of nuclear materials, radioactive substances, hazardous chemicals and hazardous biological agents and toxins' under section 187 and section 285 of the 'General Threats of the Criminal Code'.
- The court also ruled on the above-mentioned sections of the Criminal Code as an unintentional act, and he was sentenced to two years of imprisonment with a conditional deferral for three years.



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Case Title:

Wolf Mountains - Private Waste Management Facility



Year of Investigation:
2014 - 2018

Country of origin:
Slovakia

Region/State:
Vlčie hory, Hlohovec

Case category:
Chemical and
Biological and
Radiological

Incident Summary:

- A legitimate waste management facility 'Wolf Mountains' was part of an undercover operation and investigation into alleged misuse and disposal of hazardous substances. The property was originally divided in landfill for non-hazardous waste (communal waste), and landfill for hazardous waste (mostly liquids), with a third section designated for inert waste. The landfill for dangerous waste was official closed in 2013 and any waste management activity was forbidden.
- Environmental activists and citizens of the nearby town of Hlohovec recorded increased quantities of dangerous substances and increased movement of trucks during the night. A range of suspicious activities were reported to Police including, polluted surroundings, frequent fires in the landfill causing odours, and even the death of animals.
- An undercover police investigation was initiated in 2014.
- During the search of the crime scene, radioactive substances were also found within a barrel, inside a building. The radioactive material located was 100 times higher than the values of the natural background. The radioactive chemicals were identified as Radium 226 and Thorium-232 compounds.

- At the beginning of 2015, the police carried out the first police intervention and launched an investigation of the illegal dumping of hazardous materials under the supervision of the responsible prosecutor. During the crime scene investigation, police seized 40 plastic tanks of hazardous liquid waste stored in a landfill for non-hazardous waste and other evidence. Multiple searches and interviews were carried out. The liquid was dangerous for water animals and environment. The laboratory forensic analysis proved high overstep of limits for dangerous chemical substances - e.g. arsenic (As), lead (Pb). The police, military CBRN battalion and control chemical laboratory found also a hazardous biological material - medical waste in the landfill for non-dangerous material and chemicals like lead (Pb), antimony (Sb), chlorides, fluorides, materials exceeding limits for hydrocarbon index C10-C40, with high concentration of Arsenic (As). The landfill for inert waste contained plenty of refined oil products that had formed into oil lakes. Chemicals located were characterized as highly hazardous substances with a hazard classification such as: toxic substances, highly flammable substances, corrosives, and hazardous substances.
- The competent authorities subsequently decided to close the entire landfill and to prohibit the import of waste into the landfill, as well as to instruct the proper disposal of the identified substances.
- However, after some time, the private company responsible for waste management re-imported hazardous material to the landfill, despite a previous ban.
- Subsequently, there was another police intervention in 2018 and a complex criminal investigation, comprised of several charges. The collection of evidence from this crime scene was the longest in the history of Slovakia (30 nights).
- The case investigation is ongoing.

Investigative Intelligence:

- Police were notified of suspected illegal dumping of hazardous material by informants.
- Additional information related to the activities of the waste management company was provided by ecologist activists and citizens.
- Increase in citizens' reports including environmental pollutants, fires with unusual odours and dead animals.
- As a result of this intelligence and information, the Enviro / CBRN police unit started the undercover operation in 2014.

Keys Points of Evidence:

- Several dangerous chemicals, radiological material and hazardous biological waste found at the crime scene and collected for analysis.
- Related invoices and other financial documents.
- Testimonies of witnesses.

Challenges:

- Risk identification and assessment on-site at initial phase of investigation, due to located of chemical and biological and radiological substances.
- Longest crime scene investigation in Slovak criminal history, occupying an active crime scene for 30 days.
- Due to the hazardous nature of the scene, the support of large number of personnel from several agencies (CBRN and Enviro Crime Specialists of Presidium of Police Force, was required as well as the use of Personal Protective Equipment, including level B ensemble.

- In addition, Police Force District Police investigators provided support during night shifts. Public order police units to secure the place and fire fighters were required to be in place during the opening of barrels, providing handheld detection equipment and decontamination.
- Samples were sent to the Control Chemical Laboratory, with additional support provided by the Civil Protection, CBRN Battalion of Armed Forces (1st CSI in 2015).
- District Bureau (Environmental agency responsible for dangerous waste management), Ministry of Environment and Ministry of Interior, provided insight into negotiations about liquidation of illegally disposed waste and impacts to the environment.
- The scene produced hundreds of samples and exhibits. A total of 1703 samples of various hazardous materials were collected including, dangerous gases such as hydrogen cyanide.

Outcomes:

- Closed and permanently monitored landfill.
- Investigations identified international stakeholders and links.
- The investigation and charges against perpetrators are still ongoing.



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Challenges of Laboratory Analytics

04

01

Key Focus Area

Background description of specialist laboratory analysis

02

Overview of laboratory classification and networks

03

Considerations to processing hazardous evidence (where the chemical or biological agent is still present)

The processing and analysis of evidence associated with chemical and biological crimes often requires specific and complex scientific analysis and interpretation. The analysis of the chemical and biological agents has several aims, these include:

- To identify the agent (classification or grouping).
- To identify the potential source of the agent (geographic distribution, storage locations, and natural or man-made).
- To link the agent with the perpetrator and their actions (comparison analysis, i.e., is this agent the one used by the perpetrator?).

For this guide, evidence containing chemical or biological agents will be referred to as hazardous evidence. Types of hazardous evidence include traditional evidence such as, latent marks and DNA, that may be contaminated with chemical or biological agents, and samples of the chemical or biological agents, materials, or precursors, found at crime scenes.

Prosecutors and investigative agencies need to ensure that the samples and the evidence they contain have been collected in accordance with relevant laboratory criteria, and jurisdictional rules of evidence.

Submission of samples to an appropriate laboratory will require appropriate documentation to assist in the identification of suitable analytic techniques, and ensure results obtained from such evidence is admissible in court.

Forensic laboratories that receive, process, analyse and store, hazardous evidence must have practices, procedures, and facilities to manipulate samples with appropriate chemical and biological safety and security, and maintain samples to preserve evidentiary chain of custody as well as be applicable in a court of law.

Traditional methods of evidence processing may be used providing appropriate safety can be maintained. However, it may be necessary to incorporate novel or non-traditional methods of analyses in cases involving chemical or biological crimes. Consequently, some methods may require validation and approval for use in trials if they have not been used previously. Relevant technical subject matter experts will be critical to the prosecution as they may be required to conduct species analyses, interpret analyses and results to juries, present the strengths, limitations and significance of results.

The following sections provide an overview of methods used to analyse hazardous evidence. Various countries may have instituted laws and statutes for their approval in courts of law; therefore, it may be possible to use them as exemplars for development of laws in countries without them.

Microbial Forensics

The ability to analyse and identify the source and characteristics of a microorganism or toxin for attribution purposes, defines microbial forensics. This subset of forensics focuses on the characterisation of evidence from a bioterrorism act, bio crime, hoax, or inadvertent release. For attribution, higher resolution characterisation is required to determine the original source, human manipulation and potential weaponization and dissemination methodologies.

Such technologies and analysis include genetic profiling of the microbe to strain and sub strain level, chemical and physical analysis of components, and bioinformatics of the material to assist in determining the process used to prepare, store, or disseminate the agent.

Such analysis requires often complex and specific equipment, and methodologies that should form part of a quality assurance program to ensure adequate validation of techniques and reliability as part of the evidentiary process.

Chemical Fingerprinting

Chemical analysis may provide investigators and a prosecutorial team with insights into the history of a chemical sample: its original source, its production methodology, as well as links to specific manufacturers or distributors, any of which may be helpful to link a toxic sample to a perpetrator. A chemical sample is often a mixture of many chemicals including solvents, reagents, precursors, degradation products, and side products. In the same way that chemical profiling has been used to identify illicit drug dealer-user networks, chemical profiling of chemical threat agents can help to identify relevant chemical markers that can be compared to chemical profiles of other samples to elucidate the provenance of a sample.

For example, traces of unreacted precursors or side products can be used to determine the synthesis route used to produce a threat agent. Additionally, the chemical fingerprint of impurities in a sample may show linkage back to specific precursor batches from certain companies or geographic areas. Impurities from starting solvents have been found to survive multiple synthetic steps, even surviving mild decontamination, to be present in the

final product. Furthermore, other chemical markers, such as isotopes, may also be useful to link samples to each other.

The OPCW Scientific Advisory Board has noted that “impurity profiles for known synthetic routes to nerve and vesicant agents could serve as a resource to those working in the field of chemical weapons related investigations.” An international group of chemical forensic experts are conducting and sharing research on chemical forensics of threat agents for attribution. Through advances in analytical instrumentation and chemometric data analysis, the Chemical Forensic International Technical Working Group is advancing the science of chemical forensics for the global community.

Case Examples

American Anthrax Letters

Summary of Incident

Spores of *Bacillus anthracis* contained on letters mailed within the United States, resulting in 22 infected people and 5 deaths. It was the largest microbial investigation of the 21st Century. Complex analysis was used to trace and track the source of the bacteria and build a case for prosecution.

Type of Analysis

Genome sequencing of known Ames strains- morphological variant testing

Relevance to the proof of evidence

Identify laboratory strain or environmental source.

Genetic sequencing of bacterial spores in letters	To identify strain and determine if bacteria had been deliberately genetically engineered or modified. (e.g. antibiotic resistance).
Liquid Chromatography Mass Spectrometry (LCMS)	Identification of additives to the powder (potential enhancement of weaponization).
Gamma phage analysis of bacteria isolated from samples	Based on the B. anthracis susceptibility to lysis. This test has been shown to be 97% specific for B. anthracis.
Real time PCR	Detection of virulence plasmids (pXO1 and pXO2).

Example of Chemical

Summary of Incident

Surface-to-surface rockets with CWA payloads were fired in the Ghouta area of Damascus, Syria on 21 August 2013. A United Nations team deployed to collect information and samples in order to determine what happened and the effects of the incident on those involved.

Type of Analysis	Relevance to the proof of evidence
Gas chromatography-mass spectrometry	Identify chemical compounds present in samples.

Gas chromatography-mass spectrometry, liquid chromatography-mass spectrometry, gas chromatography-flame photometric detection

Presence of signatures of exposure to a chemical warfare agent in biomedical samples (urine, plasma, blood).

Physical examination (with photography collection)

Examination by medical professionals can identify symptoms of exposure to chemical weapon agents, potentially indicating the type of chemical agent.

Physical length measurements

Provides information on the size of a potential weapon used; also relevant to indicate amount of chemical agent that may have been used/released.

Laboratory Networks

Countries have different laboratory capabilities for managing incidents involving chemical and biological materials, based on available resources and capabilities. For example, Australia, the United Kingdom, Canada, and the United States and some countries in Europe, have national, territorial, and local laboratories, each with specific roles in response to public health incidents involving chemical and biological threats. These laboratories work closely with law enforcement counterparts for terrorism and criminal incidents.

- 01. Biological Laboratories** Samples requiring analysis and identification of biological pathogens and toxins, are usually received by a designated public health laboratory that possess microbiology and molecular biological testing capabilities. These laborato-

ries are classified according to the level of laboratory containment and protective and barrier equipment procedures they contain.

The World Health Organisation publishes the Laboratory Biosafety Manual (LBM), a guide for laboratory biosafety that serves as a global standard for best practices and sets trends in biosafety. A number of countries have published similar guides based on concepts and perspectives of the respective national context. All agree on the foundational knowledge of biosafety and laboratory criteria for each biosafety level. These guidance documents serve as comprehensive resources for infrastructure, equipment, and practices associated with all levels of biological laboratories. In addition, information and resources and training is provided by the International Federation of Biosafety Associations, a not-for-profit, non-Governmental network of biosafety associations.

There are four biosafety levels (BSL), also referred to as protection level (P) or containment level, each of which is comprised of a combination of infrastructure, design features, safety equipment, practices, and procedures. Each subsequent level builds on the previous level and becomes more complex in infrastructure and design features. Complementary biosafety levels (BSL) for animal pathogens are referred to as animal biosafety level laboratories (ABSL).

The primary objective of each BSL is to provide infrastructure to minimize the likelihood microorganisms will escape containment. Practices and procedures augment this infrastructure, as each BSL is only as secure as the personnel who conduct the work at each biosafety level.

Relaxed or sloppy practices may result in lab acquire infections with the potential to cause community-wide outbreaks, either in human or animal populations. Transportation of infectious substances is regulated by transportation guidelines including International Air Transport Association (IATA) and national Dangerous Goods Acts.

Biosafety level 1 (BSL-1) or P1 laboratories and facilities offer minimum containment and contain standard equipment that is appropriate for manipulation of characterized microorganisms that do not typically cause disease in healthy, immunocompetent humans. Examples of BSL-1 laboratories are training laboratories.

BSL-2 laboratories and facilities build on BSL-1 and are suitable for work with agents that pose moderate risk to human or animal health and cause disease by direct contact or ingestion.

BSL-3 facilities build on BSL-1 and BSL-2 facilities and are suitable for work with indigenous or exotic agents that can cause potentially lethal disease by inhalation.

BSL-4 facilities are reserved for work with exotic agents that cause diseases that are frequently fatal, and for which there are no vaccines or treatments.

The following table summarises some primary characteristics, practices, and equipment associated with each BSL; for additional information see the guidance documents referenced in this section. Perpetrators may attempt to emulate biosafety infrastructure, equipment, and practices in an improvised setting.

BSL	Agent Types	Practices	Facility Design Features	Equipment and PPE
1	Well-characterized agents that pose low risk or are not known to consistently cause disease in immunocompetent individuals	Standard microbiological practices such as aseptic technique; no eating or drinking in work area; hand-washing	Laboratory doors, sink for handwashing, bench, windows with screens	No special PPE required, however, face protection, gloves and lab coats as appropriate
2	Agents posing moderate risk of human disease caused by direct contact or ingestion; treatments available	Limited facility access; procedures resulting in aerosol performed in biosafety cabinet; decontamination of area and surfaces	BSL-1 plus lockable doors and windows, biosafety cabinet for aerosol generating procedures, and autoclave nearby, sink near exit	PPE for protection against aerosols, work in biosafety cabinets as needed; autoclaves and proper waste disposal

3

Agents that pose significant risk of life-threatening disease caused by inhalation with few treatments available

Entry through anteroom biological agent movement using secondary containers and all infectious work conducted in biosafety cabinet

BSL1 and 2 plus: ducted ventilation with negative airflow into laboratory

Biosafety cabinets, waste disposal, respiratory protection as needed

4

Dangerous indigenous or exotic agents that pose high risk and life-threatening disease by inhalation; no vaccines or treatment or unknown mechanism of transmission

Clothing change before entry, all waste decontaminated prior to removal

BSL1, 2, 3, plus entry through airtight door, sealed and easy to decontaminate floors, walls, ceilings, passthrough autoclave, all waste including effluent decontaminated, all infrastructure with redundancies

Full body air-supplied suit, all work with infectious material in biosafety cabinet; coveralls or scrubs respiratory protection and Class III biosafety cabinet.

02. Chemical Laboratories

Under the Chemical Weapons Convention, the Director-General of the Technical Secretariat (Secretariat) of the OPCW shall certify the laboratories designated to perform different types of analysis. The official OPCW proficiency tests are the procedure that the Technical Secretariat has put in place to allow the Director-General to carry out this certification. Laboratories within the 193 OPCW Member States are invited to participate.

The OPCW Designated Laboratories (DLs) network is a network of States Parties' laboratories

that may be tasked with the analysis of authentic samples retrieved from OPCW missions. This requires a robust proficiency testing regime to ensure that the DLs can perform the task to the standard required by the OPCW. The Proficiency Testing programme, which the OPCW Secretariat administers and guides through the OPCW Laboratory, provides this assurance to all States Parties; not only does it test the technical proficiency of laboratories, it also provides assurance, through rigorous reporting criteria, that the sample chain of custody is maintained, and the testing and reporting remains unbiased. This assurance is further supported by the requirement for any DLs to have internationally recognised accreditation in place, for example, ISO/IEC 17025.

At present, there are two types of Proficiency Test (PT) and hence two types of designation, namely, Environmental PTs which assess DLs for the analysis of authentic environmental samples, and Biomedical PTs which assess DLs for the analysis of authentic biomedical samples.

During a deployment, samples may be collected and shipped to the OPCW Laboratory with the samples' chain-of-custody (CoC) maintained throughout the process. The OPCW Laboratory verifies the CoC and then will split the samples.

The split samples are then shipped to at least two designated laboratories in accordance with

03. Authentic Sample Handling and Analysis

international shipping rules and standards. The identities of the designated laboratories are kept secret, including from each other, which adds another level of impartiality and independence to the analytical process. Further to this, the OPCW Laboratory anonymises the samples as well as the control samples such that the DL is not able to determine the origin (provenance) of the samples.

Upon arrival, the DLs would verify that CoC has not been compromised and accept the samples for analysis. The DLs are provided with a scope of analysis and asked to provide the OPCW with a written report, within a specific timeframe.

The Designated Laboratories are able to compare the data they generate (e.g., by mass spectrometric techniques) to a database developed and curated by the OPCW; the OPCW Central Analytical Database (OCAD). The OCAD is built from chemical warfare agent and related compound analytical data submitted by Member States.

Following completion of the authentic sample analysis, the DLs transmit their analytical reports to the OPCW. Chain of custody of the report is maintained throughout as well. The findings of the DLs are then collated by the OPCW Laboratory into a single report.

The DL summary report is then integrated with various other pieces of evidence (e.g., witness

interviews) into a final report by the Secretariat. The findings presented in the final reports are the result of independent, unbiased, rigorous and stringently controlled scientific analyses.

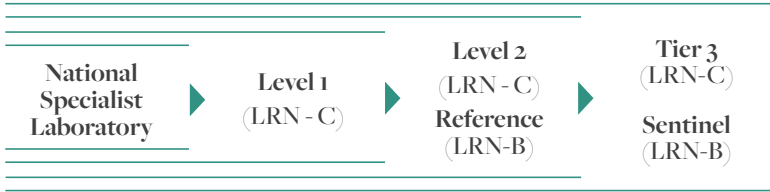
The Americas: The United States

The United States Centers for Disease Control and Prevention (CDC) has established a network of national, state, and local laboratories, referred to as the Laboratory Response Network (LRN) that respond to incidents involving biological and chemical materials. LRN-B facilities respond to incidents involving biological threats and bioterrorism while LRN-C respond to incidents involving chemicals and chemical terrorism incidents.

The LRN has laboratories established in a tiered system. Tier 3 and sentinel laboratories are the most numerous and serve as frontline laboratories in every state and many locations. Reference and tier 2 laboratories are fewer in number and are responsible for analysis of referral samples. Only two or three national laboratories are responsible for specialized characterization of organisms, bio-forensics, and special activities involving highly pathogenic organisms. These entities work closely with local and state law enforcement and the Federal Bureau of Investigation, which is the lead law enforcement agency for terrorist incidents.

04. Example of Laboratory Networks

Biological and Chemical Laboratory Networks Levels



Asia Pacific Example: Australia and New Zealand

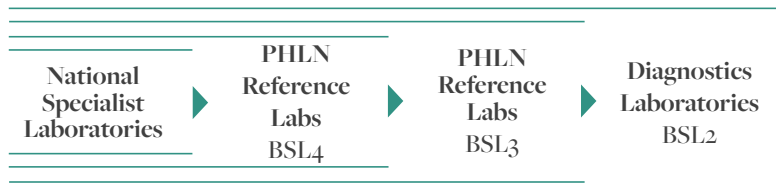
Within Australia and New Zealand, the collaborative group of laboratories known as the Public Health Laboratory Network (PHLN), provides leadership and consultation across all aspects of public health microbiology and communicable disease control. The safe handling of high-risk pathogens and toxins requires access to safe protocols and infrastructure. Each State and Territory has access to a Biosafety Level (BSL) 2 and (BSL) 3 facilities. BSL2 laboratories are clinical laboratories that are likely to receive the sample of a routine diagnosis.

When a high-risk pathogen or toxin is detected by a primary diagnostic lab, samples will be directly diverted to a nominated public health (PHLN) laboratory for proper handling, diagnosis, containment, and storage.

Particular pathogens such as high-risk animal pathogens and viral haemorrhagic fevers, require direct transfer to the BSL4, the highest-level

el facility. There are at least one BSL3 facility in each state and territory and one national BSL4 facility. In addition, some of these BSL3 and 4 facilities specialise in certain high-risk pathogens, undertaking associated research and supporting a range of national and international diagnostic and reference laboratories.

Public Health Laboratory Network



The Chemical Warfare Agent Laboratory Network

To enable the receipt and analysis of low-risk chemical warfare agent samples, the Department of Defence Science and Technical Group provides training, collaborative trials, and reference standards to nominated laboratories across Australia and New Zealand. These identified laboratories form part of small technical laboratory network bringing together forensic experts and chemical agent analysis.

Methodologies for the safe identification, collection and transport of potential chemical agents has been developed and training provided to select chemists who may be integrated into specialist CBRN forensics teams.

Eastern Europe and Western Asia Example: Georgia

The public health laboratory network within Georgia, is based on the National Centre for Disease Control and Public Health, tasked with protecting and responding to the public health events nationally. The Centre provides a series of nominated laboratories for the primary detection and identification of pathogens and toxins.

Working under a 'One Health' concept, Georgia's laboratory network is comprised by public health and veterinary laboratories which are located at regional (ZDL) and district levels (LLS). A total of 20 laboratories are engaged in the laboratory network, including 11 veterinary and 9 public health laboratories. The Lugar Center is the country's highest level BSL 3 laboratory, providing human as well as animal disease detection.

**Lugar Center
Highest Level
National
Laboratory**

**Zonal Diagnostic
Laboratory**
ZDL-2

**Regional
Laboratory**
LSS-1

05. Laboratory Quality and Accreditation

There is not a universally accepted international standard for formal accreditation of chemical, microbiology and biomedical laboratories. However, forensic and higher classified laboratories must meet certain standards by ensuring instrument calibration, reliable and repeatable results and these standards are applicable to numerous facilities. Countries should consider national and international guidance and regulations when considering facility accreditation options.

The International Organisation for Accreditation bodies (ILAC) was established as an international arrangement between member accreditation bodies and is based on peer evaluation and mutual acceptance. The ILAC Mutual Recognition Arrangement (MRA) was signed by 104 accreditation bodies with peer evaluation in accordance with ISO/IEC 17011 standard. ILAC operates in accordance with other ISO/IEC standards and promotes the use and acceptance of accredited calibration, testing, medical testing and inspection data and results, proficiency testing programs and reference materials internationally.

The ILAC MRA signatory accreditation bodies assess and accredit conformity assessment bodies against relevant international standards. Because of its international approach, ILAC provides advice and assistance to countries that are in the process of developing their own accreditation systems. These countries can participate in ILAC as Associate members

and access the resources of ILAC's more established members.

The following examples of accreditation standards have been provided:

- **ISO 35001:2019**

Is an international biorisk management standard for laboratories and related institutions. This standard outlines a process to assess, identify, mitigate, and monitor risks associated with hazardous biological materials and provides a roadmap to reduce associated risks. This standard is applicable to facilities that manipulate, store, transport, and/or dispose of hazardous biological materials and is intended to complement existing international standards. ISO35001:2019 is not intended for laboratories that test for the presence of microorganisms and/or toxins in food or feedstuffs or for the management of risks associated with the use of genetically modified crops in agriculture.

- **ISO/IEC 17025:2017**

Is an international standard that outlines competence requirements for testing and calibration laboratories. This standard specifies general requirements for competence, impartiality and

consistent operation of laboratories. ISO/IEC 17025 enables laboratories to demonstrate competence, ultimately promoting confidence in their work both nationally and internationally. ISO/IEC 17025:2019 also facilitates cooperation between laboratories by generating wider acceptance of results between countries which help rest result acceptance and certificates from one country to another without the need for further testing.

- **ISO 71.040.10**

Is an international standard for chemical laboratories and laboratory equipment. This standard outlines the requirements for laboratories undertaking analytical chemistry and includes the calibration of laboratory equipment and apparatus utilised for measurement of volume, mass, density and viscosity.

Challenges of Hazardous Evidence

Once a crime scene has been established, whether pre-event or post, crime scene teams will usually undertake a sequence of crime scene processing that involves the collection of physical and trace evidence. This may include scene photography, video mapping, collection of biological hairs and fibres, recovery of latent finger-marks, shoe marks and recovery of non-hazardous liquids. In addition, swabs may be taken for potential DNA analysis from bodily fluids or stains.

While these scenes may contain blood, semen, urine or other hazardous material, these areas, once identified, can be avoided, covered, or removed, reducing, or removing the danger of exposure to the forensic operator. The collection of traditional forensics evidence and crime scene samples can generally be performed wearing standard crime scene apparel (disposable coveralls, shoe covers, hair nets and disposable gloves), with no requirement for specialist packaging or decontamination (noting the exception to this is the processing of a clandestine drug lab). The collected items are recorded and transferred to appropriate laboratories based on well-established order for forensic analysis and a clear understanding of the laboratory capabilities.

However, the processing of a crime scene that contains, or potentially contains, chemical or biological agents or toxins, poses unique and complex challenges to the identification and collection, transfer, and processing of traditional forensic evidence, this is particularly true when processing a scene where the chemical or biological agent has been dispersed.

In this instance the hazardous substance, a toxic chemical with potential inhalational or skin contact risks, or microscopic infec-

tious pathogen, cannot easily be avoided, or safely contained. It is therefore assumed that all items within that scene may be contaminated with the agents and therefore they cannot be handled safely within a standard forensic laboratory.



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The scene presents two evidentiary priorities with associated challenges. Key considerations are presented in the following points:

1. Collect samples to confirm the identification of the agent present.

- Chemical detectors may be utilised to identify non-hazardous chemicals from toxic hazardous chemicals including CWA's.
- Presumptively identified CWA's will be required to be collected and transported in accordance with the nominated chemical laboratory. The chemical laboratory capable of such testing and analysis of high-risk samples may be overseas or require attendance, in country, by specialist personnel, such as specialists from the OPCW. Refer to chapter 4 for laboratory classifications.
- Powers, liquids, or trace swabs potentially containing high-risk pathogens, including bacteria, bacterial spores, viral particles, or toxins, will require specific packaging and screening for other hazards, prior to submissions to the nominated public health laboratory. Note that not all public health laboratories can safely receive and analyse samples containing bacterial spores, due to the aerosolization risk. Refer to chapter 4 for laboratory classifications.

2. Collect items of evidence (physical or trace) to support the investigation and identify the perpetrator(s), target, and intent.

- Items such as documents, glassware and digital equipment may be of interest to the investigation and provide potential sources of finger-marks, DNA or digital intelligence. As these items are potentially contaminated with a high-risk agent, the recovery of such evidence cannot be routinely undertaken in a traditional forensic laboratory as its level of contamination would pose significant risk to the operators and laboratory environment. The handling of such items and recovery of traditional evidence requires adaptive methodologies and additional personal protective equipment.

There are three options that investigators and prosecutors should be aware of when considering the evidentiary plan:

Processing in-situ

- Forensic evidence may be processed in-situ (within the hazardous crime scene,) where forensic operatives have been trained to recover traditional evidence while wearing level B or C personal protective equipment, and where methodologies have been established and tested under such conditions. While possible, processing evidence in-situ should only be done when absolutely necessary.
- Items of evidence may also be processed with a mobile laboratory if equipped appropriately, and

with the ability to decontaminate post forensic examination.

2. Decontaminating items prior to laboratory receipt

- Removal of the hazardous substance (chemical or biological agent) from the substrate (paper, glass, plastic, digital equipment) requires specialist knowledge, specific environmental conditions, access to certified chemical products and ability to test the items for the hazard.
- Decontamination processes can destroy trace evidence including finger-marks and DNA, and damage electric equipment. There are several research articles that describe these processes although laboratories able to perform decontamination on critical evidence are very limited worldwide.

Collect and Overpack

- All hazardous evidence requires proper overpacking for removal from the crime scene. Because everything coming out of a hazardous scene requires decontamination, the overpack is decontaminated, but leaves the evidence intact. Hazardous evidence being collected at a scene should be packaged and overpacked appropriately according national and international regulations for chemical and biological materials/ infectious substances and transported to a specialist laboratory. This requires suitable overpacking material, shipping and transport documentation and approval form receiving laboratory.





Building a Case for Prosecution

05

01

Key Focus Area

Summary of key considerations for building a case

02

Importance of evidence integrity and preservation

03

Investigative avenues and importance of case reviews

Law enforcement officials and prosecutors investigating potential crimes involving chemical and biological agents and toxins may encounter several challenges. For example:

- Necessary preservation and collection of evidence must be balanced with health and safety concerns and the need for immediate site remediation or treatment of the injured.
- Biological agents may be endemic or naturally occurring, making it difficult to identify potential criminal intent.
- There are myriad types of existing and newly created chemicals and their precursors.
- Raw materials or laboratory equipment needed to make biological or chemical weapons often have dual uses (legitimate and illicit ones).
- Persons who initially have authorisation or permission to access certain materials can misuse their positions for criminal ends.

Accordingly, primary investigative goals must include an assessment of criminal intent and the facilitation and coordination of safe and effective evidence collection and preservation.

Components of building the case

Prosecutors should strive to gain or establish:

- An understanding of applicable legislation prior to any attack, anticipating that those criminal laws addressing biological and chemical attacks often involve complex legislation with which most prosecutors have no prior experience.
- Access to case-specific, necessary expertise (within law enforcement or from academia and the private sector).
- A timeline for the case (allocation of clearly defined roles among the prosecution/investigative team, continuity of law enforcement teams, and considerations for post-conviction legal challenges).
- The complexities of the case lifecycle (planning, acquisitions, and production may have overseas connections, considerations for international cooperation from the outset).
- Motive and target considerations are appropriately re-assessed throughout the course of the investigation to ensure the scope of the attack and its perpetrators are fully known.

Investigators should work closely with prosecutors who have prior experience in building cases involving biological agents or chemical toxins. The body of relevant legislation is often specific and nuanced, and the science behind the creation of bio-

logical or chemical weapons is often complicated, making it challenging to navigate these prosecutions for those unfamiliar with chemical or biological matters, or CBRN more broadly.

Evidence Integrity and Preservation

Collection of evidence, including samples of biological and chemical agents, requires an investigative strategy that balances the need for immediate risk assessment with thorough development of evidence for potential use at trial. Integrity and preservation of evidence can be especially challenging as there could be many agencies and investigative bodies involved within the incident scene (first responders, military, CBRN teams, police, and environmental agencies).

Like other investigations, the field testing or collection of biological or chemical material and other traditional evidence types, must be clearly documented through the established “chain of custody” procedures. These procedures allow prosecutors at trial to persuade a jury that the evidence in court is the same material seized from the crime scene. Evidence collection technicians who are specifically trained in identifying and safely handling evidence, which may be contaminated with infectious or toxic agents, are essential.

Evidence at scenes where chemical and biological agents are being produced or where they were released must be collected in a manner to prevent personal exposure; collection vessels must be properly sealed to prevent accidental release and to ensure that the evidence is not compromised during decontamination.

Evidence collected at hazardous scenes should be collected in containers appropriate for the hazard and packed into second-

ary “overpack” containers. In most cases, overpack containers used to extricate samples from hazardous scenes must be decontaminated prior to removal from the scene. Evidence chain of custody must be maintained during the process of overpack container decontamination. Consequently, overpack containers should be decontaminated in parallel and near personnel decontamination so the collecting officer can maintain sight of the evidence during sample/evidence decontamination. Once collected and decontaminated (where required), the items will be transferred to either a secured police exhibit area or a nominated public health or chemical laboratory, depending on the nature of the samples and the evidentiary processing required. Regardless of the type of facility, both require secure, safe, and often temperature-controlled environments, to preserve the evidence, and adequate laboratory information management systems and procedures, to protect sample integrity.

Critical evidence will not only include samples of the agents and toxins, but also laboratory equipment and various other aspects of the individual’s life. Intent and motivation (e.g., private, political, financial) for having such material may be gleaned from traditional law enforcement techniques, such as interviews with family, friends, neighbours, and co-workers, along with searches for information revealing an individual’s “digital footprint” (e.g., purchase history, email accounts, online search queries, and social media presence), and relevant data from computers and phones. Efforts seemingly to hide one’s activities involving biological and chemical materials – erroneous information on invoices used to obtain equipment, working unusual hours on unauthorised research – may be indicative of criminal intent. Evidence whether physical or trace, hazardous or safe, needs to be properly collected, recorded, and stored.

Proper collection and preservation of evidence will often require coordination between national, state, local, and private partners. As mentioned above, the lead investigative body may need to work alongside state and local partners, first responders, and public health officials. These partners may be the first to a crime scene and duplicative or conflicting investigative steps should be avoided through prior coordination and planning.

In addition, biological and chemical crimes may implicate domestic and international law and may involve coordination and collaboration with the suspect's country of citizenship. To secure overseas evidence, reliance upon informal information-sharing and mutual legal assistance treaties may be necessary to determine the existence of any conspiracy or to secure further evidence for trial. Investigators should work closely with prosecutors before, during, and after collaboration with foreign law enforcement agencies to ensure the admissibility of any collected evidence.



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Investigative Avenues

As with criminal investigations in general, a single piece of evidence may be relevant to multiple aspects of a case. Some recurring examples from cases involving biological and chemical agents include:

Potential evidence	Relevance to crime lifecycle
PPE purchases	Provides protection from exposure or contact with chemical or biological hazard during the preparation or deployment stages of the attack.
Antibiotic prescriptions	Provides prophylactic protection from some bacterial pathogens.
Digital evidence	Provides search history, documents, online transactions relevant to motivation, intended targets, procurement of precursors, and location of accomplices.
Courier deliveries	Acquisition of chemical or biological equipment or materials.
Storage facility leases	Used to store purchased equipment, materials, specific biological or chemical agents, or as a makeshift laboratory.
Chemical licences	Access to restricted chemicals or bulk orders.

**Fake identifications/
identify fraud**

Used to make purchases of equipment or materials, rental premises or vehicles, or order specific chemical or biological agents; may be used to falsely implicate an innocent third-party.

**Out of hours access
to laboratory / dual
use industry, facilities**

Gain access to dual-use equipment or source materials including small quantities of biological pathogens, toxins, or precursor chemicals without arousing notice.

**Intercept of
third-party supplier**

Disrupt execution of crime; gain insight into buyer's intentions; use third-party supplier as potential witness.

**Phone records
(contacts, associates)**

Identify potential associates or witnesses connected to the suspect.

Investigative Reviews

An investigative review is a formal, unbiased review of the investigation. Undertaken by the investigative leads and prosecutors, it is best conducted after the first 24 to 72 hours of the commencement of the investigation, to establish situational awareness, and provide an opportunity to identify and agree on a strategy, considering operational needs and challenges.

In addition to the initial case review, regularly scheduled meetings between the lead investigators, prosecutors and external experts as required seek to evaluate the progress of the investigation critically and constructively, ensuring integrity and objectivity throughout. In addition, the review process can provide direction to the investigation and identify areas of the investigation that require enhancement to achieve a successful prosecution.

Reviews provide reassurance that no contraventions to current legislation have occurred, or reasonable investigative opportunities have been missed.

The fundamental process of an investigative review should follow an already established process or standard. The review process should increase the confidence in all parties involved that the investigation is being managed effectively with an ethical, methodical, and professional approach being applied, to achieve a positive resolution to the investigation.

Reviews should be seen as an opportunity to identify good practices but also areas of enhancement, with an overall view to improving working practices, future procedures and potential changes to legislation, positively impacting future investigations and prosecutions.

What types of reviews exist?

The following provides a summary of three different types of review meetings.

1. Investigation/Operational Review

Generally, the Senior Investigating Officer (SIO) will determine the attendance of persons to attend the operational review. But generally, in the first few meetings, a representative of all areas of investigation, forensics, intelligence, laboratory and legal will be present. The SIO will ensure the security access of all persons attending the meeting is at the required level.

The investigation/operational review will identify the status of the investigation, the evidence already obtained to meet the elements of the prescribed offences and identify the evidence that

is required to achieve a successful prosecution. Recommendation should be considered, and a decision made to accept them or not, with the rationale behind the decision recorded and ownership of the action clearly marked. Task appointed to groups or individuals to be completed within a reported timeframe.

When should these reviews take place?

- Within the first 72 hours of the commencement of the investigation.
- Every 14 days thereafter, or more regularly as determined by the SIO or Prosecutor.

2. Pre-trial Review

The SIO together with key investigators will review the case with the Senior Prosecutor and prosecution team. The Senior Prosecutor will ensure that the SIO has all required evidence, witnesses and experts prepared for the trial. The Senior Prosecutor may instruct the SIO to conduct final searches for any required or missing evidence. At the end of the pre-trial review the brief of evidence should be ready for presentation at Court.

3. Trial Review

At the conclusion of court proceedings, a Trial Review will produce the outcomes of the investigation and prosecution achievements. It also provides an opportunity to evaluate areas of enhancement to the investigational procedure and recommend changes to legislation.

The more significant the biological or chemical case, the greater likelihood that frequent updates to higher-level managers (e.g., Attorneys General or Justice Ministers), independent overseers

(e.g., courts or legislative bodies), and the public (beyond specific victims) can be expected. Furthermore, when an investigation becomes lengthy, personnel changes and diminishing institutional memory of the case history require a plan for the inevitable handovers of responsibilities from outgoing to incoming team members without interrupting or hampering the investigation's progress.





Investigative Technology

06

CHAPTER SIX



Key Focus Area

01

Types of technology in use by investigative and undercover teams

02

Types of technology in use by crime scene teams

03

Limitations and considerations for advanced technology as evidentiary source

Technology In Use

As technology advances, police and investigative authorities must consider the role of technology in all phases of the investigation and the impacts its use might have on the legal case. Whether undertaking surveillance, monitoring purchases, detecting, or identifying potential chemical or biological agents in the field, the rate at which technology is advancing may not be in line with legislation, limiting the application and use of evidence obtained through such technology.

Courts may challenge technology in the following way:

- Has the legal framework kept up with advancing technology?
- Is all evidence captured from such technology admissible?
- What are the limitations of such technology when building case for prosecution?

In addition to challenging the use of certain technology, prosecutors may need to consider the use of subject matter experts. Certain technology and its applications may be complex in nature, subject to various interpretations and bias. Utilisation of recognised experts in either the application of the technology or the interpretation of the technological data, may provide relevant context and clarity throughout the legal process.

The following headings describe examples of technology and considerations for current or potential applications.

Investigators and Undercover Operatives

Investigators and Undercover Operatives The collection of information including physical, digital, and audio, has long been used to supplement the collection of traditional investigative evidence. As technology and information sharing platforms have evolved, so too has the methodology for which investigative authorities collect, process and analyse information.

The following paragraphs provide insight into some of these technologies and their application.

Surveillance and Monitoring Devices

There are a number of types of surveillance and monitoring devices which may be utilised by police, civil defence, and military, as well as specialist undercover teams. Such technology varies greatly in size and complexity and their use depends on existing legal framework and the financial capacity of the relevant agencies.

Such technology may include some of the following:

- Unmanned Aerial Vehicle (UAV) - includes drones
- Unmanned Ground Vehicle (UGV)
- Unmanned Underwater Vehicle (UUWV) - underwater drones
- Unmanned Water Vehicle (UWV)
- Video imaging and Closed-Circuit TV (CCTV)
- Digital technology including dispersion modelling, vulnerability checks, social media and darknet monitoring

An understanding of the application of such technology within the context of a chemical and biological crime will be important for prosecutors.

Video and Audio Devices

The use of video and audio devices will be subject to the legal requirements and may be temporary placed or permanently fixed in a particular location.

Temporary placed interception and recording devices may be used for targeted surveillance of an individual or multi-person video conversation and are mainly used to obtain operational information and evidence for further investigation. This includes remote control monitoring devices, which may record the movement of monitored persons or collect operational information and evidence for further investigation. Depending on the situation, they require the approval of the relevant judges.

Some countries are able to use highly specialised equipment to obtain and evaluate various data not only for military but also for law enforcement activities. Known as a motion imagery processing and exploitation (MIPE) system, it provides various images that are collected from earth-orbiting satellites or electronic signals, together with full-motion video, recorded by cameras placed on planes or remote-control vehicles. These are subsequently evaluated and interpreted.

By comparison, devices fixed to a location, such as the use of Closed-Circuit Television (CCTV) are commonplace in many cities and community public spaces. They may be utilised to monitor the legitimate movement of people or materials, gather environmental information, or provide direct access to time spe-

cific imagery, such as past movements of people, suspicious or otherwise, during a particular timeframe.

Examples

The following table provides an overview of examples and considerations for prosecution.

Technology category	Prosecution considerations
Video and audio temporary placed devices - listening devices	May be allowed as evidence in some jurisdictions, where footage, images or recorded sound pertain to the investigation.
Video and audio remote control devices (fixed or temporary)	May be allowed as evidence in some jurisdictions, where footage, images or recorded sound pertain to the investigation. Remote controlled vehicles may require a license for use.
Video imagery - motion imagery processing and exploitation devices	May be allowed as evidence in some jurisdictions, where footage, images or recorded sound pertain to the investigation.
CCTV and fixed sound sensors at the public spaces	May be allowed as evidence in some jurisdictions, where footage, images or recorded sound pertain to the investigation.

Digital Technology

In addition to video and audio technologies the use of digital technology has assisted law enforcement and other responding agencies to better prepare for likely outcomes of an unknown or complex incident. The ability to model potential situational or environmental variables has enabled investigating authorities, including prosecutors, to simulate various scenarios and assess potential outcomes. For example, digital technology may be used to simulate the release of a highly toxic chemical within a city environment, assessing influences, such as weather conditions and topography. Results can have a predictive effect and may influence where first responders' stage, the likely distribution of the hazard and the extent of environmental contamination.

The following paragraphs provide insight into some of these technologies and their application.

Modelling and simulation

Modelling and simulation is a technology that has long been utilised by military forces and some national police agencies.

In relation to chemical and biological crimes, such technology may be useful during the preparation and training, enabling modelling to simulate scenarios and provide opportunity for responding teams to identify risks and threats and formulate response tactics.

During an active response and investigation, such technology may be able to assist investigative teams including prosecutors, to assess potential human movement, geographic exposure

sites (e.g., plume modelling), potential source and therefore area of interest and forecast potential evidence sites.

Digital Forensics

This branch of science encompasses the processes of preservation, identification, extraction and documentation of computer evidence primarily in relation to digital crimes or attacks. However, such techniques can be utilised to verify the veracity and changes made to the metadata of a photo or video, this can be especially important given the advances in artificial intelligence.

Digital Monitoring

Digital platforms and the Internet are expanding exponentially. The way we communicate, perform transactions, collect and analysis data, can all be done on digital platforms, with no need for physical contact with another person.

This has provided significant challenges to investigators across a range of crimes and has escalated the need for investigating bodies to apply significant resources and skills around digital monitoring.

Internet and social media

In practice, there are several tools that allow investigators, operators, and other experts to monitor events on social networks and analyse online conversations. Considering the lifecycle of chemical and biological crimes, perpetrators may use digital platforms, such as the Internet, social media and gaming to request and share information. In addition, perpetrators have been known to use the dark web (darknet) to acquire materials and share information and expertise.

Monitor communication on various applications and gaming platforms will be subject to national legislation. The ability to effectively monitor these platforms requires the establishment and ongoing maintenance of keywords and subsequent analysis which may require specialist knowledge.

Vulnerability Assessments

Digital tools can be used to assess the vulnerability of IT networks as well as physical buildings, public spaces and critical infrastructure. They may assist to identify physical deficiencies and set appropriate control measures, for example, crime scene investigators may use this technology to predict potential risks and consequences of a chemical or biological attacks and prepare appropriate mitigation measures.

Threat Detection and Monitoring Technologies

Different types of unmanned devices can be deployed to monitor people or the environment, and subject to the addition of specialist detection devices, may be utilised to monitor or detect the presence of chemical or biological agents in the environment. Such detection would be considered as a preliminary result and would require confirmatory testing within an approved laboratory network.

To counter the above-mentioned threats, law enforcement may utilise specific threat disposal technologies like UAV detection systems, GPS Spoofing and jammers, which may play a key role within the law enforcement tasks.

Technology in Use by Crime Scene Teams

A crime scene identified as containing a hazardous chemical or biological agent requires additional time to be adequately assessed. This usually involves the activation of specialists' forensic teams or CBRN teams, who have a deeper understanding of the complex nature of such scenes, an ability to assess the risks, and knowledge of specific requirements to protect and preserve both traditional forensic evidence (DNA, finger and shoe marks, hairs, and fibres) but also the evidence associated with the chemical or biological agent itself.

Regardless of which lifecycle phase the crime scene falls under, such scenes require appropriate pre-planning, evidence prioritisation, and use of specialists' detection and identification technology to guide the development of a suitable crime scene processing and evidence collection plans.

Chemical and Biological Agents Detection Devices.

Detection of chemical and biological agents within the environment can be challenging, as the sensitivity (ability to detect very small amounts) and specificity (ability to discriminate between biological agents), of detection and analysis equipment varies, and operators must have a clear understanding of these limitations prior to use. The following provides a short summary of existing chemical and biological technologies in use by crime scene operators and specialist CBRN teams.

Chemical: There are various technologies that are capable of detecting trace levels of chemical warfare agents and toxic industrial chemicals and gases in the environmental. This type of technology can be handheld, portable, or fixed to a location.

The type of technology can be simple or complex in application and may include:

- Chemical detection paper (simple handheld paper that indicates potential presence of chemical agents).
- Multi-gas monitors (handheld or purpose-built systems, gas detectors).
- Gas Chromatography- Mass Spectrum (GC-MS) (handheld or portable/ mobile laboratory with confirmatory testing capability).

Biological: The detection of biological agents and toxins in the environment is complicated by the fact that some agents may have a natural presence in the environment and in addition, the presence of environmental elements, such as, background particulates and elements like chlorine, magnesium, and sodium,

may interact with the detection device causing false negative or false positive reactions.

Handheld detection devices for biological agents and toxins provide presumptive analysis, requiring approved confirmatory testing using agreed gold standard methods.

Examples of biological agent detection technologies may include:

- Biological antigen tests (simple handheld basic technology).
- ELISA tests (enzyme-linked immunosorbent assay).
- Bio aerosol fluorescence (counts airborne particles and discriminates based on fluorescence emission).
- Portable PCR machines (molecular detection of biological agents using nucleic acid amplification and genetic sequencing). May be employed in mobile laboratories and in some in-field applications.

It is important to note that many biological detection devices maybe utilised to simply rule out a high-risk pathogen or toxin rather than identify it, this is especially true if the pathogen is novel or emerging. Confirmatory testing of all samples suspected of containing biological material should be conducted by a qualified laboratory.

In field Crime Scene Tools

All crime scenes present a series of risks to the operators entering the scene. From physical and structural obstacles or dangers,

including weapons, to the presence of hazardous substances including, bodily fluids or flammable or toxic substances. For the most part, these risks can be made safe, through the application of safe methodologies and provision of basic personal protective wear such as gloves. For example, creating a safe entry and egress pathway and removal of dangerous chemicals, such as those from a clandestine laboratory. In addition, crime scene operators wear coveralls, shoe covers and gloves to protect themselves and the evidence within the scene.

However, unlike a typical crime scene, the safe removal of the chemical and biological agent is not always possible, especially if the hazardous agent has been dispersed as an aerosol. These hazardous particles now form a contaminated layer over the scene, contaminating all people and equipment that enters the scene.

All personnel, equipment and overpacked evidence must therefore exit through a decontamination process that may include, surface washing and chemical treatment. Equipment and technology used in the scene therefore needs to be adapted or developed with this in mind.

Examples of CBRN crime scene technology may include:

- 3D crime scene scanner.
- Waterproof cameras and video equipment.
- Remote video imagery.
- Radio Frequency Identification Device (RFID) technology.

- Dispersion and contamination modelling.
- Level A personal protective equipment (fully encapsulated suit with self contained breathing apparatus), may be utilised for primary entry.
- Level B and C personal protective equipment (self-contained breathing apparatus and CBR filtered mask and coveralls respectively).



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Technology category

Prosecution considerations

Chemical and biological threat detection and identification technology

Primarily handheld equipment or remote-controlled devices.

May provide an indicator of hazards present or rule out the presence of others.

May provide presumptive analysis which can inform onsite hazards evaluation and protective measures. Usually requires laboratory confirmation.

Mobile laboratories

Can be utilised to provide onsite analysis of certain chemicals and biological pathogens and toxins.

May include some presumptive and confirmatory technology.

Some sample analysis requires confirmation at a designated laboratory.

Crime Scene forensics

Traditional forensic techniques employed within a hazardous crime scene require alteration of methodologies and/or equipment used. Prioritisation of evidence recovery is important as evidence may be destroyed during onsite recovery methods or where decontamination methods are employed prior to evidence recovery.



Role of the Prosecutor

07

CHAPTER SEVEN



01

Key Focus Area

Brief description of prosecutors under Civil Law and Common Law systems

02

Considerations for documenting

03

Case examples related to national, regional, and international contexts

Legislation Framework

There are two main types of legal systems operating today, namely, Common law (adversarial) and Civil law (inquisitorial), with most countries adopting features from one or the other into their own legal frameworks.

Both these systems have variations around the world, as different countries have modified their criminal procedure in various ways over the years, in balancing the interests of the State in apprehending and adjudicating offenders with the interests of individual citizens who may be caught up in the legal process.

The differences presented here only serve as an illustration of various distinctive features that pose significant differences between Common law and Civil law systems.

Common Law

Common law evolved in England around 11th Century and was later adopted in the USA, Canada, Australia, New Zealand and other countries of the British Commonwealth.

Common law countries use an adversarial system to determine facts in the adjudication process. The principle is that earlier judicial decisions, usually of higher courts, should be followed in subsequent cases, i.e., that precedents should be respected. The adversarial system is also based, largely on statutes, including Acts and Codes. The prosecution and defence compete against each other, and the judge serves as a referee to ensure fairness to the accused, and that the legal rules of criminal procedure are followed. The adversarial system assumes that the best way to get to the truth of a matter is through a competitive process to determine the facts and application of the law accurately.

The adversary procedure requires the opposing sides to bring out pertinent information and to present and cross-examine witnesses.

Under the adversary system, each side is responsible for conducting its own investigation. In criminal proceedings, the prosecution represents the people at large and has at its disposal the police department with its investigators and laboratories, while the defence must find its own investigative resources and finances. Both sides may command the attendance of witnesses by subpoena. If the defendant is indigent, his attorney's opportunities for a broader investigation may be limited. In criminal law under the adversary system, the accused needs not be present in grand jury indictment proceedings (no longer conducted in Great Britain and rarely used in many U.S. state courts). If an indictment is handed down by the grand jury, its proceedings, including the testimony and other evidence presented to it, are available to the defendant.

In an adversary trial, the opposing sides present evidence, examine witnesses, and conduct cross-examinations, each in an effort to produce information beneficial to its side of the case. Skilful questioning can often produce testimony that can be made to take on various meanings. What seemed absolute in direct testimony can raise doubts under cross-examination. The skills of the attorneys are also displayed at the time of summation, especially in a jury trial, when their versions of what the jury has heard may persuade the jury to interpret the facts to the benefit of the side that is most persuasive.

In adversary proceedings before juries, the judge functions as moderator and referee on points of law, rarely taking part in the questioning unless he or she feels that important points of law

or fact must be made clearer. In a bench trial (without a jury), the judge decides the facts of the case as well as points of law.

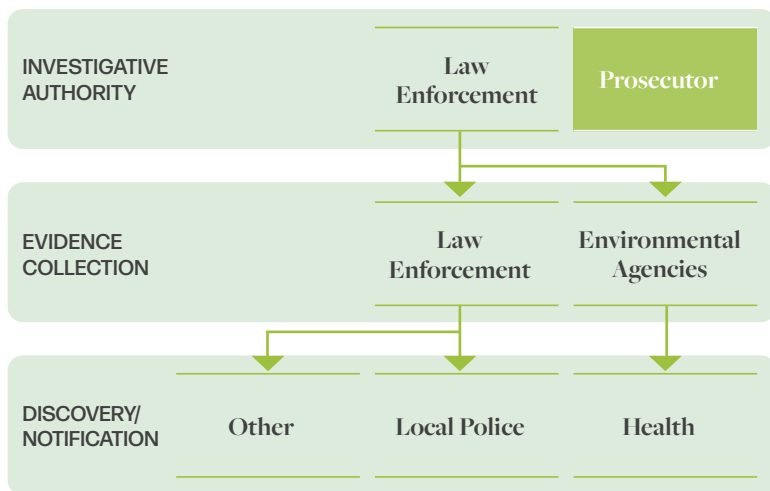
Role of the Prosecutor

In the adversarial system the investigation is led by law enforcement. The initiation of the investigation likely comes from first responders, including local police or other investigative agencies or the intelligence community. Many jurisdictions developed specialist police teams with increased knowledge in Chemical, Biological and Radiological agents, who can identify certain triggers related to the identification of such crimes. This has allowed for early activation of the investigation and increased success in the preservation of evidence that may be critical to prosecution.

Briefs of evidence are provided to the prosecution for advice and direction. Prosecutors play an important role in exercising their advisory or supervisory authority, including review of each proof of evidence, assisting police with the direction of the investigation.

Under the Common law system, a crime of this complexity and nature would quite often result in the formation of a joint, State and Federal investigative and prosecutorial team. This would enable the pooling of standard and specialist resources, given the likely timeline of such an investigation.

Example Common Law Structure



Civil Law

Civil law has its origins in Roman Law. Countries following a Civil law or inquisitorial system are typically those that were former French, Dutch, German, Spanish or Portuguese colonies or protectorates, including much of Central and South America. In addition, most of the Central and Eastern European and East Asian countries also follow a Civil law structure.

The main feature of Civil law is that is contained in civil codes, which can be described as single laws with precise and broadly applicable text. One of the basic characteristics of the Civil law is that the courts main task is to apply and interpret the law contained in the code or a statute to the facts of the case.

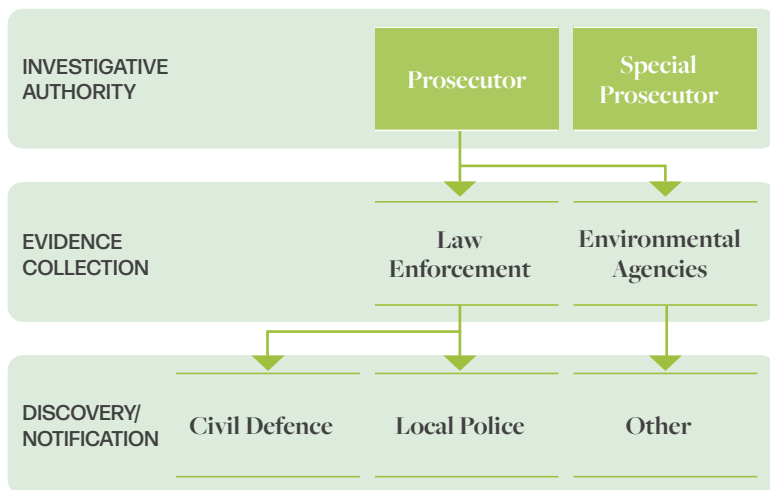
It is characterised by extensive pre-trial investigation and interrogations with the objective to avoid bringing an innocent person to trial. The inquisitorial process can be described as an official inquiry to ascertain the truth, whereas the adversarial system uses a competitive process between prosecution and defence to determine the facts. The inquisitorial process grants more power to the judge who oversees the process, whereas the judge in the adversarial system serves more as an arbiter between claims of the prosecution and defence.

Role of the Prosecutor

Under Civil law (Continental law), the Prosecutor or Special Prosecutor has oversight of the entire police investigation, including the identification of both physical and trace evidence requirements, collection of statements and intelligence links. In some civil systems, the prosecutor may be responsible for leading and carrying out elements of the investigation. In this case, Prosecutors responsible for the leading the investigation, should have a sound understanding of the nature and challenges related to chemical and biological crimes and the types of evidence that can be of value.

As described under Common law countries, the nature and context of the chemical or biological crime will dictate the level of prosecutor assigned, for example a small targeted attack on individual using a common chemical may be led by a local prosecutor, while intercept of a clandestine biological laboratory may be assigned to a more specialised national prosecutor, a crime crossing national borders would be assigned to several specialised prosecutors.

Example Civil Law Structure



Levels of Prosecution

The prosecution of crimes relating to the deliberate acquisition, production, storage, transport and use of chemical and biological agents, relies not only on increasing knowledge about the characteristics and processes of such crimes, but also on the interaction and cooperation of prosecutorial teams at the national, regional, and international level.

It is the nature of such crimes that increases the likelihood that some elements of the crime lifecycle may be linked to different jurisdictions, including courts of appeal, different nations, and be subject to different criminal law systems.

In such cases, appropriate handover from one prosecution team to another, whether national or international will ensure continuity of the investigation in a timely and effective manner.

Generally, an offence will only be triable in the jurisdiction in which the offence takes place. That said, there are several ways by which a state can exercise jurisdiction:

- Statute and Criminal Codes (i.e., explicit reference in statute to the jurisdictional reach of the offences created in the statute).
- Active personality (i.e., the accused may be prosecuted in the country of the nationality of the offender).
- Passive personality (i.e., the accused may be prosecuted in the country of the nationality of the victim).
- Universal jurisdiction (i.e., the state will be able to prosecute regardless of the nationality of the offender, the victim and where the offence was committed).

Where jurisdiction is identified as an issue, best practice is for prosecutors and investigators of the relevant jurisdictions to meet face to face to consider and balance different factors that should be considered when reaching a decision where to prosecute.

Prosecutors should consider the following factors:

- Whether the prosecution can be divided into separate cases in two or more jurisdictions.
- The location and interests of the victims.
- The location and interests of witnesses.

- The location and interests of the accused.
- Potential delays.

Reference may also be made to 'prosecute or extradite' provisions in extradition treaties and transfer of proceedings between jurisdictions.

Case Examples

The following case examples provide examples of cases and the challenges faced in the process of prosecution.

- Sulphur Mustard case, Tbilisi International Airport, Georgia.
- Frans v Anraat, Supreme Court, The Netherlands.
- US v Cheng Le (Ricin Dark Net Case), USA.
- American Anthrax Letters, USA.



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Case Title:

The use of mustard gas (Blister Agent)

Year of Investigation: 2018

Country of origin: Georgia
Level: National

Incident Summary:

- The security service sent an emergency response call to respond to the "Aeroflot" ticket office at Tbilisi International Airport.
- The office desk and room appeared to be contaminated with identified liquids.
- The liquid had a very pungent odour. Airport staff showed signs of chemical exposure.
- The CBRN Incident Response Unit and Police forensic and investigative teams were activated.
- Various forensic analysis of the area was made, including onsite and laboratory analysis. The liquid sample was analysed for the presence of chemical warfare agents with presumptive tests indicating the presence of a blister agent (Sulphur Mustard).

Initial Investigative Focus:

- A review of video surveillance cameras and operative material identified a person of interest seen spraying the liquid in the area of the "Aeroflot" ticket office.
- The suspect was arrested and interviewed. The suspect had no links to terrorist groups. Yet declared a personal vendetta towards a person close to him.
- The suspect also declared a personal connection to a staff member located at the Aeroflot ticket office.
- Airport staff identified areas with unknown liquid spills in the office, with presumptive onsite testing indicating the presence of highly toxic chemicals.

Prosecutorial Priorities:

- A smelly liquid at the airport, in a place where it should not have been.
- Fluid puddles in different places, on the ticket desk and in the room.
- Infected person with blisters and ulcers on the body.
- Initial testing conducted by the CBRN team and local analytical laboratory indicated the presence of a chemical agent.
- Laboratory testing confirmed the presence of sulphur mustard on samples provided from the airport.

Challenges:

- Inadequate risk assessments were conducted by first responding airport staff and security, who were inadvertently exposed to the sulphur mustard liquid due to lack of appropriate personal protective equipment (PPE). Subsequent responding police teams wore adequate PPE.
- There were no specialised medical personnel able to attend to the symptomatic person at the airport.
- The current CBRN legislation could not be applied, since it does not cover personal revenge.

Outcomes:

- The offender was charged under the Law of Georgia, Criminal Code of Georgia, Article 117. Intentional grievous bodily harm. (<https://matsne.gov.ge/en/document/view/16426?publication=235>)
- In addition, the offender was charged under Article 288, Violation of the procedures for handling environmentally hazardous substances or waste. Criminal Code of Georgia, Law of Georgia on Hazardous Chemicals. – Violation of the procedures for handling environmentally hazardous substances or waste. (<https://matsne.gov.ge/en/document/view/16426?publication=209>)
- The offender was sentenced to four years in prison and deported to Russia after 12 months.



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Case Title:

Frans van Anraat (Historical Case)

Year of Investigation: 2003

Country of origin: **The Netherlands**
Level: **National/International**

Incident Summary:

- Mr F. van Anraat was a Dutch businessman who, from 1984 until 1988, purchased large quantities of the chemical thiodiglycol from the United States and Japan.
- This chemical was then sold, through a number of different companies located in different countries, to Saddam Hussein's government of Iraq.
- After 1984, Mr. Van Anraat was the Iraqi Government's major supplier of the chemical. The chemical is a key component in the manufacture of mustard gas and was in fact used for this purpose by Hussein's government who then proceeded to deploy the gas in attacks against Iranian military and civilians in the Iran-Iraq war, and against the Kurdish population in northern Iraq.
- The effect was devastating, thousands of individuals were killed and many thousands more were injured with long-term effects including blindness and cancer.
- Mr. Van Anraat was tried for war crimes in relation to the delivery of chemicals that were subsequently used to manufacture the chemical warfare agent Mustard Gas.

Relevant historical context:

In the 1980s an increasing number of Kurdish villages were destroyed and as many as 500 000 Kurds were forced to relocate to amalgamated villages and government complexes. In early 1987, the forces of the Kurdish leaders Barzani and Talabani joined together to fight the Iraqi army. Around this time, the government of Iraq came to identify all Kurds as the enemy and adopted a policy aimed at eliminating this population in what came to be known as the Anfal Operations. In the context of the Anfal Operations, in March 1988 government forces launched chemical attacks against Kurdish villages. There were also chemical attacks on Kurdish villages in Iran between 1984-1989. .

Initial Investigative Focus:

- In 2003 Mr. Van Anraat was interviewed on Dutch TV, where he subsequently admitted the delivery of chemicals to the Saddam Hussein regime.
- The day after the interview the Dutch prosecution started the investigation and in December 2004 Mr. Anraat was arrested.
- Together with a special war crime unit within the police, a specialised prosecutor was appointed to conduct research and gather evidence. This team was supported by the legal team of another specialised prosecutor.
- They travelled to the area and spoke with victims, experts and (other) witnesses.
- In November 2005 the court proceedings commenced.
- The head of the Iraqi team that set up the so called Full Final and Complete Disclosure gave testimony before the examining judge.

Prosecutorial Priorities:

- The initial investigative priority sought to locate proof of the chemical deliveries.
- Next, to find proof of any accomplice's connected to the delivered chemicals in that specific period.

- Followed by the development of assessment tool to identify, locate and speak with witnesses and victims and assess whether they could testify on trial (including considerations and issues like traumatized witnesses/ victims' protection).
- Preparing for the inevitable international complications and consequences of such a prosecution.
- To provide sufficient evidence for the provision of suitable charges to made against Mr. van Anraat.
- The Public Prosecutor issued a writ of summons against Mr. Van Anraat (amended on 21 November 2005) for charges of conspiracy to commit genocide and conspiracy to commit war crimes in Iraq by supplying chemical weapons components, in particular, thiodiglycol - which is used in the production of mustard gas under Saddam Hussein's regime in the period 1986 to 1988.

Challenges:

- Obtaining historical evidence in relation to the acquisition and delivery of the chemicals by the accused.
- That the chemicals delivered by the accused were deliberately used to manufacture chemical weapons, and that these chemicals were used against people in cities in Iraq and Iran as mentioned in the charges.
- The nature of the investigation provided geographic challenges. The prosecutorial team was required to travel all over the world to conduct interviews with witnesses, many of which required translators and interactions with other lawyers and prosecutors.
 - Risk and threat assessments were required due to the security requirements for travel.
 - Building the proof of evidence posed difficulty and challenging legal questions including:
 - What is the required degree of intention for complicity to genocide?

- What is the required degree of intention for complicity in war crimes?
- Is there a sufficient causal nexus between the accused's delivery of chemicals and the actual implementation of the ammunition that had been filled with mustard gas at the locations mentioned in the charges?

Outcomes:

- International criminal law is still developing regarding the question of the degree of intention required for a conviction for complicity in genocide. Certain decisions of international criminal tribunals have held that the accomplice must have known that the perpetrator acted with a genocidal intention; Article 48 of the Dutch Penal Code on the other hand provides for a lesser degree of intention, namely that the accomplice willingly and knowingly accept the reasonable chance that a certain consequence or circumstance will occur. In the present instance, the evidence does not establish, even this lesser standard, therefore the Court declined to comment as to the applicable standard (para. 7).
- The accused was aware that his supplies of thiodiglycol were used in the production of mustard gas in a country that was involved in a long-lasting war. From this, it follows that the accused had awareness that the mustard gas was going to be used by Iraq in its armed conflict and his had knowledge that the use of such gas had actually taken place. The accused was therefore very aware that in the ordinary course of events the mustard gas was going to be used (para. 11.16).
- The causal requirement pursuant to Article 48 of the Penal Code requires that the accused provided the opportunity and/or the means to carry out the attacks described in the charges. Prior case law of the Supreme Court of the Netherlands has held that assistance need not be indispensable; it suffices that the assistance offered by the accessory has indeed promoted the offence or has made it easier to commit that offence (para. 12.4).

- The Court of Appeal upheld the accused’s conviction for complicity in war crimes (para. 13) and increased his sentence to 17 years’ imprisonment (para. 20).
- On 30 June 2009, the Supreme Court of the Netherlands upheld the 2005 conviction of Van Anraat for complicity in war crimes. However, the Court reduced his sentence by six months due to the length of the proceedings.
- On 6 July 2010, the European Court of Human Rights rejected Van Anraat’s claims challenging the jurisdiction of the Dutch courts and the legal certainty of the criminal acts being prosecuted.

Case Title:

United States v. Cheng Le, 902.F.3d 104 (2dCir.2018)

Year of Investigation: 2018

Country of origin: USA
Level: National/Federal

Incident Summary:

- The defendant repeatedly accessed a dark net marketplace in an attempt to acquire ricin, a highly dangerous biological toxin, with the ultimate purpose of re-selling it for profit.
- The defendant communicated with a vendor on the darknet, exchanging over two dozen encrypted messages in which he sought “good quality” ricin for buyers who were already “lining up.” The “vendor” was an undercover FBI agent.
- The defendant solicited advice from vendor about administering ricin by injection and ingestion. Defendant confirmed that ricin had no antidote and that it was untraceable in autopsies. He then placed an order with the vendor, to be delivered via the U.S. Postal System ostensibly to a third person whose identity the defendant previously had stolen, in New York, NY.

- The defendant was convicted of attempting to acquire a biological toxin (ricin) in violation of the Biological Weapons Anti-Terrorism Act, using a false name to conduct unlawful activity by means of U.S. Postal Service, and aggravated identity theft.

Initial Investigative Focus:

- An FBI agent posed as a vendor on a dark net marketplace and exchanged nearly two dozen encrypted messages with Defendant. The innocent third party whose name Defendant used for the ricin order was actually a Texas resident who had lost his wallet in March 2013 and had reported identity theft.
- Further investigation revealed that the address provided by Defendant was linked to a post office box at a UPS store.
- The FBI prepared a sham ricin pill and vial of fake ricin powder and sent them to Defendant's requested address. FBI agents then watched Defendant enter the UPS store. Defendant retrieved the package, opened it, and carried the contents back to his apartment.
- Pursuant to a search warrant, FBI agents entered Defendant's apartment and arrested Defendant.
- During a search of Defendant's apartment, FBI agents recovered the sham ricin pill and powder. They also seized a quantity of castor seeds and Defendant's computer, which showed that the device had logged into dark net accounts.

Prosecutorial Priorities:

- Disrupt a putative trafficker in ricin by proving a violation of the Biological Weapons Act (18 U.S.C. § 175(a)).
- Gather and admit to the jury corroborating evidence of defendant's intent to illicitly buy/sell ricin.
- Establish that a violation of federal law, as opposed to state/local law, was appropriate disruption strategy

- Show Defendant’s actions did not merely constitute “purely local” criminal conduct versus that of national import, i.e., the Biological Weapons Act is constitutional under the Commerce Clause to the U.S. Constitution.
- Safely search the perpetrator’s residence for additional evidence of his involvement in ricin trafficking (e.g., seizure of castor beans and personal protective equipment).

Outcomes:

- A trafficker in dangerous biological agents was apprehended before his scheme led to someone’s death or injury.
- Defendant was convicted and sentenced to sixteen (16) years in prison.
- Successful prosecution illustrates the need to deter the trafficking of dangerous biological substances on the dark web.

Case Title:

American Anthrax Letters

Year of
Investigation:
2001 - 2010

Country of origin: **USA**
Level: **National International**

Incident Summary:

- In September and October of 2001, at least four envelopes containing significant quantities of *Bacillus anthracis*, a biological agent and causative pathogen of Anthrax, were mailed to two U.S. Senators in Washington, D.C., and media organisations in New York City and in Florida. Each of the envelopes also contained a photocopy of a threatening, handwritten note suggesting radical Islamic terrorism was responsible for the attacks.
- The anthrax attacks killed 5 people and sickened 17 individuals (of the 22, half suffered from inhalational anthrax and half from cutaneous infections). A total of 31 people tested positive for exposure to anthrax, and roughly 10,000 others took precautionary prophylactic measures.
- Additionally, thirty-five postal facilities and commercial mail-rooms, seven government buildings in Washington, D.C., and two mail processing and distribution centres were contaminated by the anthrax powder contained in the letters.
- A lengthy and extensive investigation was undertaken. Dr. Bruce E. Ivins, who worked at the United States Army Medical Research Institute of Infectious Diseases, was identified as the primary suspect; however, Ivins died before being indicted and the case was ultimately closed

Initial Investigative Focus:

- **Traditional Law Enforcement Techniques:** Investigators interviewed witnesses, utilized pen registers, executed search warrants, engaged confidential sources, pursued over 17,000 investigative leads and citizen tips, and utilized traditional forensic tools in an effort to identify the perpetrator(s).
- **New Scientific Investigatory Measures:** By 2007, traditional law enforcement techniques were supplemented with ground-breaking genetic analyses that identified several morphological variants in the particular strain of anthrax found in the envelopes which showed that the spores were derived from a strain of anthrax created and maintained at a high-level US laboratory..

Prosecutorial Priorities:

- Identify and prosecute the person(s) responsible for one of the most significant bioterrorist attack on U.S. soil. Determine whether Dr. Ivins conducted the act, and whether he acted alone or with accomplices.
- Ensure that the scientific analyses, both those novel as well as traditional ones, would have sufficient reliability for admission in court proceedings.
- Appropriately address legitimate concerns/inquiries from victims and the general public as to investigation's progress.

Challenges:

- Promptly recognizing that an attack has occurred. Crimes involving biological agents initially may not be recognized as such, threatening public safety, and undermining the integrity of the evidence. For example, some victims of the anthrax letter attack

did not become symptomatic until weeks after the letters were mailed and some of the first victims were originally misdiagnosed as having contracted common infections.

- Determining intent/motive and ruling out potential culprits. The investigation sought to determine whether the letters constituted state-sponsored terrorism, the work of a foreign terrorist organization (as suggested by the accompanying threats), a domestic violent extremist group, or the work of a lone actor.
- Managing an extraordinarily complex criminal investigation; one of the largest and complex in United States history, in terms of fear and panic and uncertainty. The investigation involved over 600,000 investigator work hours, interviews of over 10,000 witnesses across six different continents, execution of 80 searches, the issuance of over 5,750 federal grand jury subpoenas, and the collection of 5,730 environmental samples from 60 different locations.
- Developing scientific tools to augment existing forensics. Despite the enormous amount of evidence gathered using traditional law enforcement techniques, limitations on available scientific methods and tools initially hindered the ability to identify anomalies in the composition of the anthrax powder and determine who was responsible for the attacks.

Outcomes:

- By 2007, newly developed scientific methods (high-resolution whole genomic sequencing and genomic comparisons), in combination with traditional evidence gathered by law enforcement, indicated that the anthrax found in the letters was linked to an American high-level facility, where the primary suspect, Dr. Ivins worked.
- The investigation ran over years and required complex scientific technology and analysis to build the case for prosecution. In addition to the microbial evidence, a number of other factors were included in the case for prosecution including, the level of

the anthrax powder; highly suspicious behaviour, such as unexplained access to the laboratory in the weeks preceding the attacks and efforts to obscure certain activities; and use of aliases and fake email accounts.

- Potential motive for the crime was linked to long-term research and development of an anthrax vaccine.
- Before Dr. Ivins could be formally accused or charged, he committed suicide.



International Cooperation and Support

08

CHAPTER EIGHT



01

02

Key Focus Area

Brief description
of international
conventions

A summary of
available international
organisations and
support agencies

Criminal investigations and subsequent prosecutorial proceedings that involve security sensitive and high risk, chemical or biological agents, may require assistance of relevant international organisations and agencies.

The following section provides an overview of some international conventions and the type of resources and assistance that may be provided by international organisations and supporting agencies.

International Conventions

After the experience of World War-I and other recorded uses of chemical and biological weapons, the international community identified the need to ban the use of chemical and biological weapons and agents. This agreement saw the development of number of United Nations Conventions, treaties, and specific resolutions. Additional international tools include, the United Nations Convention against Transnational Organised Crime (UNTOC), the UN Convention for the Suppression of the Financing of Terrorism, and the Council of Europe Convention on Mutual Assistance in Criminal Matters. In addition to these the following Conventions and treaties are described.

Biological Weapons Convention (BWC)

Biological weapons disseminate disease-causing organisms or toxins to harm or kill humans, animals, or plants. The use or misuse of such agents is likely to have cross border impacts.

The Biological Weapons Convention (BWC), prohibits the development, production and stockpiling of bacteriological (Biological) and toxic weapons and on their destruction. Opened for

signature in 1972, entered into force in 1975, the BWC was the first multilateral disarmament treaty banning an entire category of weapons of mass destruction and enjoys almost universal membership today.

As of 2021, a total of 183 States Parties and four signatories to the Convention recorded.

Cartagena Protocol on Biosafety to the Convention on Biological Diversity (1992).

This protocol describes Living Modified Organisms (LMOs) obtained via modern biotechnology and focuses on the exchange of information about LMO's and their risk associated by submission to a bio-safety clearing house. There is a system of trans-boundary movements, procedures for handling, transporting, and packaging identification system as well as National Focal Points who monitor the regulatory requirements of unintentional cross-border movements and emergency measures and illegal movements in view of assessing potential adverse effects.

Chemical Weapons Convention (CWC)

The Chemical Weapons Convention (CWC) is focused on disarmament and non-proliferation of chemical weapons.

Opened for signature in 1993, it entered into force in 1997. The Convention contains a complete ban on the development, production, stockpiling and use of chemical weapons and their precursors. The Convention also calls for such weapons to be destroyed.

To ensure confidence in compliance of States Parties, it provides for a rigorous verification regime.

As of 2021, a total of 193 States Parties have joined the Convention.

The full title of this multilateral treaty is Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction.

Mutual Legal Assistance (MLA) Initiative

This initiative, led by Slovenia, Argentina, Belgium, Mongolia the Netherlands and Senegal, advocates for the adoption of the Convention on International Cooperation in the Investigation and Prosecution of the Crimes of Genocide, Crimes against Humanity and War crimes. The initiative provides inter-State cooperation mechanisms for the investigation and prosecution of serious international crimes.

The Rotterdam Convention on the prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (PIC).

This Convention (1998) focuses on chemicals and highly hazardous pesticides and their components that have been banned or severely restricted for health and environmental reasons by Parties and which have been notified by Parties for inclusion in the Prior Informed Consent (PIC) procedures for import and export.

The PIC convention entered into force in 2004. National authorities have been appointed (Designated National Authorities DNA) and authorised to act in the performance of the administrative functions required by the PIC Convention.

The PIC Convention does not cover narcotic drugs, radioactive materials, waste, chemical weapons, pharmaceuticals, or food.

United Nations Security Council Resolution 1540

In Resolution 1540 (2004) on non-proliferation of weapons of mass destruction it is decided that all States shall refrain from supporting by any means non-State actors that attempt to develop, acquire, manufacture, possess, transport, transfer or use nuclear, chemical or biological weapons and their delivery systems. All States are requested to adopt and enforce appropriate laws and effective measures to prevent the proliferation of these weapons and their means of delivery to non-State actors, in particular for terrorist purposes.

Secretary-General's Mechanism for Investigation of Alleged Use of Chemical and Biological Weapons (UNSGM)

The UN General Assembly established and under Resolution A/42/37 C (1987), the Secretary-General's Mechanism (UNSGM) to carry out investigations, at the request of a Member State, in response to allegations of the possible use of chemical and biological weapons, where there is a possible violation of the 1925 Geneva protocol or other relevant rules of customary international law. The UNSGM can, as part of that investigation, deploy a fact-finding team and report the results of that investigation to all Member States. If deployed the UNSGM is made up of nominated expert consultants who form part of an approved roster, who may be called upon in accordance with the guidelines and procedures endorsed by the General Assembly under Resolution A/45/57C (1990).

International and Regional Assistance

For many countries responding and investigating complex chemical and biological crimes will require international and regional assistance and guidance. The following table provides a brief summary of some of the international and regional organisations and supporting bodies and the type of support they may provide.

For more updated and detailed information, please refer to the websites of the organisations described below. Further detail on the level of support and resource availability can be found through the links provided.

Summary Table for International and Regional Organisations and Agencies

International and Regional Organisations	Brief Summary and Links
BWC ISU	<ul style="list-style-type: none"><li data-bbox="435 761 927 999">▪ General Description: BWC Implementation Support Unit sits within the Geneva Branch of the UNODA with a mandate to provide administrative support and assistance to States Parties including national implementation and confidence building measures as well provide Secretariat to meetings of the BWC.<li data-bbox="435 1025 927 1263">▪ Capabilities: Article VII of the Biological Weapons Convention disposes that each State Party undertakes to provide or support assistance to any Party to the Convention which so requests, if the UN Security Council decides that such Party has been exposed to danger as a result of violation of the Convention. However,

BWC ISU

it provides no procedure for States to request such assistance nor for the international community to deliver it. The BWC is a treaty governed by its States Parties. The BWC ISU was established in 2006 and it has no mandate, legal personality or capacity to undertake coordination of response and assistance operations in case of use of biological weapons.

- **Website:** <http://www.unog.cj/bwc>

EUROPOL

General Description: The European Union's Law Enforcement agency, based in The Hague. Supporting 27 EU Member States, EUROPOL provides assistance and advice to law enforcement operations with a focus on organised crime, terrorism and cybercrime. They provide access to specialists and forums to support the training of chemical, biological, radiological and nuclear experts and investigators, in conjunction with the European Police College (CEPOL).

Capabilities: Provides access to CBRN expertise to Member States, supports Joint Investigative Teams (JITs) and provides forensics support to law enforcement agencies.

CBRN training is provided to Member States through CEPOL.

- **Website:** <https://www.europol.europa.eu/>

European Union

General Description: The European Commission is composed of the College of Commissioners from 27 EU countries providing political leadership across a number of core areas including but not limited to, Climate action, Environment, Security policy, Justice and fundamental rights and public health.

The EU CBRN Centres of Excellence Initiative deals with CBRN topics. Aim of the Initiative is to support Partner Countries and regions in strengthening CBRN risk mitigation and an all-hazards security governance in Partner Countries, following a voluntary and demand-driven approach.

Capabilities: The European Union (EU) Chemical, Biological, Radiological and Nuclear (CBRN) Risk Mitigation Centres of Excellence (CoE) is a global initiative funded and implemented by the European Union as part of its goal to promote peace, stability and conflict prevention. The EU support is provided to implement a wide range of CBRN risk mitigation activities including needs and risk assessments, national and regional action plans, capacity building activities, legal framework reviews, table top and real time (including cross-border) field exercises, inter-regional exchange of best practices and lessons learnt.

Website: https://europa.eu/cbrn-risk-mitigation/index_en

EUROJUST

- **General Description:** The European Union Agency for Criminal Justice Cooperation is responsible for the coordination of national authorities to assist in cross-border criminal investigations including terrorism and environmental crime. Eurojust provides specific assistance in a number of areas including but not limited to, judicial cooperation including the life cycle of the case, transmission of information, joint investigative teams, extraditions and consultative forums.
 - **Capabilities:** Provides assistance and access to coordination meetings upon request of international legal teams.
 - **Website:** <https://www.eurojust.europa.eu/>
-

INTERPOL

- **General Description:** An intergovernmental organisation providing advanced international police cooperation to 194 member countries. Providing access to police data management and databases, forensics support, criminal analysis and investigative support including, specialist Chemical and Biological advice and resources as provided under the respective Biological and Chemical Prevention Units. Support is coordinated through headquarters (Lyon), and INTERPOLs Regional and National Central Bureaus. Crimes/Terrorism.
- **Capabilities:** Support is coordinated through headquarters (Lyon), and INTERPOL Regional and National Central Bureaus. The CBRNE and Vulnerable

Targets Sub-Directorate provides support to its Member Countries through 4 main pillars: police data management, analysis, access to a global network, and specialised expertise.

Depending on the specific request for assistance from a Member Country and the needs on the ground, support may include operational response and investigative support, or victim identification.

- **Website:** <https://www.interpol.int/en/Crimes/Terrorism>

OIE

- **General Description:** The World Organisation for Animal Health (OIE), serves to provide advice and implement international standards to improve animal health and welfare to its 182 Member States. They provide technical support with regards to animal disease control, eradication and response to disease outbreaks including those that are transmissible from animal to human. The OIE provides standards that seek to enhance international trade of animals and animal products; and improve the legal frameworks and resources of national veterinary services. The OIE Biological Threat Reduction initiative provides a detailed strategy and a number of guidelines in relation to high-risk pathogens, investigation and analysis.

OIE

- **Capabilities:** Provides assistance to coordinate parallel investigations, organise coordination meetings involving judicial authorities and law enforcement; establish and fund joint investigation teams (JITs) and plan actions and provide facilities for national authorities to arrest perpetrators, dismantle organised crime groups and seize assets.
 - **Website:** <http://www.oie.int>
-

OPCW

- **General Description:** The Organisation for the Prohibition of Chemical Weapons is an intergovernmental organisation and implementing body of the Chemical Weapons Convention. Based in the Hague, Netherlands, oversees implementation of the Convention.
 - **Capabilities:** Provides technical assistance. Has the ability to activate and deploy investigative teams and provide sample collection, transportation and analysis of high-risk chemicals and chemical weapons.
 - **Website:** <https://www.opcw.org/>
-

UNICRI

- **General Description:** UNICRI is mandated to assist intergovernmental, governmental and nongovernmental organizations in their efforts to formulate and implement improved policies in the fields of crime prevention and justice; act with its partners in the international community to facilitate international law enforcement cooperation and judicial

assistance; support the respect of international instruments and other standards; advance understanding of crime-related problems and foster just and efficient criminal justice systems.

- **Capabilities:** Supports Members States in mitigating risks related to CBRN materials, improving security at major events, protecting crowded spaces and vulnerable targets, ensuring tourism security, improving community resilience to terrorism attack/threats, improving cyber security and promote the safety and security aspects of biotechnology.
- **Website:** <http://www.unicri.it/index.php/threat-response-and-risk-mitigation-security-governance>

Non-Government and Other Supporting Bodies

NGO's and Other Supporting Bodies

Brief Summary

Australia Group

- **Summary:** An informal forum of countries, for which Australia is Secretariat, who seek to coordinate and harmonise national export control measures which assist participants to fulfil their obligations under the Chemical Weapons Convention and Biological and Toxin Weapons Convention, through a series of forums and provision of guidelines.
- **Website:** <https://www.dfat.gov.au>

International Association of Prosecutors

- **Summary:** The International Association of Prosecutors provides an international community of prosecutors with access to legal guidance and support in the areas of legal fairness, rules of law, human rights, and transnational corporation. The IAP promotes and enhances standards and principles, and promotes international cooperation in gathering and providing evidence related to transnational crime.
- The IAP brings networking, education and support to over 350,000 prosecutors in 177 jurisdictions and countries around the world. Its soon to be launched Prosecutors International Co-operation Platform (PICP) will connect verified prosecutors and facilitate secure messaging between them. IAP specialist networks, such as the CTPN, connect specialist prosecutors in specific thematic areas.
- **Website:** <https://www.iap-association.org/>

International Security and Emergency Management Institute

- **Summary:** Professional platform of former and active police, military, internal security officers, prosecutors and emergency management experts, working mainly in the field of Counter-CBRN-E Terrorism and Crime.
- Provides support and assistance in detection and investigation of CBRN-E crime, CBRN-E crime scene analysis, crime scene investigation, CBRN-E threat and hazard detection, sampling and identification, CBRN-E crime and criminal profiling, profiling in protective

security and covert operation, vulnerability profiling of public places, and risk and threat assessment including the use of new technologies.

- Conduct training, table top and field exercises with simulants and live CBRN agents.
 - **Website:** www.isemi.sk
-

Supporting Procedures

Appendix

O1

Table of Supporting Material for Operational or Tactical Level Operators

Title	Abstract	Web link
<p>IAEA Radiological Crime Scene Management Guide 2014</p>	<p>An operational framework for responding to radiological and nuclear crime scenes.</p>	<p>https://www.iaea.org/publications/10717/radiological-crime-scene-management</p>
<p>INTERPOL Bioterrorism Pre-Planning and Response Guide 2018</p>	<p>An operational overview of crime scene processes within a biological contaminated environment -to be utilised in the scene.</p>	<p>https://www.interpol.int/en/Crimes/Terrorism/Bioterrorism</p>
<p>INTERPOL Pollution Crime Forensic Investigation Manual 2014</p>	<p>A technical manual for the safe collection of environmental samples and hazardous waste.</p>	<p>https://www.interpol.int/en/Crimes/Environmental-crime</p>
<p>Chemical Weapons Convention Chemicals Analysis</p>	<p>Technical manual for CWA sample collection and analysis</p>	<p>https://onlinelibrary.wiley.com/doi/book/10.1002/0470012285</p>

<p>WHO Laboratory Biosafety Manual 4th Edition</p>	<p>Overview of biosafety and biosecurity practices for provision of safe handling within a laboratory setting.</p>	<p>https://www.who.int/publications/i/item/9789240011311</p>
<p>UNODC International Legal Framework</p>	<p>Overview of international legislation.</p>	<p>https://www.unodc.org/unodc/en/safeguardingsport/international-legal-framework.html</p>
<p>Eurojust CBRN-E Handbook</p>	<p>Overview of EU and international legislation applicable to CBRN substances and explosives.</p>	<p>https://www.eurojust.europa.eu/eurojust-cbrn-e-handbook-overview-eu-and-international-legislation-applicable-cbrn-chemical</p>
<p>UN Security Council Guidelines to facilitate the use and admissibility as evidence in national criminal courts of information collected, handled, preserved and shared by the military to prosecute terrorist offences</p>	<p>Publication providing guidance and discussion points relevant to the collection and use of evidence in national proceedings.</p>	<p>https://www.un.org/securitycouncil/ctc/sites/www.un.org/securitycouncil.ctc/files/files/documents/2021/Jan/cted_military_evidence_guidelines.pdf</p>

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Appendix

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Acronyms

Appendix

03

ABSL	Animal Biosafety Level laboratory
AG	The Australia Group
BSL	Biological Safety Level laboratory
BTWC	The Biological and Toxin Weapons Convention
BWC	Biological Weapons Convention
CAS registry number	Chemical Abstracts Service registry number
CB	Chemical and Biological
CBRNE	Chemical, Biological, Radiological, Nuclear and Explosives
CCTV	Closed Circuit Television
CDC	US Centres for Disease Control and Prevention
CWA	Chemical warfare agents
CWC	The Chemical Weapons Convention
DNA	Deoxyribonucleic Acid
DURC	Dual-Use Research of Concern

ECDC	The European Center for Disease Prevention and Control
ECHA	The European Chemicals Agency
EC numbers	European Community number
EU	European Union
GPS	Global Positioning System
HAZMAT	Hazardous Materials
HAZCHAM	Warning-plate system used in the United Kingdom, Australia, Malaysia and New Zealand on vehicles transporting hazardous substances, and for storage facilities
LBM	Laboratory Biosafety Manual
LMOs	Living Modified Organisms
IDHL	Immediately Dangerous to Life or Health
IED	Improvised Explosive Device
ILAC	International Laboratory Accreditation Cooperation
LC50	Lethal concentration 50%

LCt50	Lethal 'Concentration time' Ct is used as a measure for the exposure to (or dose of) an aerosol or vapour.
LD50	Lethal dose 50%
LOD	The Limit of Detection
LRN	Laboratory Response Network
MERS	Middle Eastern Respiratory Syndrome
NIOSH	US National Institute for Occupational Safety and Health
OPCW	The Organisation for the Prohibition of Chemical Weapons
PPE	Personal Protective Equipment.
PPM	Parts Per Million
RCV	Remote Control Vehicle
RVD	Relative Vapour density
SARS	Sever Acute Respiratory Syndrome
SCBA	Self-Contained Breathing Apparatus
SOP	Standard Operating Procedure

TICs	Toxic Industrial Chemicals
TTX	Tabletop Exercise
UAV	Unmanned Aerial Vehicle
UGV	Unmanned Ground Vehicle
UN	United Nations
UUWV	Unmanned Under Water Vehicle
UWV	Unmanned Water Vehicle
URC	Unique Consignment Reference
WCO	World Customs Organisation
WHO	The World Health Organisation

Glossary

Appendix

O4

Definitions in this Glossary were taken from the European CBRNE Glossary, except for those marked with “*” sign.

Aerosol

A suspension of very small solid, liquid or solution particles dispersed in air or another gas. The solid particle mix is also referred to as smoke, and the liquid particle mix as fog or mist.

Agroterrorism

The deliberate malicious introduction of chemical, biological, radiological, nuclear agents against crops and livestock with the goal of disrupt the food chain, generating fear, causing economic losses and impaired food security by disruption or damage of a country’s agriculture, and/or undermining social stability.

Ammunition

Ammunition (munition) is a complete device charged with explosives, propellants, pyrotechnics, initiating composition or chemical, biological, radiological or nuclear material, for use in military or law enforcement operations, including demolitions. Certain suitably modified munitions may be used for training, ceremonial or non-operational purposes. Some amount of ammunition is used by civilians for hunting, sport or self-defense purposes (small firearms).

Anthrax

An acute, infectious, febrile disease of animals and humans, caused by the *Bacillus anthracis*, (a bacterium that under certain conditions forms highly resistant spores capable of persisting and retaining their virulence for many years). Three main clinical pictures are observed, depending on the route of infection of humans: the most common skin anthrax (contact with infected animals or their products), gastrointestinal anthrax (consumption of meat from infected animals) and pulmonary anthrax (inhalation of spores) (the most dangerous for humans).

Antidote

A drug (with a known action mechanism) given to a patient to counteract the toxic effects of a poison by modifying its toxicokinetics or toxicodynamics, and whose administration reliably produces a significant benefit

SOURCE: CEN standard EN 17173:2020 'European CBRNE glossary'.

Examples include atropine and oximes as antidotes for nerve agents; physostigmin as an antidote for atropine or BZ; opioid antagonists (naloxone or naltrexone) for fentanyl and other opioids; British anti-Lewisite (BAL, dimercaprol) for Lewisite; and hydroxycobalamin (vitamin B12a, Cyanokit®) for cyanides."

Antitoxin

An antibody produced by human body or derived from plants, animals or microorganisms in response to and capable of neutralizing a specific biologic toxin such as those that cause diphtheria, gas gangrene, tetanus or botulism. Antitoxins are used prophylactically and therapeutically.

Arboviruses

Arboviruses (arthropod-borne viruses) represent a group of viruses that replicate in both arthropods, such as mosquitoes or ticks, and vertebrates (birds, mammals). These viruses can be transmitted to vertebrates by a bite of blood-sucking arthropods.

Australia Group

The Australia Group (AG) is an informal forum of countries, which assists in the harmonisation of export control licensing measures. AG aims to prevent industries from contributing to the development and proliferation of chemical and biological weapons (of mass destruction).

Bacterium

Bacterium is a prokaryotic, in most cases a single-cell, self-reproducing microorganism of few micrometres in size, lacking a true nucleus and organelles. It is surrounded by a cytoplasmic membrane and in most cases additionally by a cell wall. Bacteria typically live in soil, water, organic matter, or the bodies of plants and animals, that make their own food especially from sunlight or are saprophytic or parasitic. Some of them are capable to induce disease in humans, animals or plants.

Bacillus anthracis

Bacillus anthracis is the causative agent of anthrax. It is a relatively large Gram-positive, non-motile, rod-shaped bacterium occurring typically as chains of bacteria under the microscope. A broad spectrum of animals as well as humans can be infected by *Bacillus anthracis*. The bacterium exists in spore form in the soil, and can survive for decades in this state.

Blood Agent

A chemical agent that interferes with oxygen transportation from blood to body tissues.

Blister Agents or Vesicants

These are chemical warfare agents that cause blistering of the skin (chemical burns) as well as severe skin, eye and mucosal pain and irritation, first as irritant and then as a cell poison. Larger doses can cause death. Effects arise from liquid or vapour contact with any exposed skin and mucous membranes (airways, eyes). Belonging to this group are:

1. the 'mustards': sulphur mustard and nitrogen mustard;
2. the 'arsenicals': Lewisite; and
3. phosgene oxime (not a 'true vesicant', but able to create solid lesions).

Dispersed in liquid or vapour (aerosol) form, according to the weather situation, these agents may persist for days. Like phosgene, mustard agents have a delayed effect.

Binary device, chemical

The precursor which plays the most important role in determining the toxic properties of the final product and reacts rapidly with other chemicals in the binary or multicomponent system.

SOURCE: Chemical Weapons Convention (CWC): Article II, Definitions and Criteria]

Biological hazard

Biological hazards (or biohazards) refer to biological substances like microorganisms or biological toxins that pose a threat to the health of humans or animals or to other living organisms. National and international authorities have categorized various agents and diseases in levels of biohazard.

Biological Weapons Convention

The Biological and Toxin Weapons Convention (BTWC) is a multilateral disarmament treaty banning the development, production and stockpiling of biological and toxin weapons. Opened for signature in 1972, entered into force in 1975, BTWC was the first multilateral disarmament treaty banning an entire category of weapons and enjoys almost universal membership today. The full title is Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction.

Biological agent

Biological agents are microorganisms (bacteria, viruses, fungi or cell cultures and endoparasites including genetically modified organisms) and biological toxins which may induce an infection, disease or allergy in humans, animals or plants (adapted from EU Directive 2000/54/EC).

Biological toxin / Biotoxin

Biological toxins are toxic substances explicitly derived from living organisms or similar substances produced synthetically. These substances are non-replicative, non-infectious material but can be extremely hazardous even in small quantities. Biological toxins can be used for contaminating of air, food, water supplies and to target specific individuals. Toxins that have been considered to be used as weapons include, among others, ricin, abrin, botulinum, staphylococcal enterotoxin B (SEB) and Tricholthecene Mycotoxins (T2s).

Biotoxins are toxins explicitly derived from living organisms.

Biological weapon

A biological weapon is defined as a device that releases a disease-causing organism (biological agent such as bacteria, viruses, fungi, prions or rickettsiae) or toxins of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes and that are harmful to living beings (humans or animals) and/or vegetation (plants). A biological weapon consists therefore of the biological agent with/without the dissemination mechanism.

Biosafety

Development and implementation of administrative policies, containment principles, technologies, and practices (including facility design, work practices, maintenance, and safety equipment) to prevent the unintentional exposure to biological agents and toxins, or their accidental release to laboratory personnel, other persons and the environment.

Biosecurity

The protection, control and accountability 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.

Botulinum neurotoxin

Group of toxins that can be produced by the bacteria *Clostridium botulinum*, *C. butyricum* and *C. baratii*. Botulinum neurotoxins (BoNTs) cause a muscle- paralyzing disease (botulism) in humans or animals.

Botulism is mostly foodborne (ingestion of toxins or bacteria), could be waterborne and possibly pulmonary (toxin inhalation). Clinical symptoms are muscle weakness, blurred vision, progressive paralysis, respiratory distress and cardiac dysfunction. Other forms of botulism are infant and wound botulism. Infant botulism can occur when an infant consumes the spores of *C. botulinum*, which then grow and produce toxin in the intestinal tract. Wound botulism is caused by the bacterium that secretes the toxin in infected wounds. No known transmission between humans.

CAS registry number

Often referred to as a CAS number, this is a unique numerical identifier (RN) assigned by the Chemical Abstracts Service (CAS) to every chemical substance described in open-access scientific literature. Some CAS numbers are assigned to groups of substances. A CAS-RN is separated by hyphens into three parts: the first comprises up to seven digits, the second comprises two digits, and the third is a single digit serving as a check digit - e.g. petroleum: CAS 9072-35-9; acetylsalicylic acid (Aspirin®): CAS 50-78-2; methyl- (iso)cyanate: CAS 624-83-9.

The CAS registry is a collection of disclosed chemical substance information, containing more than 88 million organic and inorganic substances and 65 million protein and DNA sequences.

Chemical Biological Radiological Nuclear and Explosive

CBRN is the abbreviation commonly used to describe the use of Chemical, Biological, Radiological and Nuclear materials or weapons. The malicious use of such materials could cause significant harm or disruption.

CE-marking

The CE mark is a mandatory conformity marking for certain products, e.g. explosives sold within the European Economic Area (EEA). It consists of the CE logo and, if applicable, the four-digit identification number of the notified body involved in the conformity assessment procedure. The CE marking is the manufacturer's declaration that the product meets the requirements of the applicable EC directives.

Chemical warfare agent

Chemical warfare agents (CWA) are a group of toxic chemical substances developed for military use. The so-called 'toxic agents' (also called 'casualty a.' or 'lethal a.') are intended to cause death or serious injury through their toxicological effects in exposed humans or animals, and include:

1. pulmonary agents (lung-damaging agents, also called choking agents - official name according to OPCW);
2. 'blood' agents (cyanides);
3. blistering agents (vesicants); and
4. nerve agents.

In addition to the above, there is a group of 'incapacitating agents' or 'non-lethal agents' which are intended to cause incapacitation (a temporary inability to perform one's duties). The most important examples are BZ (causing hallucinations) and fentanyl derivatives (causing unconsciousness). Riot-control agents, like 'tear gases', 'pepper spray' or vomiting agents, are not recognised as incapacitating agents or CWA if they are used by law enforcement.

Most chemical warfare agents are liquids (except for riot-control agents and BZ, which are solids at temperatures and pressures normally encountered).

Chemical Weapons Convention

The Chemical Weapons Convention (CWC) is a multilateral treaty that bans the production, stockpiling, and use of chemical weapons and their precursors. 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 and regulates:

- State party obligations (art. I: never to develop, produce, otherwise acquire, stockpile, or retain chemical weapons and to destroy all chemical weapons stockpiles as well as all production facilities);
- the destruction of chemical weapons (art. IV); and the shutdown, and conversion or destruction of production facilities (art. V).

For preventing the spread of precursors and toxic chemicals that may be used as weapons, their development, production, acquisition, retaining, transfer and use are subject to limits (art.VI) and inspections. Implementation of the Convention is monitored by the OPCW – Organisation for the Prohibition of Chemical Weapons. In September 2019, 193 States committed to the Chemical Weapons Convention, 98% of the global population live under the protection of the Convention, 97% of the chemical weapons stockpiles declared by possessor States have been verifiably destroyed.

Chemical weapon

A chemical used to cause intentional death or harm through its toxic properties. Munitions, devices and other equipment specifically designed to weaponise toxic chemicals also fall under the definition of chemical weapons". It consists of a substance or agent (CWA) and of some form of carrier or container (e.g. ammunition).

Chemical weapon precursor

Any chemical reactant which takes part at any stage in the production by whatever method of a toxic chemical.

SOURCE: 'Chemical Weapons Convention'.

Choking agent

See: Pulmonary agents.

Chromatography

Chromatography is a method for separating the components of mixtures and their analysis. The basic principle is the distribution of components of a mixture between the mobile and stationary phase. One of basic analytical chemistry technique for separating compounds mixtures for further identification (frequently in detector in the same apparatus/device). Examples type of the chromatography: GC (gas chromatography), TLC (thin layer chromatography), HPLC (high performance liquid chromatography).

Contagious disease

Communicable, or contagious diseases, are caused by microorganisms such as bacteria, viruses, parasites and fungi that can be spread, directly or indirectly, from one person to another. Some are also transmitted through bites from insects while others are caused by ingesting contaminated food or water. A variety of disease-producing bacteria and viruses are carried in the mouth, nose, throat and respiratory tract. Conditions such as leprosy, tuberculosis (TB) and different strains of influenza (flu) can be spread by coughing, sneezing, and saliva or mucus on unwashed hands. Sexually transmitted infections (STIs) such as HIV and viral hepatitis are spread through the exposure to infective bodily fluids such as blood, vaginal secretions and semen. Hepatitis is a significant concern in the African Region and the majority of people living with hepatitis B and C are unaware of their infections. Insects play a significant role in the transmission of disease. Bites from *Anopheles* mosquitoes transmits malaria parasites that can wreak havoc on high-risk populations such as children under age 5 and pregnant women. Yellow fever has also seen resurgence due to reduced vaccination efforts. Many neglected tropical diseases are caused by unsafe water, poor housing conditions and poor sanitation in the Region.

SOURCE: WHO website

Contamination

The presence or transfer of hazardous chemical, biological or radioactive substances/materials to personnel, structures, areas, mobile and immobile objects, surface, soil or water.

Critical infrastructure

Those physical and information technology facilities, networks, services and assets which, if disrupted or destroyed, would have a serious impact on the health, safety, security or economic well-being of citizens or the effective functioning of governments in the Member States.

Cross contamination

Also referred to secondary contamination. The process by which materials are unintentionally transferred from one object to another.

Dangerous goods

Dangerous goods are goods containing substances and articles, which have been identified as hazardous for transport and present a risk to people, property and the environment. The transport requires an appropriate package.

Decontamination

The removal or reduction of hazardous materials from the undesirable place (contamination) to lower the risk of further harm and/or cross contamination.

Detection

In the chemical, biological, radiological, nuclear, and explosive (CBRNE) context, detection is the act of locating CBRNE hazards or discovering or perceiving the presence and in some cases, to get an assessment on the type of CBRNE threat substances.

Disarmament

Disarmament is defined by the United Nations General Assembly and refers to the reduction, limitation, physical elimination and abolition of weapons, often referring to nuclear, biological or chemical weapons of mass destruction. According to See UNIDIR, "Coming to Terms with Security," UNIDIR/2001/16 (Geneva: UNIDIR, 2001): Disarmament aims at the physical elimination of agreed types of weapons, or mutual commitments not to produce them

Disease

An unhealthy condition of the body (or a part of it) or the mind (illness, sickness) presented by symptoms peculiar to it. Chronic diseases are diseases of long duration (3 months or more) and generally slow progression. Nosocomial disease is a disease acquired in a hospital, especially in reference to an infection.

Dispersion

Spread of radioactive particles, chemical substances or biological agents.

Dose - biological

The infectious dose gives information on the amount of a particular infectious agent (measured in number of microorganisms) that is necessary to lead to an infection of a host (human or animal).

Dual-use

Is described as research, knowledge, technology (including software) and material that is intended for peaceful purposes but could potentially be misused to harm humans, animals or the environment. The EU controls the export, transit and brokering of dual-use items so the EU can contribute to international peace and security and prevent the proliferation of Weapons of Mass Destruction (WMD).

- UN Security Council Resolution 1540
- The Nuclear Non-Proliferation Treaty
- the Chemical Weapons Convention
- the Biological Weapons Convention

EU export controls reflect commitments agreed upon in key multilateral export control regimes such as the Australia Group, the Wassenaar Arrangement, the Nuclear Suppliers Group and the Missile Technology Control Regime.

Dual-use item

Dual-use items are 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). The EU Council Regulation 428/2009 controls the export, transit and brokering of dual-use goods, software and technology which can be misused.

Dual-use research of concern

The term dual-use research of concern (DURC) applies to life sciences research knowledge, technology and material that could potentially be misused without further modification (immediacy) and that has a significant potential to cause serious harm (scope) to public health and safety, agricultural crops and other plants, animals, the environment, material or government security.

European Centre for Disease Prevention and Control

The European Center for Disease Prevention and Control (ECDC) seated in Stockholm. The ECDC mission is to identify, assess and communicate threats to human health by infectious diseases.

European Chemical Agency, Helsinki

The European Chemicals Agency (ECHA) in Helsinki is the EU's agency for the implementation of EU chemicals legislation. It is responsible for implementing the 'Regulation concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals' (REACH).

Ebola virus

Ebola virus and the closely related Marburg virus are highly contagious viruses of the family Filoviridae that cause viral haemorrhagic fever characterised by high fever, headache, respiratory symptoms, stomach pain, diarrhea, bleeding, and sometimes central nervous system involvement with coma. The symptoms that tend to follow include vomiting, rash, and bleeding problems that include bloody nose (epistaxis), spitting up blood from the lungs. Progressive organ failure leads to death. Ebola and Marburg hemorrhagic fevers are associated with a very high case fatality rate. The virus can be transmitted by secretions (by contact with blood, feces, or body fluids) of symptomatic patients. Worldwide is no treatment or vaccine available. Ebola and Marburg hemorrhagic fevers are zoonoses observed in Africa. Molecular, serological, and virological studies imply that bats are the reservoir. The main source of human infections is the handling of infected primates. Based on the high mortality rate of the agents, they are considered as potential bioweapons.

Endemic

Endemic refers to a continuous presence of a disease or infectious agent, that occurs at a predictable rate, at low levels and with low prevalence in a population (human, animal or plant) or geographic region.

Enzyme

An enzyme is a protein that catalyses a chemical reaction of a substance (substrate) without being destroyed or altered. Enzymes increase the rate at which a chemical reaction occurs.

Epidemic

The occurrence of new cases of a certain disease in a given geographic area or in a given population during a given time period which exceeds the expected number of cases. An epidemic is the rapid spread of an infectious disease in the population of a geographic area at a given time period.

European chemical numbers

Also referred to as European Community number, EC number, EC No., EC#, the European chemical number is a unique seven-digit identifier (with the format xxx-xxx-x) which is assigned to chemical substances for regulatory purposes within the European Union.

Explosive precursor

Is a chemical reactant that takes part in the production of a home-made explosive.

First responder

Certified member of an authority with responding first to the scene of an emergency.

Note 1: First responders are members of fire and rescue departments, police departments, other law enforcement agencies, hazardous materials response teams, emergency medical services, workers, and other organizations that have public safety responsibilities and who would respond to rescue and treat victims, and who would protect the public during an incident.

SOURCE: CEN standard EN 17173: 2020 'European CBRNE Glossary'

Food Terrorism

An act or threat of deliberate contamination of food and feed with chemical, biological or radio nuclear agents for the purpose of causing injury or death to civilian population and/or disrupting social, economic or political stability.

Forensic sampling

Forensically acceptable techniques to identify CBRN hazards and to confirm, by the unequivocal use of CBRN agents by an adversary.

SOURCE: CEN EN 17173:2020 'European CBRNE Glossary'

GC-MS

This is a combination of two different analytical techniques: a gas chromatography (GC) instrument with a mass spectrometer (MS). The gas chromatograph separates the volatile and semi-volatile compounds of the chemical mixture into pulses of pure chemicals and the mass spectrometer identifies (by providing detailed structural information, including the full unambiguous chemical structure thank to MS impact electronic and chemical ionization modes) and quantifies the individual chemicals.

Francisella tularensis

Gram negative bacteria, cause of the disease tularaemia, which can affect humans and animals (especially rodents, rabbits and hares). Transmission routes are cutaneous/ocular (skin and/or eye contact with bacteria), pulmonary (inhalation of bacteria) or oral (ingestion of bacteria). Symptoms depend on transmission routes and affect mainly the site of entry. Systemic infections (e.g. after ingestion or inhalation) show a higher fatality rate. Transmission by insect bites is relevant. No known transmission between humans. Two types of *Francisella tularensis* are relevant for human infections: *Francisella tularensis* biovar *tularensis* (type A) (Northern America), responsible of the most serious pulmonary form, and *Francisella tularensis* biovar *palaeartica* (type B) (worldwide). Infections with type A are the more severe disease. Ciprofloxacin, streptomycin and doxycycline are first-line antibiotic treatment and post-exposure prophylaxis. A vaccine against tularaemia does exist and is authorised in a few countries (e.g. Russia) but availability is limited.

Hazardous materials

A hazardous material or HAZMAT is defined as any substance or material that could adversely affect the safety of the public, handlers or carriers, or the environment.

HAZCHEM

This warning-plate system is used in the United Kingdom, Australia, Malaysia and New Zealand on vehicles transporting hazardous substances, and for storage facilities. The first line includes an emergency action code (EAC) comprising a single number (1 to 4, representing the type of fire suppressant) and either one or two letters (representing the required type of PPE, containment measures and the possibility of violent reactions). The second line contains the UN number, the third line gives a telephone number for specialist advice, and a warning symbol is also displayed on the plate.

Host

Hosts are organisms (humans, animals, or plants) that can be infected by an infectious agent under natural (as opposed to experimental) conditions.

Immediately Dangerous to Health of Life

Immediately Dangerous to Life or Health is a reference threshold defined by the U.S. National Institute for Occupational Safety and Health (NIOSH). IDLH refers to the highest airborne concentration from which a person could escape within 30 minutes without any escape-impairing symptoms or any irreversible health effects. Other than for ERPG or AEGL thresholds, no severity levels are defined.

Improvised Explosive Device

Improvised Explosive Device (IED) is an explosive device produced by the non-authorized person and without security and quality standards applicable on industrial explosive device production. An IED is a unique bomb constructed typically from whatever available explosives, an ignition system, a detonator, electronics, power source and a container and are used in an improvised manner. It is mainly produced and used by terrorist or organized crime members.

Incubation Period

The time from the moment of exposure to an infectious agent until the appearance of symptoms and/or clinical signs of the disease. Incubation period is the time elapsed between exposure to a pathogenic organism, a chemical, or radiation, and when symptoms and signs are first apparent.

Infection

Invasion with subsequent multiplication of microorganisms such as bacteria, viruses, and parasites that are not normally present in a host organism, causing a symptomatic or asymptomatic, but verifiable reaction like immune response. These infectious organisms are known as pathogens. Infections can be classified according to the route of infection, the origin of the infection and the course of the infection. An infection may remain localised, or it may spread through the blood or lymphatic vessels to become systemic (body-wide).

Intoxication

Is the poisoning by a toxic substance.

Lethal Concentration 50%

LC50 (Lethal concentration 50%) is the concentration of a gas or vapour in air or substance in water required to cause death in half of the (experimentally) exposed hosts during the observation period (i.e. for a set period of time, usually 4 hours).

Lethal Concentration time 50%

Lethal 'Concentration time' Ct is used as a measure for the exposure to (or dose of) an aerosol or vapour. LCt50 is the concentration time which kills 50 % of an exposed population. It is usually expressed in time (minutes) multiplied by concentration (milligrams per cubic metre): mg.min/m³.

Lethal Dose 50%

LD50 (Lethal dose 50%) is the amount required to cause death in half of the (experimentally) exposed hosts. It is a standard measurement of acute toxicity and is given in milligrams per kilogram bodyweight: mg/kg. LD50 is also called median lethal dose. Lethal dosage often varies depending on the route of administration (i.e. inhalation, oral, percutaneous, intravenous). For this reason, LD50 figures are often qualified with the mode of administration, e.g., "LD50 i.v."

Latency

It is the time delay between exposure and the first sign of symptoms. It is one of the defining factors for any toxic effect: toxicity, latency, persistency and transmissibility of the toxic substance. In substances with short latency, the effects will be immediately recognisable; examples are fast-acting pulmonary agents (with high water solubility), 'tear gas', nerve agents or cyanides. In substances with long latency, exposure may take place unknowingly, e.g. in the case of sulphur mustard exposure. After exposure to slow-acting pulmonary agents (with low water solubility) delayed lung oedema may occur.

Limit of detection

The Limit of Detection (LOD) or Detection Limit (DL) is often defined as the minimum concentration of a substance, which can be observed in a sample with some degree of confidence. The confidence level is usually 99 %. According to ICH guidelines, LOD refers to the lowest concentration of an analyte in a sample that can be detected, but not necessarily quantified, under the stated conditions of the test. According to IUPAC, LOD is the smallest amount of concentration of analyte in the sample that can be reliably distinguished from zero.

Liquid chromatography (LC)

Liquid chromatography (LC) involves techniques where the mobile phase is always a liquid and the stationary phase is either a liquid or is embodied in a solid carrier.

Liquid chromatography is a technique used to separate a sample into its individual parts. This separation occurs based on the interactions of the sample with the mobile and stationary phases. Because there are many stationary/mobile phase combinations that can be employed when separating a mixture, there are several different types of chromatography that are classified based on the physical states of those phases. Liquid-solid column chromatography, the most popular chromatography technique features a liquid mobile phase which slowly filters down through the solid stationary phase, bringing the separated components with it.

Morbidity

The incidence of a disease/the number of ill persons due to a specific disease, scaled to the size of that population, in a given time period (typically expressed in ill persons due to a specific disease per individuals per year).

**Mortality
Rate**

The number of deaths (in general or due to a specific cause) in a population, scaled to the size of that population, in a given time period (typically expressed in deaths per individuals per year). In comparison, the term case fatality rate (CFR) describes the rate of deaths due to a specific disease or injury scaled to the size of persons who contracted that disease.

Nerve Agent

A group of chemical warfare agents. They are extremely neurotoxic organophosphorous compounds that were developed during or after World War II. Included in this group are: tabun (GA), sarin (GB), soman (GD), ethyl sarin (GE), cyclohexyl sarin (GF), and VX. Nerve agents are viscous liquids under temperate conditions. As their odour- described as the smell of fruit or fish - may be faint or lost after storage, olfactory detection (by smelling) is not a reliable indicator. Nerve agents inhibit acetylcholinesterase, leading to a massive over-stimulation of those parts of the nervous system in which acetylcholine is the transmitter substance. The SLUDGE (Salivation, Lacrimation, Urination, Diaphoresis, Gastrointestinal motility, Emesis) syndrome is following by paralysis (including respiratory muscles one) leading to death results. According to OPCW: *nerve agents* block impulses between nerve cells or across synapses and are highly toxic with rapid effects. They act primarily by absorption through the skin and lungs. Nerve agents are divided into two main groups: G-series agents and V-series agents, named for their military designations. Some G-agents, particularly tabun and sarin, persist in the environment for only short periods. Other agents, such as soman and cyclosarin, persist longer and present a greater threat to the skin. V-agents are extremely potent, with only milligrams needed to cause death, and persist for long periods of time in the environment.

Neutralisation

This is a chemical reaction between an acid and a base to form a salt.

The Organisation for the Prohibition of Chemical Weapons*

The Organisation for the Prohibition of Chemical Weapons is a treaty-based international organisation with a focus on chemical disarmament and non-proliferation.

Pathogenic agent (pathogen)

Pathogenic agents are organisms or infectious particles or toxins with the ability to cause disease. This ability to cause disease is called pathogenicity.

Percutaneous

This defines a substance's route of entry into the body - i.e. 'through the skin'.

Personal Protective Equipment

Personal protective equipment (PPE) is the equipment worn to prevent or minimize exposure to serious injuries and illnesses. Personal protective equipment may include items such as lab coats, gowns, full-body suits, fire retardant or chemical-proof clothing, protective footwear, gloves, safety glasses, safety goggles and shoes, earplugs, hard hats, masks and respirators, or coveralls, vests and full body suits, according to specific countries existing regulation.

Precursor A precursor is a chemical reactant, which takes part in the production of another chemical. In safety and security context frequently referred to illegal drugs precursors, explosive precursors or chemical weapon precursors.

Radiation Radiation is a form of energy emitted during radioactive decay. There are two basic types of radiation: ionising and non-ionising, depending on their energy. Ionising radiation – IR, with energy above 5 eV (electron volt), such as alpha particles and X-rays – can ionise atoms, which means it can remove electrons from atomic shells. Non-ionising radiation – NIR, with energy below 3 eV, like, for example, ultraviolet (UV) light and visible light – cannot ionise atoms.

Radioactive material Any material, which releases a spontaneous emission of particles (alpha, beta, neutron) or radiation (gamma, K capture), or both at the same time, from the decay of certain nuclides that these particles are, due to an adjustment of their internal structure.

Relative vapour density

RVD is defined as the mass of a gas or vapour compared to air, which has an arbitrary value of 1. If the RVD value of a gas is less than 1, then the gas is lighter than air and hence will rise – the lighter the gas the faster it rises. If the RVD value is greater than 1 then the gas is heavier than air and will sink. To calculate the RVD of a gas: $\text{RVD} = \text{Relative molecular mass of gas} / \text{Relative molecular mass of air}$.

Self-contained breathing apparatus

The personal respiratory equipment used when extremely toxic chemicals are present, in an oxygen-deficient atmosphere, or when the contaminant or concentration is not known. The SCBA's are also typically used in emergency situations. SCBA's consist of a bottle (tank or cylinder), carrying assembly, gauge, safety valve, and a full facepiece. The bottle is equipped with an alarm to warn the wearer when air in the tank is getting low (about 25% of the tank air remains). Some SCBA's operate in an open-circuit mode; that is, the exhaled air is vented to the atmosphere and not rebreathed. Other SCBA's operate in a closed-circuit mode where exhaled air is filtered before it is rebreathed.

Spore Spores are dormant cells formed by certain organisms like bacteria or fungi to survive critical environmental conditions. Spores are surrounded by a thick multilayer cell wall and are highly resistant against extreme conditions of cold, heat and dryness. In comparison to the vegetative form of the agents, spores are also highly resistant against treatment with chemical and physical disinfectants. Therefore, special efforts have to be considered for an effective decontamination. Spores of organisms like *Bacillus anthracis* could be suspected for usage as biological weapons.

Standard operating procedure A standard operating procedure (SOP) is a set of step-by-step instructions compiled by an organization to help workers carry out complex routine operations. SOPs aim to achieve efficiency, quality output and uniformity of performance, while reducing miscommunication and failure to comply with industry regulations. According to the International Council for Harmonisation (ICH), SOPs are defined as “detailed, written instructions to achieve uniformity of the performance of a specific function”. SOPs usually get applied in pharmaceutical processing and for related clinical studies. In CBRNE situations, e.g. a minimum detection standard or standards for PPE are suitable.

Surveillance* Surveillance is the covert observation of people, places and vehicles, which law enforcement agencies and private detectives use to investigate allegations of illegal behaviour. These techniques range from physical observation to the electronic monitoring of conversations.

Toxic substance* Poisonous substance.

Toxic industrial chemicals Toxic industrial chemicals (TICs) are used in industrial operations or research, which, if released, have adverse effects on human health or on the environment. Some TICs can be used as CWA, e.g. chlorine or phosgene. Any kind of TICs with an acute toxicity can be used as CWA as underlined by the CWC. According to the general purpose criterion of the CWC, a toxic or precursor chemical may be defined as a chemical weapon depending on its intended purpose. Put simply, a toxic or precursor chemical is defined as a chemical weapon unless it has been developed, produced, stockpiled or used for purposes not prohibited by the Convention. The definition thus includes any chemical intended for chemical weapons purposes, regardless of whether it is specifically listed in the Convention, its Annexes or the three schedules of chemicals. NATO defines a TIC as a chemical that: (1) is more toxic than ammonia; and (2) is produced in quantities greater than 30 tons per year at any given production facility.

Toxic chemical The Chemical Weapons Convention defines a toxic chemical as any chemical that can be used directly as a weapon agent. According to Article 2 of the CWC, “Toxic chemical” means any chemical that through its chemical action on life processes can cause death, temporary incapacitation or permanent harm to humans or animals.

Transmissibility Transmissibility is the quality of a disease or trait being able to be passed on from one person or organism to another.

Volatility Volatility (or maximum concentration in a closed space) is the tendency of a solid or liquid substance to pass into the vapour state at a given temperature. The volatility depends on vapour pressure and varies according to the temperature.

Weapons of Mass Destruction

The 2004 UN Security Council Resolution 1540 implicitly defines weapons of mass destruction (WMD) as nuclear, chemical and biological weapons, including their means of delivery (missiles, rockets and other unmanned systems). The Resolution states that UN member states must impede non-state actors in the development, acquisition, manufacture, possession, transport, transfer, or use of such WMD.

The EU Strategy against the Proliferation of Weapons of Mass Destruction sets out the objective to prevent, deter, halt and, where possible, eliminate the proliferation of WMD, but does not provide a definition.

World Health Organisation

The World Health Organisation (WHO) is an agency of the United Nations (UN), based in Geneva (Switzerland). Within the UN, it is the directing and coordinating authority for health. Its main duties and responsibilities include the leadership on global health matters and global public health promotion. In 2007, WHO started to implement the International Health Regulations.

Zoonotic Disease

A disease that affects both humans and animals (more specifically, a disease that normally exists in animals but that can infect humans). It is estimated that around 60% of human pathogens are also pathogenic for other animals.



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