CBRN-E crime and offenders' motives

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JUNE 2021

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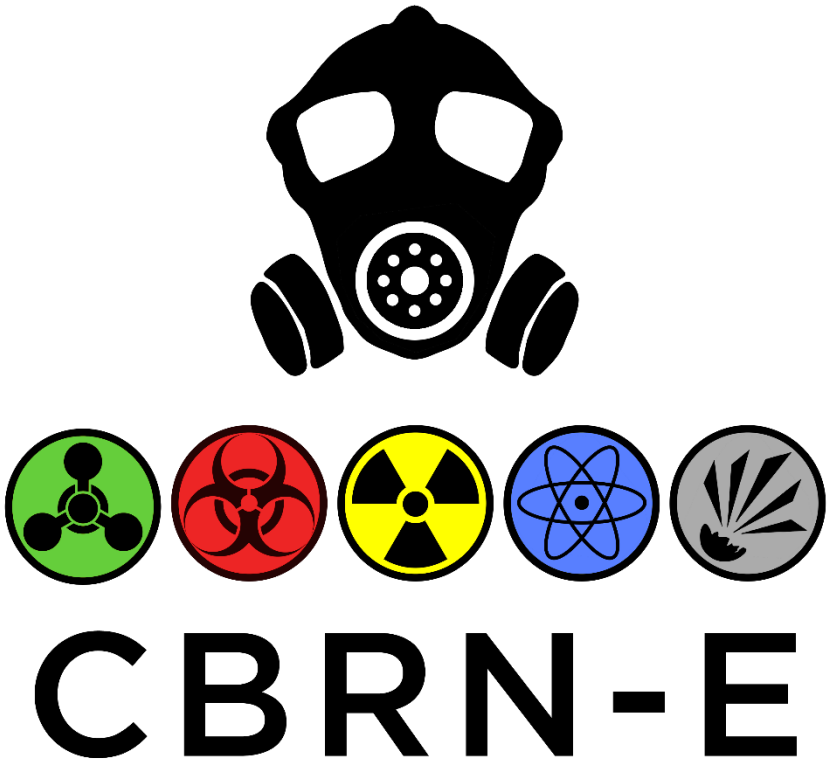
What is it? Why people do it?

Definitions of terms, legislation review and cases studies.



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Abstract

Topics related to chemical, biological, radiological, nuclear and explosive materials are increasingly being discussed in today´s society. Their connection with crime leads us to another dimension, which necessarily requires deeper investigation. This significantly affects several types of crime, including environmental crime, because they are closely related to each other.

From practice, we feel that there is no comprehensive (and) global view of law enforcement activities in the existing complex CBRN-E crime. We also perceive the shortcomings in the standard operational procedures of security forces for CBRN-E incidents, which must be regularly updated in connection with emerging technologies. These shortcomings often stem from the different terminology from which many activities are derived. This applies in particular to CBRN police units, teams such as SWAT, EOD, K9, special operation teams (undercover), security and protection forces, CSI-forensics, public order police, environmental police, and anti-narcotics force, etc.

Literature writes mostly about CBRN-E terrorism, and only a minimal amount of information on wide range of CBRN-E crimes is mentioned. Therefore, linking this topic only to terrorism is not relevant today. It is necessary to perceive this phenomenon in a broader context.

The aim of this article is to present the results of our comparative study related to the definitions of CBRN-E and HazMat materials, threats, and incidents. In the article, we also propose our own definition and categorization of CBRN-E crime, including related concepts based on our examination of real cases around the world, a study of the literature, legislation and history.

Another aim of this paper is to create a basis for in-depth qualitative and quantitative research by the ISEM Institute related to the prevalence of CBRN-E crime in selected countries, as well as a framework for a deep case comparative study. In the final part of the article, we will focus on the motivation, motive and intents in committing CBRN-E crime using specific analysed cases, which may be used in the future in the investigation of similar cases and case linkage.

Content

Abbreviations

ABAG - Association of Bay Area Governments

AGV – Augmented guided vehicles

AUV – Automatic guided vehicles

BDD – Biological dispersion device

BWC ISU – Biological Weapon Convention Implementation Support Unit

CBRN CoE – CBRN Centre of Excellence of the EU

CBRN-E – Chemical, biological, radiological, nuclear and explosive

CDD – Chemical dispersion device

CITES - Washington Convention on International Trade in Endangered Species of Fauna and Flora

CRISPR - clustered regularly interspaced short palindromic repeats

CSI – Crime scene investigation

CT – Counter-terrorism

CWA – Chemical warfare agent

C2NRBC - Special Gendarmerie units - National CBRN cell

DG HOME – Directorate General of Migration and Home Affairs (European Commission)

EOD – Explosive ordnance disposal

EU – European Union

HazMat – Hazardous material

HCSS - Hague Centre for Strategic Studies

IAEA – International Atomic Energy Agency

IATA - International Air Transport Association

IED – Improvised explosive device

INES - Institut National de l'Énergie Solaire

IRCGN - Criminal Research Institute of the Gendarmerie

IRSN - The Institute for Radiation Protection and Nuclear Safety

ISEMI (ISEM Institute) – International Security and Emergency Management Institute

ISIS/ISIL – Islamic state of Iraq and Syria/Islamic state of Iraq and the Levant

IUU - Illegal, unregulated and unreported

K9 – Canine unit

LD_{50} – Lethal dose, LD_{50} is the amount of a substance, that kill 50% of a tested sample; it can serve to measure the short-term poisoning potential - acute toxicity

NED – Nuclear explosive device

NID – Nuclear improvised device

NRC – Nuclear regulatory commission

OCLAESP - Central Office for the Fight Against Environmental and Public Health Attacks

ODS – Ozone depleting substances

OPCW – Organisation for the prohibition of chemical weapons

PIF Crime - (Protection of Financial Interest) – financial crime

POICN - Profiles of Incidents involving CBRN and Non-state Actors Database

PPE – Personal Protective Equipment

RDD – Radiological dispersion device

RED – Radiological exposure device

RFMO - Regional fisheries management organisations

SARS - Severe Acute Respiratory Syndrome

SUJCHBO - National Institute for Nuclear, Chemical and Biological Protection – Czech Republic

SWAT – Special weapons and tactics

TCDD - Tetrachlorodibenzo-p-dioxin

TERR – European Parliament Special Committee on Terrorism

UAV – Unmanned aerial vehicles

UGV – Unmanned ground vehicles

UK – United Kingdom

USA – United states of America

UUV – Unmanned underwater vehicles

UWV – Unmanned water vehicles

WHO – World health organisation

WMD – Weapons of mass destruction

3D – three-dimensional

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Introduction

CBRN-E crime is often described as a threat with a potential long-term destructive impact. It deals mainly with the possible misuse of CBRN-E materials for terrorist purposes, whether in combination with or without explosives. Connections are made to both, state and non-state actors. Weapons of Mass Destruction (WMD) are in this context also frequently mentioned especially in defence policy and NATO documents.

On the other hand, many experts in the field of CBRN threat analysis conclude, that the frequent occurrence of CBRN terrorist attacks is unlikely (**1**). This is also confirmed by global statistics for other several years.

In recent years, terrorist groups have used modus operandi which did not require extensive training. It was mainly the use of cold steel weapons, firearms and vehicles. Marco Macori (**2**) states that conventional, more frequent terrorist attacks, such as in Paris or Mumbai, prove that CBRN materials are not necessary to cause mass casualties. To this we can add many other conventional attacks from previous years (2015 - 2021) on the African continent, in the USA, Australia, New Zealand, Asia, but also in the EU - e.g. Nice, Rouen, Magnanville, Marseille, a train from Amsterdam to Paris, Brussels, Liége, Berlin, Turku, Barcelona, London, Stockholm, Amsterdam, and Vienna.

It is certain that for highly successful CBRN-E attacks, a highly specialized knowledge, the availability of materials, an ability to procure, process and adapt them for use, arrangement for transporting them to the place of attack, (and considering) the capacities for their application and knowledge of protection against their negative effects and destructive effects, are necessary.

However, in the area of security, we can never underestimate criminal and terrorist groups. And with the society's gradual development, new opportunities are emerging for some types of CBRN-E attacks without sophisticated preparation. As we have read in the in-depth HCSS study (**3**), the threat of these material or substance abuses is and will still be present, and relates to several aspects of society's development. Although the HCSS study is older, trends are clearly visible today. Chemistry and biology convergence in connection to technology has been and will continue for several years. We are seeing more and more great progress in the development of nanotechnologies, with the number of experiments in the engineering of chemical and biological materials on the rise, and the possibilities of easier access to CBRN-E materials are also growing.

According to analyses by the National Academies of Sciences, Engineering, and Medicine, similarly to the Knutzen arguments (**4**), it appears that we are facing new threats related to synthetic biology. The worldwide (global) pandemic of COVID-19 showed us many weaknesses in the response to this crisis and at the same time in the possibilities of rapid spreading of the virus. In addition, we see how quickly science has been able to respond to COVID-19, opening new doors in medication and vaccine development. On the other hand, it carries risks related to previous and current discoveries in the modification and creation of biological organisms, such as CRISPR-Cas9 technology and the interests of terrorist groups.

In one of our studies carried out for the European Commission, we included a potential attack of the spread of the SARS CoV virus among the CBRN terrorist threat scenarios as early as 2017, resulting in an epidemic. We didn't even think about a pandemic at the time, and SARS CoV2 probably didn't exist or had not yet been discovered officially. This current experience can ideally tell us what new challenges lie ahead.

As regards the possible spread of CBRN substances during an attack, technological advances in the construction of remote-controlled devices (drones, drone swarms, ground, underwater, water vehicles) and artificial intelligence facilitate the work of criminal groups and automatically make it difficult for security forces. The various types of autonomous vehicles and drones, which are multifunctional, increasingly lighter and more sophisticated, raise a number of questions about how to deal with threats (**5**). Existing counter-measures in the form of jammers, spoofing systems etc., must be constantly improved in order to catch up with their development.

The advertising of terrorist group activities and the associated individual radicalization, recruitment, preparation for attacks using new technologies as well as their coordination by organized crime, can also be simplified through anonymous communication via the darkweb, social networks, various game consoles and other electronic platforms. Detailed information on the methods and procedures for processing CBRN-E materials for use in attacks is increasingly present on the Internet. The development of the deepnet and darknet, as well as the use of cryptocurrencies, also allows experts in the fields of chemistry, biology and nuclear energy with malicious intentions to make their knowledge available to organized crime groups without exposing their activities. It is also necessary to emphasize the radical progress in the development of malware in recent times, which raises concerns about new types of sophisticated cyber-attacks on critical infrastructure and industry dealing with CBRN-E material. And we must not forget the huge progress in 3D technologies, which, in addition to the possible rapid production of plastic firearms, also enable the extrusion of microreactors capable of synthesizing chemical substances. The interest of terrorist groups in 3D technology has already been clearly demonstrated by ISIL/ISIS. A number of bombs used in Syria showed signs of using some parts printed by 3D technology (**6**).

An equally important technology of communication of criminal groups is steganography, a very old effective tool for covert messaging used by several terrorist groups in the past and nowadays. This involves inserting secret text into ordinary documents or images so that a third party cannot suspect it after viewing it. One example is planning an attack on a salad bar with a biological agent, where a photograph of a specific attack site in a restaurant would be masked by another common image, making the message of the attack site clearly conveyed. The difference between steganography and cryptography is that steganography only hides the message, while cryptography encodes it.

In today's era of new technologies, steganography has taken a new direction and criminal groups use many applications such as Xiano, Image steganography, Steghide, Stegais, Camouflage, Crypture, rSteg, OpenStego, SteganPEG, Hide'N'Send, SteganographX Plus, SSuite Picsel, Our secret and Concealment. On the other hand, there are several tools for detecting anomalies and hidden communication, such as StegExpose and StegAlyze (**7**).

Although many plans and attempts to complete CBRN attacks have failed in recent years, the preparation itself and the effort to carry them out also indicate an increasing risk of their frequency in the future. As stated in the Member States' preparedness for CBRN threats study carried out by the European Parliament for the TERR Committee in 2018, *"Increasing indications, reports and studies provide good reason to believe that threats from the deliberate use of Chemical, Biological, Radiological and Nuclear (CBRN) materials remain high and are evolving* (**8**). "

It is also important to look at CBRN-E attacks from a socio-psychological and health, but also economic point of view. It can be assumed that a mass psychological effect could be one of the main goals of a terrorist attack. The physical and health effects of such attacks sometimes appear either immediately, within hours, days, or even weeks. However, even if the consequences of such an attack would not have the character of mass destruction, the very fact of its occurrence could cause a huge psychological effect with subsequently cascading consequences of panic, associated injuries and long-term fear, including economic consequences and disintegration. Serious psychological effects can also occur in the case of a published threat or attempted CBRN-E attack.

If we look at the mapped statistics of CBRN terrorist-related incidents in the POICN database, 517 were recorded from 1990 to 2017 (**9**). It is important to mention that this is not a comprehensive list of all incidents, as there is no single global record system supported by all countries. In addition, the exclusion criteria in the analysis of data from the POICN database were incidents in the form of hoaxes, state actors' attacks, and crimes without an identified ideology for financial gain, revenge, or under the influence of delusionary mental illness.

The following graph indicates what types of CBRN terrorist incidents were recorded in the POICN database. We generated the graph from the table on page 10 in STUDIES IN CONFLICT & TERRORISM **(9)**.

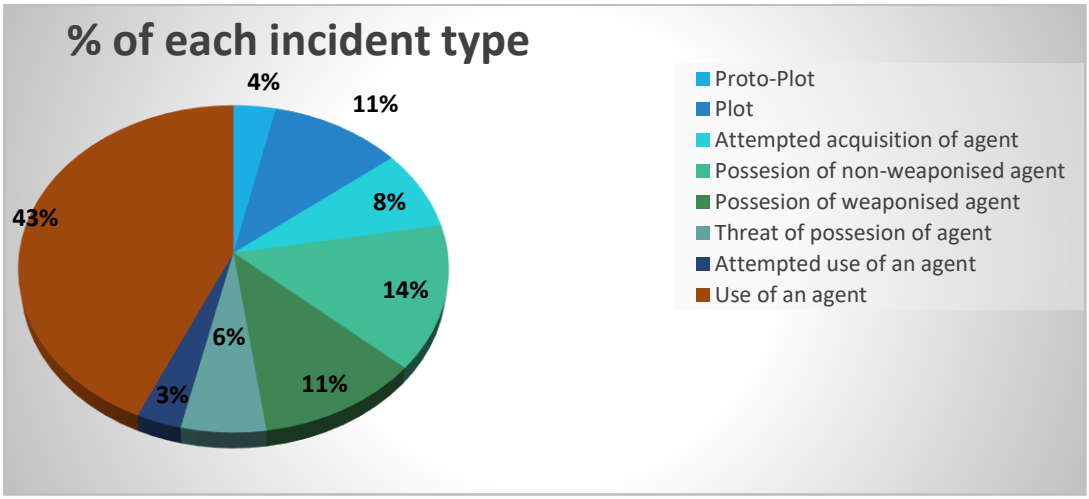


Figure 1 – CBRN Terrorism incident types in POICN database

Another global analysis (Global terrorism database) (**10**) states about 451 CBRN terrorist incidents from 1970 to 2019. These were either implemented attacks or attacks in an attempted stage, 401 of which were chemical attacks resulting in 62 deaths. In 37 cases it was biological

terrorism with 9 deaths, and finally in 13 terrorist incidents using radioactive substances, where no one was killed.

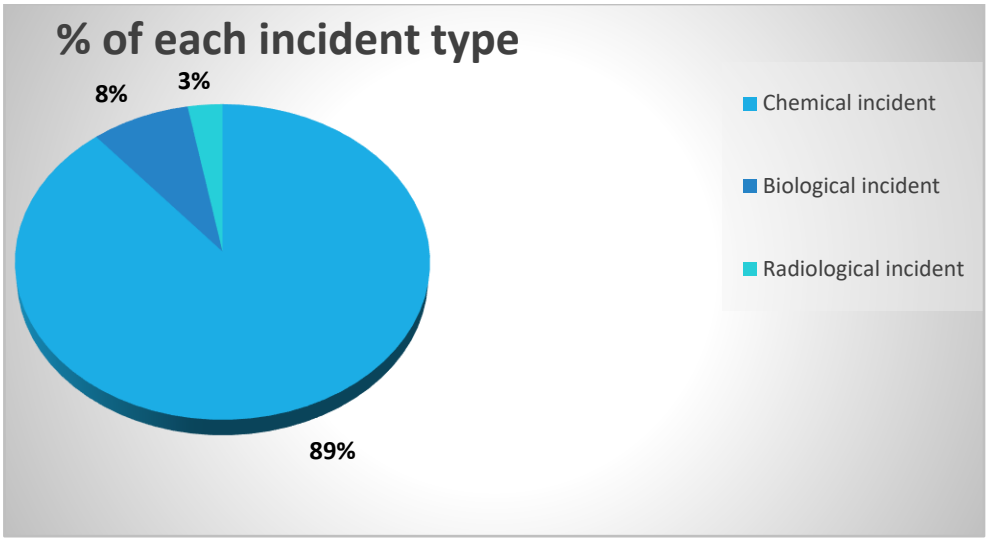


Figure 2 – CBRN Terrorism incident types in Global terrorism database

CBRN-E is not just about terrorism

In the next part of the article´s introduction, we would like to emphasize one fact that is little taken into account and is often overlooked by the competent authorities. CBRN-E crime is not just a link to terrorism. In recent years, we have had the opportunity to see in practice that this is a much broader dimension than just terrorism. We dare to assume that it is a far greater dimension than generally assumed. However, this assumption must definitively confirm the research we have begun to carry out and will build on in this article.

We all know that chemical, biological, radioactive, nuclear and explosive materials can be misused or used for a wide range of malicious and dangerous activities. Their negative impact can be seen in the form of threats to public security, damage to the health of the population, the environment (as such), fauna and flora, property, and it also impacts agricultural activity and the economy.

In this context, it is necessary to mention other much more common cases of CBRN-E crimes, even though the definition of CBRN-E crime is not yet sufficiently and uniformly established in criminal law worldwide. These include an increasing trend of assaults using acid, the illegal trafficking, production and possession of CBRN-E materials, the illegal transport and dumping of hazardous waste, and the illegal sale of CBRN-E material through the darknet, etc. (**11**).

We can clearly observe from practice and existing criminal laws that there is a wide range of CBRN-E crimes classified under different crime categories (crimes against human life and health, crimes against property, offences representing public danger, violent crime, damage and threat to the environment, crimes against the nation, peace and the state, etc.). Their impact on the population is often invisible, as it primarily affects the environment, and human health becomes a secondary consequence. Therefore, it is important to link CBRN-E crime partially

to environmental crime, depending on the type. We can also make this connection on the basis of the existing Directive 2008/99 / EC of the European Parliament and of the Council (**12**).

To define CBRN-E crime in detail, it is important to explain several related concepts. Although many dictionaries related to CBRN-E threats are publicly available, they only marginally or not at all deal with CBRN-E crime and we have not found any specific definition. The aim of this pre-print paper is to compare the different perceptions of CBRN-E agents and hazardous materials, as well as CBRN-E and HAZMAT incidents in conjunction with intentional and unintentional conduct. This study was based on the perspective of the existing literature, legislation and standard operational procedures used in interventions by various security and rescue services. The paper also includes our recommendations for defining and categorising CBRN-E crime, which are based on existing criminal and other related laws of several countries, and practical experience during our professional assignments in a number countries. It will also serve as a basis for in-depth qualitative and quantitative research related to the prevalence of CBRN-E crime in selected countries, as well as provide a framework for a comparative study of selected CBRN-E cases. The paper also addresses the perception of the (motivations and) motives of perpetrators in committing CBRN-E crime on the basis of case studies from Slovakia, Czech Republic, France, Georgia and UK.

1. CBRN-E versus hazardous materials and types of incidents – definitions

What does CBRN stand for? Normally, there is a simple answer related to hazardous substances. Ultimately, however, this abbreviation encompasses a much broader context than just chemical, biological, radiological, and nuclear materials with certain chemical, biological, and physical properties. If these materials are used in activities violating the law, we can talk about their impact on many aspects of people's lives and society.

In this context, we will try to characterize the abbreviation CBRN from several perspectives. Therefore, we can also talk about CBRN as:

Crowd

Began

Running

Noisily

or

Complicated

Blood-curdling

Redoubtable

Nuisance

By this we want to indicate that behind the four letters there is not only chemistry, biology, physics and nuclear science. As we stated in the introduction of the article, CBRN threats must also be assessed from a socio-psychological, sociological, medical, communicative and economic point of view.

In any CBRN threat, it is necessary to assume the emergence of crowd psychosis and the uncontrollable behavior of the population, which can lead to secondary injuries — the crowd began running noisily, for instance.

An example is the footage of EURONEWS and Dailymotion (**13**) from a false alarm broadcast in Paris on 15 November 2015, two days after the coordinated ISIL attacks on the Stade de France in Saint-Denis and the Bataclan theatre. According to SLATE.FR, memorial manifestations were held in several places for the victims of the attacks from previous days. They took place at the Place de la République, Beaubourg, and Étienne Marcel. However, there were screams out of nowhere and panic began to spread at the Place de la République, causing the mindless running of hundreds of people, resulting in many injuries. The panic appears to have been caused by firecracker explosions (**14**). It was enough to combine the lingering fear of recent attacks with an explosion-like sound, and one person's psychological processes provoked a naturally confusing reaction. Her panicked cry affected others under the influence of the

circumstances, and so there was a wave of reactions from bystanders. This is how the panic spread.

This can be compared to a definition based on the Entrapment theory of flight, where the typical response to danger is aggression or mass flight in search of a safe place (**15**).

However, in the EURONEWS video (**13**), we could also see elements of mutual help when men in a restaurant were navigating running people where to hide https://www.youtube.com/watch?v=yDJvnWgREQw.

A Mawson study (**15**) points out that in bombings, people tend to be helpful to others and seek refuge with loved ones. However, Mawson also mentions attacks using CBRN materials, where it is difficult to predict how masses of people will behave in an unprecedented attack. As an example, he cites the behavior of the population after the (nuclear) bombing attacks during World War II in Hiroshima and Nagasaki. Some reports contained information that people fled in droves hysterically and were confused after the initial peaceful evacuation (**C**omplicated, **B**lood-curdling, **R**edoubtable **N**uisance from our concept). Another example of widespread panic was the anthrax attacks in letters sent by post in the United States in 2001, despite the fact that there were minimal casualties (**16**).

We can also assume that in the event of a terrorist attack with radioactive substances, mass panic psychosomatic symptoms will develop in the affected population caused by the exaggerated fear of the effects of radiation. This may frustrate or complicate rescue operations (**17**). The indirect consequences of a terrorist attack in the form of anxiety, fear for life and health, or unexpected dangerous behavior can also complicate the successful management of a crisis situation. The combination of ignorance and misunderstanding of the situation can even result in extreme forms of behavior such as total passivity, disobeying or disregarding the instructions of the security forces, or deliberately opposing the authorities' recommendations (**18**).

The socio-psychological effects of a potential terrorist attack with CBRN materials can be long-term. As Khripunov further points out in connection with a potential terrorist attack using a radiological device, (**16**) the effects of radiation can cause depression, guilt and loss of control of their lives in victims and their descendants.

In the case of CBRN-E incidents, it is also necessary to take into account the psychological consequences that may occur in first responders, especially if they intervened in places with a large number of victims. Khripunov speaks of *"compassion fatigue"* and *"vicarious traumatization"* (**16**). However, it is also important to perceive secondary traumatisation as secondary traumatic stress, which can significantly affect the lives of first responders. This phenomenon is based on situations in which rescue services help victims of devastating traumatic events. At the same time, trauma is transmitted from the victims to the rescuers who did not have to experience the traumatizing situation themselves. Symptoms may occur in the long term with repeated or extreme survival of similar situations without direct sensory perception (**19**). Therefore, when perceiving CBRN-E incidents, we must always think about adequate training of intervening teams and monitor their mental health regularly.

The psychological effects of CBRN-E attacks are closely linked to communication between the intervening components and also to the public in order to avoid panic and cascading consequences. These are specific situations that generate uncontrollable emotions, to which it is necessary to react intelligently. This type of crisis brings with it unexpected behavior of the population, which tests the trust and credibility of public institutions. Communication in such cases requires special attention to the ethical and social elements in public speeches, as the clear time and place boundaries of a CBRN-E event are not easy to predict from the outset. It is also important to be aware of the public's ignorance of this type of incident background (**20**).

Conventional communication standards cannot work effectively in such situations. This can be explained by two theories. The theory of *Negative dominance* speaks of understanding positive and negative information in crisis situations, creating an asymmetric relationship between them. Greater weight is placed on negative information. People try harder to cope with losses and negative consequences compared to gains and positives. The second model is called *Mental noise*. Its aim is to assess how people react to the information obtained in times of crisis while under stress. It explains that the ability to communicate effectively is reduced due to various emotional excitations. Anxiety then creates the so-called "*Mental noise*", which curtails the ability to react rationally. Lynn Davis, Tom LaTourrette, David E. Mosher, Lois M. Davis, and David R. Howell therefore state that communication containing negatives is more (widely) perceived and kept in memory for a longer time period (**21**). For this reason, it is essential to create a communication strategy for a CBRN-E incident so that the population's attention is captured as soon as possible by a correct and clear message, recorded in the long term, but at the same time providing clear solutions to the crisis.

At the same time, we must take into account that media communication is a tool for terrorist organisations. The communication strategy by the competent authorities must therefore be balanced, taking into account the need for communication to the public and considering the tactical components targeted at the terrorist group. The role of the media in this context is therefore crucial, with commercial benefits set aside. At a minimum, they should be balanced with social benefits.

During the preparation of communication channels in the event of a terrorist attack with CBRN-E materials, it is strategic to think in advance of multichannel communication, which will effectively bring together the authorities responsible for crisis management, news media, civil society and citizens (**22**).

Failure to do so may result in serious errors. Confusion will be created, which will lead to even more misconduct:

Confusion

Bringing

Radical

Negative act

During many field security exercises of various countries in the field, we were able to observe the frequent occurrence of errors during operational procedures, unless the communication was clear, unambiguous and the flow of information went in the right direction. Therefore, during a CBRN criminal incident, we should use:

Clear

Befitting

Rigorous

Notification

Failure to do so may result in serious health consequences:

Casualties

Became

Rapidly

Numerous

CBRN threats can ultimately have a devastating impact on the economy and society, which is illustrated by our following abbreviation:

Consumptive

Babel

Reinforcing

Nasty mess

Unfortunately, there are only a very small number of publicly available studies focused on the economic impacts of a possible CBRN-E attack, both crime and accident. From what we have found in the literature, most information is available in connection with the incidents in Bhopal, Chernobyl and Goiania, or in connection with epidemics such as SARS (**23**). When the current COVID-19 pandemic culminates, we can also expect a global study of its economic impact on individual countries and the world economy. This could make a significant contribution to planning expenditure on measures related to biological threats.

As a concrete example of the significant economic consequences, we can mention the case of Goiania in Brazil. The negligent actions of people from a private radiotherapy institute when moving to new premises caused an unprecedented incident. The former premises of the institute were partially demolished, and during the removal they forgot about an old device used for radiotherapy. An abandoned radioactive source from a cancer treatment machine was found by two people who brought it home, where they were manipulated it. Later they brought it to the metal scrapyard. The owner of this metal scrap company noticed that parts of the source in the size of rice grains glowed blue in the dark. He then brought the individual parts to several families to point out the special phenomenon of these small special “iron”

grains. The radioactive source cesium 137 caused internal contamination and external irradiation of several persons. The radioactive source was in the form of cesium chloride salt. It is a highly soluble and readily dispersible substance. As a result, four people died and approximately 112,000 people were monitored for contamination. Of these, up to 249 were contaminated internally or externally. Many suffered serious internal and external contamination due to the way they handle cesium chloride salt, as they rubbed their skin, consumed food with contaminated hands or touched buildings, furniture and kitchenware that were also contaminated (**24**).

In addition to the health consequences, this case also had psycho-social and economic consequences. Gradually, the population became very stigmatized because a large group of people thought they were contaminated. Up to 100,000 persons underwent examination and over 8,000 were certified as not contaminated. Hotels outside the affected region refused to accept guests from the affected area, transport companies refused to transport them, and medical facilities to treat them. The certificates were intended to enable them to overcome this stigma. As a result, tourist business revenues fell by 40%, and half of the value of government exports was lost in the first month after the incident, mainly in connection with agricultural production. Textile and clothing production also recorded a 40% loss in value (**16**).

Another example of a chemical attack, which involved significant intervention and recovery costs, was the Scripal case in the UK in 2018. The Novichok nerve agent attack in Salisbury required not only a huge effort of over 40 UK forces, but also considerable resources to intervene and recovery phase. Many businesses were forced to close due to decontamination, which required additional support from public authorities. According to the region's Police and Crime Commissioner Angus Macpherson this attack in Salisbury cost the police force £ 7.5m (**25**).

The multiple anthrax attacks in the United States in 2001 required investment in decontamination and related services, which was approximately € 80.46m and € 1.78m for precautionary measures related to obtaining information on perpetrators.

The 1966 case in Palomares, Spain, also had a significant impact on the local economy. During a flight over the city, two planes collided, one of which was carrying four hydrogen bombs. Although rapid measures prevented a thermonuclear reaction, the explosion of high-explosive burster charges caused a dispersion of plutonium across several hectares of agricultural land. A huge effort in soil decontamination had to be expended. The clean-up process was estimated at € 43.78 m (**26**).

A case of cyanide contamination of grapes was recorded in 1989 in Chile after an anonymous call to the US Embassy in Santiago (**27**). The US Food and Drug Administration approved an embargo of grape imports from Chile. The result was several hundred million dollars in financial losses, and many small agricultural businesses went bankrupt (**28**).

The economic losses and expenditures caused by a possible CBRN-E attack are summarized in the following categories, which we have adjusted from the table created by Ramsereg, A. Kalinowski, M. B. and Weiß, L. It can be mainly (**26**):

I. Direct expenditure on the intervention of rescue and fire brigades
- detection and identification of CBRN materials;
- provision of protective equipment and clothing;
- triage of the wounded;
- saving lives and treating the injured;
- evacuation;
- securing the site of the incident and preventing the further spread of CBRN substances into the environment;
- immediate decontamination of victims and staff;
- transport to hospital facilities;
- temporary establishment of field hospitals.

II. Direct expenditure on the intervention of security and military forces
- crackdown on criminals and terrorists (neutralization);
- provision of protective equipment and clothing;
- detection and identification of CBRN materials and threats, including the use of the latest technologies (UAV, UGV, etc.);
- set-up of safe perimeter - cordoning;
- set-up of command post and crisis management permanent post;
- securing the crime scene from deterioration;
- crime scene reconnaissance, investigation and sampling;
- disaster victims´ identification;
- immediate decontamination of perpetrators and security and military staff;
- decontamination of evidence;
- transport of evidence to laboratory;
- laboratory examination, etc.

III. Recovery and reconstruction phase
- cleaning and decontamination processes, including removal of soil contamination;
- population relocation and resettlement;
- gathering of infected animals;
- disposal of contaminated objects, animal and plant carcasses;
- waste management;
- health care for the injured and disabled;
- socio-health compensation for surviving victims, the disabled and their survivors;
- reconstruction of buildings and adjacent infrastructure, etc.

IV. Indirect costs of damages caused
- losses due to the closure of production and service operations;
- losses caused by long-term lack of interest in tourist operations (hotels, restaurants)
- the need to pay social allocations to people who have lost their jobs;
- costs related to the temporary operation of replacement infrastructure;
- losses caused by the declaration of state of emergency;

- economic impact of temporary infrastructure breakdown: transportation system, public services (water supply, electricity, telephone network);
- macro-economic impacts: consequential costs from loss of income (multiplier effects) and loss of investor confidence / propensity to save

As we can see, the costs and impacts on the economy can be innumerable if the CBRN-E attack succeeds. A qualitative and quantitative study by Ramseger, A., Kalinowski, M. B. and Weiß, L. (**26**) shows that investing in preventive measures against CBRN terrorism pays off. The expected economic consequences can be much higher than the cost of countermeasures alone. However, the authors emphasize caution when calculating the costs of prevention and preparedness.

The effects of a CBRN-E incident can therefore range from minimal loss of life, physical and mental health, environmental and economic impacts to massive deaths, serious health consequences, crowd psychosis, overcrowded hospitals, serious environmental damage, and economic destruction and disintegration of state structures. It all depends on the type and amount of CBRN agent, the environment in which the incident occurs, the weather, and the mode of operandi of the perpetrators.

1.1. CBRN-E and hazardous materials and incidents

CBRN and HazMat terminology

We would like to highlight that the existence of different definitions and interpretations of terms can make it difficult to communicate and cooperate between countries. Therefore, it is necessary to know several interpretations of CBRN-E terminology. Correct CBRN-E definitions are also essential to the quality of penal legislation as they determine the scope of the law and represent the frame for the definition of the offences.

In the previous chapter, we looked at the acronym CBRN from a slightly different perspective. However, going back to the original well-known terminology, as stated by Bhardwaj (**29**), CBRN is often associated with the term *"CBRN Defense"* and covers passive protection from CBRN threats, prevention of contamination, and reducing CBRN risks.

According to the European Commission's dictionary - DG HOME (**30**), the acronym CBRN refers to chemical, biological, radiological and nuclear materials that could harm society through accidental or deliberate release or spread. The term CBRN is a replacement for the Cold War term of NBC (nuclear, biological and chemical), which replaced the previous term ABC (atomic, biological and chemical) which was used in the 1950s.

In the countries of the former Soviet Union and their socialist partners, the abbreviation *"RCHBP"* - Radiation, Chemical and Biological Protection - was also often used in military sector. This term is still used in several countries.

The definition of CBRN-E is encountered as an abbreviation for chemical, biological, radiological, nuclear and explosive materials. Interpol (**31**) states that CBRN-E terrorism poses a clear global threat to public health and security, national security, and economic and political stability.

The UK Operational Guidance of the Fire Central Program Office explains the presence of the letter "'E" in CBRN-E by saying that *"CBRN terrorist attacks may depend on an explosive (E) device for dispersal"* (**32**).

According to Eurojust, chemical, biological, radiological, nuclear and explosive substances (CBRN-E) include substances and agents designed, synthesized, extracted, processed and, where appropriate, manufactured, distributed and used by various actors (**33**).

As stated by the University of Pittsburgh (**34**), hazardous material (HazMat) means *"any object or substance (biological, chemical, radiological and / or physical) that can potentially cause injury to humans, animals or animals by itself or through interaction with other factors, and environmental damage."*

Although we can perceive the category of HazMat materials in a broader sense in terms of the impact on health and the environment, they will always be chemical, biological, radioactive or nuclear substances. These terms are mainly related to the field of transport. HazMat or hazardous / dangerous material are characterised by U.S. Department of Transportation (DOT) and IATA as *„articles or substances which are capable of posing a risk to health, safety, property, or the environment; are listed or classified in the regulations; and are transported in commerce"* (**35**).

IATA defines Dangerous Goods as *"items that may endanger the safety of an aircraft or persons on board the aircraft. Dangerous Goods are also known as restricted articles, hazardous materials and dangerous cargo. Many common items found in your household can be considered dangerous goods for the purpose of air transport"* (**36**).

The Ministry of Ecology and Sustainable Development of the French Republic states that hazardous materials do not only concern highly toxic substances, explosives and pollutants, but also the products we normally need in everyday life. These are fuels, gases, and fertilizers. The substances can be flammable, toxic, explosive, corrosive or radioactive (**37**).

According to the definition of the European Agency for Safety and Health Work and the classification of dangerous substances based on categories defined in the CLP Directive (Regulation (EC) No 1272/2008 (CLP Regulation), the hazardous substances *"include physical hazards (explosive, flammable, instable etc.), health hazards (all aspects of short- and long-term harm to health) and environmental hazards (aquatic environment etc.)"* (**38**).

Operational Guidance of UK Fire and Rescue Service describes the term of hazardous materials as dangerous/hazardous substances or goods. They can be in the form of solids, liquids, or gases. This term includes toxic, radioactive, flammable, explosive, corrosive, oxidizers, asphyxiates, biohazards, pathogen or allergen substances and organisms. At the same time, it can include materials with physical conditions or characteristics that make them hazardous under specific conditions (**39**).

According to the ABAG definition, (**40**) hazardous materials include substances which *"cause or contribute to an increase in injury, death or serious illness or pose a serious threat to humans or the environment because of their chemical, physical or infectious properties".*

With reference to the CBRN Mall Warning book methodology developed by Kolencik, Truchly, Górniak, Labaska, Bijak and the team of CBRN Shopping mall project; then with

reference to Sabol, J., Sestak, B.; Congressional research service and U.S. NRC (**41**), we propose to divide CBRN-E material into the following categories and agents of concern to be possibly used in different CBRN-E crimes. This selection of agents comes from previous criminal offences against health, life of people, against environment (animals, plant, land, water, forest, …), against public security and property, state system, nation, etc. and the assessment of their future possible use based on characteristics and hazard potential. The specific connection of the agents listed below to different crime scenarios is not provided in this public article, but is in disposal upon request in the classified version for law enforcement agencies.

Chemical/Explosive agents

Some chemicals may be found in more than one hazard group (hazard to health and property). They are listed in the table by primary effect category. It is important to highlight that some listed agents are very easily procured and some of them done so only under highly professional laboratory conditions. Many agents of concern can be synthetised only in a laboratory, some can be found in the mining and chemical industries as precursors, and some can be found in agricultural applications or home cleaning products, etc. This is not an exhaustive list of chemical agents of concern, but just some examples of the most probable agents used in CBRN-E crime.

Group of chemical hazards	Subgroup of chemical hazard	The most probable Chemical Agents used in CBRN-E crime
1.Toxic (toxic industrial chemicals, war agents)	**1.1 Acute toxicity**	- Organophosphate pesticides : (Chlormephos, Chlorthiophos, Cyanophos, Demeton, Chlordane, etc.), - Carbamate pesticides (Aldicarb, Oxamyl, Thiofanox) - Other pesticides : Fenamiphos, Mevinphos, Azinphos-methyl, Difenacoum, Fluoroacetamide, Sodium fluoroacetate, Strychnine - Substances used in professional or customer products e.g.: potassium cyanide 1,2,3,7,8, Pentachlorodibenzo-p-dioxin - Substances used in industrial processes: - Phosgene, Hydrogen cyanide, Cyanogen chloride, Arsenic acid, Acrylonitrile, 1,1,3 – Trichloroacetone, Acryolyl chloride, Glutaral - Hexamethylene diisocyanate, Methyl isocyanate, Nitrous oxide, Boron trichloride Dichlorosilane - Chlorine dioxide - Phosphine, Osmium tetroxide – trioxide, Hydrogen sulphide - Arsenic (III) oxide - Side products of industrial processes, combustion etc.: Tetrachlorodibenzo dioxin (TCDD), Dimethyl mercury
	1.2 Prolonged effect and Target organ toxicity	- Acrylonitrile - Arsine - Benzene - Carbon disulphide

		- Arsenic acid - Chlorpyrifos - Carbon tetrachloride - Nitrobenzene - Bromelain – juice - TCDD - Methyl mercury - Chlordane
	1.3 CWA (Nerve, Blister, Choking - pulmonary agents, Blood agents) – poisoning, alteration of metabolism	- Sarin-(GB) - Soman-(GD) - Tabun-(GA) - VX, Cyclosarin-(GF) - Hydrogen cyanide-(AC) - Phosgene-(CG) - Diphosgene-(DP) - 2,2'-Dichlorodiethylsulphide (Sulphur mustard, mustard gas, blister agent-HD) - Nitrogen mustard - HN-1,2,3; - Sesquimustard - Phenyldichloroarsine (PD) - Methyldichloroarsine (MD) - Phosgene oxime (CX) - Lewisite (blister agent) - Novichok – A agent - Arsine - Cyanogen chloride (CK) - Potassium cyanide (KCN) - Sodium cyanide (NaCN) - Quinuclidinyl benzilate (BZ)
2. Corrosive	**2.1 Eye damage**	- Acryolyl chloride - Acrylonitrile- Aluminium chloride - Aluminium phosphide - Arsine - Bromelain, juice - Chlorine dioxide - Dichlorosilane - Cellulase - Glutaral - Hexamethylene diisocyanate - Maleic anhydride - Methyl isocyanate - Succinic anhydride - Aniline - Benzenyl chloride - Hydrogen sulphide (irritant) - Acids - Alkali, alkali aqueous solutions - TCDD - Riot control agents CA, CR
	2.2. Skin Corrosion	- Acids (e.g. Sulphuric acid)

		- Acryolyl chloride - Boron trichloride - 2-phenylethylisocyanate - Bromelain, juice - Dichlorosilane - Hydrogen sulphide, (irritant) - Succinic anhydride - Alkali, alkali aqueous solutions)
	2.3 Objects and goods corrosion	- Acids - Glutaral
3. Sensitizing – respiratory (breathing difficulties, allergy) or skin (allergy)		- 1,5-naphthylene diisocyanate - 2-phenylethylisocyanate - Acrylonitrile - Bromelain, juice - Cellulase - Ficin - Glutaral - Hexamethylene diisocyanate - Maleic anhydride - Methyl isocyanate - Osmium tetroxide - Succinic anhydride - Chlorine - Ammonia - Nitric acid - Phosphine - Red phosporus - White phosporus - Perflurorisobutylene (PFIB) - Titanium tetrachloride - Zinc oxide - Riot control agents: Chlorobenzylidenemalonitrile (CS), Dibenz (b,f) (1,4) oxazepine (CR), Chloroacetophenone (CA), Chloropicrin (PS), Lysergide) - some solvents
4. Incapacitating (vomiting agents)		- Adamsite (DM) - Diphenylchloroarsine (DA) - Diphenylcyanoarsine (DC)
5. Oxidative (chemical burns)		- Chlorine - Chlorine dioxide - Magnesium perchlorate - saturated aqueous solution - Perchloric acid - Ammonium perchlorate - Bromine - Chromic acid - Dibenzoyl peroxide - Hydrogen peroxide - Nitrous oxide - Sodium perchlorate

	- Oxidizing acids eg. Nitric acid Sulphuric acid, 80% Acetic acid, Acetic anhydride - Sodium hypochlorite
6. Flammable (heat burns)	- Acrylonitrile - Ammonia - Arsine - Petrol - Ethanol - Hydrogen Sulphide - Methylated spirit - paint thinners - Kerosene - Acetone - Diesel - Phosphine
7. Water reacting (emitting flammable products)	- Aluminium phosphide - Dichlorosilane
8. Water reacting (emitting toxic products)	- Aluminium arsenide - Aluminium chloride - Aluminium phosphide - DA, DC
9. Explosive (fragmentation wounds)	- TNT - TATP - Pentrite - Aziroazide azide
10. Gas under pressure (explodes when heated)	- Ammonia anhydr. - Arsine - Boron trichloride - Chlorine - Chlorine dioxide - Dichlorosilane - Phosgene - Propane - Nitrous oxide - Carbon dioxide - Phosphine - Sulphur dioxide
11. Psychotomimetic agents (induce a psychosis, often including hallucinations and delusions) (42)	- Lysergic acid diethylamide (LSD) - BZ (CWA) - other benzilic acid esters - Agent 15 - Cannabinoids - Fentanil - Phenothiazines (several)
12. Pharmaceutical (illicit and commercial drugs at supra-therapeutic or toxic doses)	- Pancuronium - Carfentanil
13. Property and security threatening substances -	- Graphite (electro-chemical reaction) However, it may contain trace amounts of silica causing health hazard.

Table 1 – Chemical agents and explosives

Biological agents

Biological crimes can be carried out using toxins, bacteria, viruses, parasites and/or fungi to cause harm to people, the environment, and animals and plants, from a range of very small up to giant proportions depending upon which agents mentioned below would be used. Some of them have LD_{50} potential and some of them not, but they can still create panic. Some of them can cause harm only in some regions. Certain diseases caused by these agents are not human-to-human transmissible; others can be transmitted from human-to-human, others by different hosts or vectors. Some of them can be spread only to plants and animals, and some to humans and animals like overlapping diseases. The spread of biological agents can be "open", but also covert or masked as natural outbreaks. Furthermore, the containment of a human-to-human transmissible disease might be difficult to control in the first phase due to an early rapid spread. It is important to highlight that some listed agents are very easily procured and some of them only under highly professional laboratory conditions. This is not an exhaustive list of biological agents, but just some examples of the most probable agents used in CBRN-E crime.

Group of biological hazards	The most probable Biological Agents used in CBRN-E crime
1. Toxins (bacterial, plant, mycotoxins, animal)	- Ricin - Abrin - Aconitine - Clostridium botulinum neurotoxin - Clostridium perfrigens epsilson toxin - Conotoxins - Shigatoxins - Saxitoxins - Tetrodotoxins - Aflatoxin - Ochratoxin A - T2 toxin - Staphylococcal enterotoxin B (SEB) - Epsilon toxin of Clostridium perfringens - Food poisoning toxins (From Salmonella species, Escherichia coli O157:H7, Shigella) - Convallatoxin

2. Viruses	-Tick-borne virus (Nairovirus) causing Crimean-Congo Haemorrhagic fever (CCHFV) and Tick-borne encephalitis virus (TBEV) - Zoonotic flu viruses like H1N1 or H5N1 etc. - Dengue virus causing Dengue Fever - Cuevavirus, Marburgvirus, and Ebolavirus causing Ebola - RVF virus (RVFV) causing Rift Valley Fever - Yellow Fever virus causing Yellow Fever - Haemorrhagic Fever viruses with Renal Syndrome including Hanta virus, Apodemus agrarius virus causing Korean Haemorrhagic Fever) - Pathogenic hantaviruses (e.g. Hantaan HNTV, Seoul SEOV, Sin Nombre SNV, Andes ANDV, Dobrave-Belgrad DOBV - Monkey pox virus causing monkeypox - HIV/HCV viruses - Noroviruses - Vaccinia (orthropoxvirus) - Coronaviruses - SARS, MERS - Arenaviruses (Lassa, Machupo) - Mushroom virus X - Venezuelan equine encephalomyelitis virus causing Venezuelan equine encephalomyelitis - Rift Valley fever virus causing FVF
3. Bacteria	- “Super bugs” – multidrug resistance pathogens - Bacillus anthracis – Anthrax - Bacillus cereus biowar anthracis - Brucella genus bacteria-Brucellosis - Toxigenic bacterium Vibrio cholerae - Cholera - Yersinia Pestis – Plague - Bacterium Francisella tularensis - Tularemia - Salmonella typhi - Typhoid Fever - Bacterium Listeria monocytogenes -Listeriosis - Rickettsia prowazekii - Typhus - STEC (Bacterium) Shiga toxigenic Escherichia coli - gastrointestinal illnesses, haemorrhagic colitis (HC) and haemolytic uremic syndrome (HUS) - Legionella – (bacterium Legionella pneumophila) – legionellosis - Burkholderia mallei - Glanders - Burkholderia pseudomallei - Melioidosis - Chlamydia psittaci - Psittacosis - Q fever - Coxiella burnetii - Rickettsia prowazekii - Typhus fever - Coxiella burnetii (Q fever)
4. Parasites	- Entamoeba histolytica - Toxoplasma gondii - Giardia lamblia (giardiasis) - Tapeworm - River blindness - Filariasis - African trypanosomiasis (sleeping sickness) - Plasmodium parasite – Malaria

5. Fungi	- Candida albicans - Bloodstream infections - Fungus - Meningitis
6. Animal diseases	- African horse sickness - African swine fever - Akabane Avian influenza (highly pathogenic) - Bluetongue (exotic) - Brucellosis of cattle (Brucella abortus) - Bovine spongiform encephalopathy - Brucellosis of sheep (Brucella melitensis) - Camel pox - Brucellosis of swine (Brucella suis) - Classical swine fever - Contagious caprine pleuropneumonia - Contagious bovine pleuropneumonia - Foot-and-mouth disease (FMD) - Goat pox - Heartwater (Cowdria ruminantium) - Japanese encephalitis - Lumpy skin disease - Malignant catarrhal fever - Menangle virus - Newcastle disease (exotic) - Peste des petits ruminants - Rinderpest - Sheep pox - Swine vesicular disease - Vesicular stomatitis
7. Plant pathogens and diseases	- Phytophthora ramorum - Phytophthora kernoviae - Liberobacter africanus, L. asiaticus / Citrus greening caused - Peronosclerospora philippinensis / Philippine downy mildew (of corn) - Ralstonia solanacearum, race 3, biovar 2/ Bacterial wilt, brown rot (of potato) - Sclerophthora rayssiae var. Zeae / Brown stripe downy mildew (of corn) - Synchytrium endobioticum / Potato wart or potato canker - Xanthomonas oryzae pv. Oryzicola / Bacterial leaf streak (of rice) - Xylella fastidiosa / Citrus variegated chlorosis

Table 2 – Biological agents

Radiological agents

The penetration abilities of **alpha particles** are very small (several centimeters in air, something like 40-90 microns in tissue). This means that alpha particles striking the surface of the body do not present any harm to an exposed person (as external sources) unless there are open skin wounds. However, they are extremely harmful when an alpha emitter enters the body and exposed to its tissues internally.

Beta particles have a greater ability to penetrate materials, and comparing them to Alpha particles, they are much lighter. They can travel through many centimetres or even metres in the air, and can penetrate skin.

The most dangerous category in terms of penetration abilities through tissue is **gamma radiation** and also **neutrons**, therefore the shielding against these sources, minimum time spent close them and keeping distance are the most important aspects in ensuring adequate protection of persons.

Long-term contamination of surfaces, soil, air, etc. can also represent serious security and safety issues.

This is not an exhaustive list of radiological agents of concern, but just some examples of the most probable agents used in CBRN-E crime. Some of them (specified in a classified version of the article) emit lower energy than others, and some of them also have a shorter half-time of decay. They also have different chemical and physical properties, but they may still be dangerous to a certain extent depending on their activity (number of radioactive decay per second), the modus operandi and the intent of the offenders in a CBRN-E crime. Many radionuclides also emit more than one type of particles, but we put them in a category according to primary energy particles emission. There may be a combination of emitted β, γ, α, and n particles per a radioactive decay.

Group of radiological hazards	**The most probable radiological Agents (sealed or unsealed) used in CBRN-E crime for internal or external contamination and/or irradiation**
1. Alfa sources (natural and artificially produced)	- Americium (Am-241); in addition to alpha this radionuclide emits also some lower energy gammas - Plutonium (Pu-238); alphas are accompanied by a very low energy of gammas - Plutonium (Pu-239)**;** the primary fissile isotope used for the production of nuclear weapons - Polonium (Po-210); emits practically only alpha emitter - Radium (Ra-226); in addition, alpha emits also gammas - Radon (Rn-222); gas emitting only alphas - Uranium (U-235); in addition to alpha this radionuclide emits also some lower energy gammas
2. Beta / Gamma	- Cobalt (Co-60); beta-gamma emitter, used mainly as a gamma source with very penetrating radiation - Cesium (Cs-137); beta – gamma emitter, used mainly as a gamma source - Iodine (I-125); low energy beta and gamma emitter - Iodine (I-131); high energy beta and gamma emitter

	- Iridium (Ir-192); emits penetrating gammas - Iron (Fe-55); emits low energy photons and betas - Phosporus (P-32); beta particles able to penetrate 0.8 cm into tissue - Selenium (Se-75)); emits penetrating gammas - Strontium (Sr-89, Sr-90); main radiation emitted – high energy beta - Strontium (Sr-90); high energy beta emitter - Technetium (Tc-99m); emits penetrating gamma photons - Tritium or hydrogen-3 (symbol T or 3H) - emits a low-energy beta particle. The tritium emitted betas cannot penetrate the skin and thus they are not harmful as an external radiation source. This radionuclide may cause only small internal doses (much lower that the exposure due to alpha emitters), but still can serve as a threat. - Yytrium (Y-90); it is a pure beta emitter
3. Neutrons- associated with nuclear fission material (see below) and neutron produced by (alpha, n), (gamma, n)	- Californium (Cf-252); it is used exclusively as a neutron source - AmBe; neutron source, mixture of Am-241 and Be - PuBe; neutron source, mixture of Pu-239 and Be

Table 3 - Radiological Agents

Nuclear agents

Nuclear material can be defined as material that creates fission upon neutron irradiation. This includes material used in the nuclear weapons industry, or fuel in reactors of nuclear power plants. High activity radionuclides are also in spent nuclear fuel and disposal premises. Strong radioactive emitters can serve as a material for the so-called “dirty bomb” that can be transported to a selected target by various means. As Hall (**43**) further states, *“a nuclear bomb can be made of plutonium-239 or enriched uranium (U-235)”.*

The IAEA defines nuclear material as any source material or special fissionable material. Source material is defined as *“uranium containing the mixture of isotopes occurring in nature; uranium depleted in the isotope 235; thorium; any of the foregoing in the form of metal, alloy, chemical compound, or concentrate."*

As for special fissionable material, the IAEA describe it as *“plutonium-239; uranium-233; uranium enriched in the isotopes 235 or 233; any material containing one or more of the foregoing.”* The IAEA Board of Governors may also decide on additional source or special fissionable material depending on several circumstances in accordance with the relevant standards of the Agency (**44**).

It is important to emphasize that CBRN materials used in criminal activities other than terrorism may not all be specially modified or weaponized. These can be hazardous materials, chemicals which, without any modification, can be deliberately spilled from the original packaging as raw material on passing pedestrians, which can lead to the crime of public endangerment, personal injury, homicide, assault, etc. Their acquisition can be very simple yet difficult to observe in many cases.

CBRN-E versus HazMat incidents

Traditionally and historically, incidents have always been divided into HazMat and CBRN-E in professional circles. The difference was in the scale of the incident and in the methods of intervention, which, however, is currently not always the case after improving the intervention system and striving for uniform procedures at international level. This depends on national legislation, which often varies from country to country. HazMat teams were formed mostly within fire fighters' units or civil defence / protection agencies. CBRN-E teams were mostly part of the military or security forces.

The difference between CBRN-E agents and hazardous materials was assessed in relation to the type of incident, in particular, regardless of whether it was caused by intent or negligence. Ultimately, for example, a chemical such as ammonia may be perceived as part of the CBRN category when used to attack a specific group of people (**45**), or as part of hazardous materials if a train carrying, say, ammonia is derailed, such as in Canada in 1999 (**46**), or the tank truck accident in Houston in 1976 (**47**).

Another difference defined in some literature sources is the method of intervention in CBRN-E and HazMat incidents. B. Trefz (**48**), for example, says that the priority in CBRN operations is to identify agents and perpetrators of crime. This includes in particular the sampling of found substances as well as the collection of intelligence. These operations seek to prevent risks but at the same time accept them as part of their mission. Intervention in the event of a HazMat incident is aimed primarily at mitigating releases of substances into the environment and protecting the health of the population.

If we focus on hazardous material incident assessment (HAZMAT), as disclosed in U.S. Pat. National Library of Medicine (**49**), for hazardous materials or so-called "HazMat" means substances that may pose a risk to public health, the environment or property if not adequately handled.

In general, HazMat incidents include accidents and unintentional acts. In essence, they can be managed and controlled by professional intervention. In most cases, they do not involve disasters and mass injuries. However, we cannot rule out that an incident caused unintentionally but through negligence can also have repercussions for large sections of the population. An example is the incident in Bhopal, where due to inadequate maintenance and insufficient monitoring, deadly Methyl Isocyanate gas leaked from one of the tanks of the factory (**50**). Another example is the explosion of presumably improperly stored explosives in Beirut in August 2020, where more than 200 people were killed and thousands injured (**51**).

While we are mentioning CBRN-E incidents, according to U.S. National Library of Medicine (**49**), these are the intentional and harmful acts. The aim of such acts is primarily to cause fatal or other injuries, mass psychosis and, in certain cases, the disintegration of society. In this context, it is therefore important to examine the motive.

Steven Pike (**52**) also discusses the differences between CBRN and HazMat incidents in relation to three variables. These are the intent, risk and extent of the incident. If an accidental chemical leak occurs in a HazMat event as a result of an accident during transport or as a result of a fire, then in a CBRN-E event we speak of intentional or aggressive acts. These result in physical or environmental damage.

Pike (**52**) further emphasizes that the degree of risk also characterizes a certain difference between the two types of incidents. Intervention in the HazMat situation emphasizes the safety of staff and the public. Whereas operations in CBRN-E acts involve the acceptance of a higher level of risk.

Even according to the guidelines of the Surrey and Sussex police, the abbreviation CBRN should always be used only for deliberate, malicious, murderous, or intentional attacks or threats. The objective of such crime is to cause harm or fear by using, or threatening to use, CBRN materials (**39**).

Another of the definitions according to Ramseger, A., Kalinowski, M. B. and Weiß, L. includes both CBRN incident and hazardous materials. It refers to the incident *"that has already taken place, with damage caused by hazardous CBRN material"* (**26**). The above authors defined CBRN threats as probable threats coming up from CBRN substances but also including dangerous situations such as intentional criminal acts of war, or unintentional incidents.

As we can see from the historical overview of unintentional incidents with hazardous materials, most of them had one common denominator. Intervening specialists knew in advance the potential dangers that awaited them. For example, in the event of a tanker accident, substances leaking into the environment were known, or in the event of an accidental explosion in an industrial plant, it was known what substances leaked into the air. On the other hand, intervention in a CBRN-E incident often involves unknown substances. Efforts must therefore be made in particular to identify them through the detection and sampling, as well as to further investigate the environment, the crime scene, the persons involved, and to gather intelligence.

However, it is important to be aware of the fact that in most cases it is not possible to determine at the initial intervention whether the cause of the incident was an accident or intentional. In such situations, there are always a huge number of unknowns. It takes time and precise examination of the situation and circumstances, and obtaining as much information as possible, although we can assume that this is a pure accident without a criminal background. After all, an accident can be caused, say, by a tank officially carrying ammonia (according to original knowledge, documents and official designation), but in reality, it is carrying another type of highly dangerous chemical intentionally replaced by criminal group in order to mislead and endanger the intervening components.

Should we approach the incident as HazMat, do we use the theories defined above? Do the first or second responders in the HazMat incident always know in advance what type of danger they are dealing with? For this reason, it is necessary to treat each incident as a potential criminal offence and to take all measures to secure potential evidence for further investigation. Thus, even if it appears there is the presence of hazardous materials without intent to cause harm, we believe it is important to treat the incident investigation as having used CBRN-E material with a potentially harmful intent, regardless of whether we initially name the incident as a HazMat or a CBRN-E incident.

If we are talking about a CBRN-E incident, and during the investigation potentially criminal intent is ruled out and the accident is confirmed, the incident may be renamed from CBRN-E to HazMat (32), which, in our opinion, does not make sense.

The above conclusions, based on a review of the literature, do not mean that in all countries the characteristics of the incident with hazardous materials are as unintentional, accidental, and lower risk. However, in the criminal laws of many countries, we have discovered a definition of intentional offences using both hazardous and CBRN-E materials. This applies in particular to the sections relating to the offences of terrorism, the public threat or the environment. Therefore, we dare to say that it is not always appropriate to divide incidents into CBRN-E and HazMat. In the current development, such a division is unfounded and trends suggest that all incidents, whether intentional or unintentional, are beginning to be referred to as CBRN-E incidents in many countries. The use of the term HazMat is logical, especially in connection with the transport of these materials, and not from the point of view of the intervention of safety and rescue services.

Finally, whether we define an intentional incident as HazMat or as CBRN depending on national legislation, the most important thing is to focus on an adequate response. These include the early saving of lives, the correct detection and identification of the substance, the prevention of any further spread of the substance into the environment, and the provision of the evidence necessary to identify the cause of the incident and the potential perpetrators.

1.2 Division of CBRN-E / HazMat incidents

To the best of our knowledge, CBRN-E / HazMat incidents can generally be divided into two main categories:

I. Natural and technological

II. Human-made

I. Natural and technological incidents

I.a) Natural accidents (indirect and direct escape of dangerous substances)

Natural incidents

Natural CBRN-E / HazMat incidents can be considered such accidents in which human being could not in any way influence the cause and prevent the release of hazardous substances into the environment. These are mainly the consequences of meteorological and geological circumstances. We can talk about strong winds and storms, blizzards, landslides, earthquakes, tsunamis, floods caused by bad weather, fires caused by no human influence, and volcanic eruptions affecting facilities containing hazardous substances, etc.

These are incidents in which, under the influence of natural elements, the functions of technology do not fail, but rather there may be partial or total destruction of objects and equipment and subsequent indirect release of substances into the environment, where even perfect preparedness for a natural incident may not be enough.

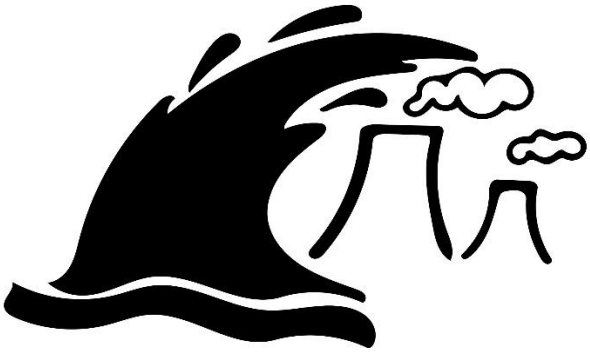
One of the many examples of the first subcategory is the leaching of hazardous chemicals such as chlorine, mercury and dioxins from the Spolana Neratovice industrial plant in the Czech Republic by the river Elbe. The cause was massive floods caused by long, heavy rains, which flooded the strategic parts of the factory (**53**).

Figure 3: Michal Sváček / MAFRA / Profimedia

Another example is an earthquake in the Nisqually Valley in the state of Washington in the United States in 2001, which resulted in a leak followed by an explosion of a natural gas line. As a result, a fire engulfed the Cedar Creek Correctional Center. Two workers were injured in this case (**54**).

The second subcategory is natural incidents, where dangerous substances are released into the environment directly from a natural source (e.g. volcanic gases after an eruption or dioxins produced by a forest fire after prolonged droughts) (**55**). It can also be a natural outbreak of infectious diseases.

I.b) Natural-technological



Natural-technological incidents

In this category we can see accidents in which hazardous materials have been released as a combination of a natural disaster and technological malfunction (**55**).

One example of a CBRN-E natural-technological incident is the disaster at the Fukushima nuclear power plant. A 15-meter tsunami caused by a strong magnitude earthquake measuring 9 on the Richter scale cut off power and consequently the cooling system of three Fukushima Daiichi reactors stopped working. This started the nuclear accident on March 11, 2011. Subsequently, for three days, all three reactor cores largely melted. In total, a radioactive release of about 940 PBq (I-131 eq.) was recorded (**56**).

The only way to prevent the release of hazardous materials into the environment in this type of incident is the precise planning of technological solutions for buildings with the presence of CBRN-E materials and preparedness for all possible natural scenarios in the region.

Figure 4: ISEM Institute (Depositphotos)

I.c Technological accidents

In this category we can include accidents caused by technological wear, short circuit of electronic components, explosion or accidental failure of equipment without human intervention, as a result of which dangerous substances leak into the environment. An example is the deterioration of containers / packaging material in undiscovered / abandoned storage premises. By deterioration of containers, we can understand damage due to the fragility of glass bottles, perforation or degradation of plastic containers, and corrosion or puncture of metal containers (**57**).

In addition to the wear and tear of materials, human failure may be preceded by human error, either as part of the construction and design of the equipment or caused during its operation by non-compliance with the relevant standards. In such a case, however, these are already human-made technological incidents, which leads to a link to the following category II.

According to the WHO definition, technological accidents are defined as: *"Accidents at hazardous installations (e.g. accidental release or explosions at chemical or nuclear power plants), and accidents while hazardous substances are in transport (e.g. oil tankers or chemicals transported by trains, tankers or lorries"* (**58**).

Among the well-known technological accidents with a very serious impact, where the human factor also played a role, we can include the cases in Bhopal, Mexico City, Basel, Seveso, the "Exxon Valdez" oil spill, and Chernobyl (**59**).

Figure 5: ISEM Institute (Depositphotos)

II. CBRN-E Human-made incidents

Human-made incidents may be subject to criminal law or administrative law. Whether the accident is caused intentionally, unintentionally due to negligence, or as a result of duty´s neglect, the degree of fault, the damage caused and the consequences, including the impact on health and the environment, are always assessed depending on national legislation. From this, the appropriate penalty is derived either under the criminal law (crime) or in terms of infringement proceedings (infraction).

II.a Unintentional

Human-made – unintentional incidents

In most cases, this is an offence involving negligence or negligent conduct. However, if serious damage to property, health and the environment has been caused, the conduct may be considered a criminal offence under the legislation of the country concerned. This category may include, for example:

- Disregard of safety regulations

- Accidents caused by malpractice or negligence

- Lapse / Failure - Neglect or breach of the duty.

All personnel working with HazMat or CBRN-E material have a legal obligation to act with reasonable care towards others and the environment. If this legal obligation is neglected, the accident may occur quickly.

For example, it may be a matter of forgetting the source of ionizing radiation in a place that is accessible to the public. Another example is the accident in the United States from the year 1991, where a Southern Refrigerated Transport, Inc.´s truck carrying a toxic fungicide crashed. The chemicals spilled into a nearby river and killed a lot of fish. The court held the carrier liable for the value of the fish killed because of negligence while the truck driver was performing his duty (**60**).

The recent case of Dahej, India, from June 2020 may also be a warning example of negligence. After an explosion in a pesticide factory owned by Yashashvi Rasayan Pvt Ltd in

Gujarat's Dahej, eight people died, more than 50 workers were injured, and 4,800 people were evacuated to avoid further loss of lives. The factory manufactured over 15 different environmental and health hazard chemicals, such as 4-Amino Benzonitrile, 2,4,5-Trichloroaniline, 4-Nitrobenzonitrile, and 2,3-Dichloroaniline. According to official statement, the chemicals in the factory were mishandled. The probable reason was human error or negligence of management because skilled labor was unavailable as a result of the nationwide COVID-19 lockdown (**61**).

There are thousands of similar cases of accidents during the transport of HazMat materials and accidents in chemical plants around the world.

Figure 6: ISEM Institute (Depositphotos)

II.b Intentional

Human-made – intentional incidents

Intentional CBRN-E incidents are considered mostly a crime by all countries. It is a deliberate breach of security regulation and a deliberate criminal act committed by individuals or groups

of criminals, and an act of terrorism (law impact, medium impact, serious, organized crime and terrorism).

The UK Center for the Protection of National Infrastructure defines the acronym CBRN as a malicious act in the following way:

• *"Chemical: Poisoning or injury caused by chemical substances, including traditional (military) chemical warfare agents, harmful industrial or household chemicals.*

• *Biological: Illnesses caused by the deliberate release of dangerous bacteria or viruses or by biological toxins (eg ricin, found in castor oil beans).*

• *Radiological: Illness caused by exposure to harmful radioactive materials.*

• *Nuclear: Life-threatening health effects caused by exposure to harmful radiation, thermal or blast effects arising from a nuclear detonation (**62**). "*

In certain circumstances, intentional conduct relating to CBRN-E and hazardous materials may be considered an infraction when it violates of an administrative regulation only, but this depends on national legislation. However, such action must not cause significant damage to health, property or the environment and must not be in line with organize group or terrorist intent. Therefore, it doesn't fall under the criminal law. It concerns mainly the offence against environment.

There are many examples of intentional crimes and offences. Some of them are listed in the following chapter. We provide also some examples below:

CBRN Act of terrorism, Chlorine bomb case in Indonesia - 2015

Figure 7: Indonesian CSI Police

CBRN crime against environment, Wolf Mountains case – Slovakia, 2018

Figure 8: Slovak police

CBRN crime against public security – illicit trafficking of radioactive material Pribenik case – Slovakia, 2007

Figure 9: Slovak police

1.3 CBRN-E crimes

As follows from the conclusions of subchapter 1.2, we propose following definition of CBRN-E crimes.

CBRN-E crime can be considered to be such an offence that is included in the relevant category of offences directed against public safety and security, health, human and animal life, plants, soil, air, water, forest, environment, property, nation, state, humanity, peace, international regulations and the economy in the criminal or similar law of a given country, and which in any way includes directly or indirectly hazardous CBRN-E materials. CBRN materials can be also dispersed using explosives in certain specific crimes, and therefore we add (E) - explosives to the abbreviation "CBRN".

Back to our abbreviation concept, we could say, the CBRN-E crimes are:

Combined

Broad

Radical

Non-linear

Extreme acts.

Finally, this **C**rime **B**egan **R**apidly **N**on-stop **E**volving.

Based on practical experience, we consider it important to either incorporate a separate category of CBRN-E offences into the legislation or to automatically define existing offences using CBRN-E and hazardous materials as an aggravating circumstance. In particular, there is a need to analyse developments in this area effectively and regularly, for which statistics on individual types of CBRN-E crime could be used. These statistics can be useful in predicting CBRN-E criminal behavior in certain regions and countries and can help prevent such behavior, including potential terrorist attacks, smuggling of CBRN material, illegal dumping of CBRN material into environment by organised groups, etc.

There are several reasons for extending an aggravating circumstance in criminal law to criminal offences. The first is the use or attempt to use hazardous CBRN-E materials that can significantly endanger the health and life of individuals or groups, as well as the environment due to cross-contamination, rapid spread or intrusion into the environment, and potential prolonged exposure depending on persistence; substance or half-life in the case of radionuclides. Thus, even in the case of an attack with dangerous materials on one person, the consequences could have a wider impact on a wider range of people, the environment and property (eg: attack with nerve agent Novichok - Scripal case in UK, 2018) (**63**).

As another example, we can cite the use of an iron rod in an intentional crime of injury to health by an offender whose motive was anger-related to wrongdoing and performed the criminal act under the influence of emotional agitation. The perpetrator committed the crime independently and had had no previous criminal record. He took the iron rod in his hand because he had it at his disposal. He didn't take it with him in advance to attack. He was a

person of good repute, and other parts of the aggravating circumstantial paragraph do not apply to the act itself. Attenuating circumstances would apply to the judgment.

However, if the same perpetrator had used a dangerous chemical instead of an iron rod, which he coincidentally had on hand due to its professional use, the attack would automatically have been considered an aggravating circumstance. It is understandable, however, that other special circumstances would have to be taken into account, which could possibly alleviate or eliminate the aggravating circumstance. In any case, depending on the type of chemical, the resulting impact and severity of the health and environmental consequences at the point of use, as well as of other persons, should also be assessed.

However, if the perpetrator had planned the attack and illegally procured the CBRN-E substance in advance, he automatically would have committed another crime. Depending on national legislation, the concurrence of the two offences could thus be considered an aggravating circumstance. Some countries, such as the US, the UK (Section 1, 4 / C of the Counter-terrorism and Sentencing Act 2021), Spain (section 455 of the Criminal Code), Russia (Article 63 of the Criminal Code), Kazakhstan (Art. 54), Kirghizstan (Art. 55), Cambodia (Art. 458), Philippines (Art. 14), Moldova (Art. 77), Tajikistan (Art. 62), Mongolia (Art. 56), partly also Belgium for theft offences (Art. 472 , 477), etc. already have aggravating circumstance incorporated into their laws in connection to the use of CBRN-E / toxic, poisoning or dangerous materials. Some other countries use aggravating circumstances for offences related to CBRN-E materials using other terminology without citing CBRN-E or hazardous substances (e.g.: serious conduct, in particularly dangerous form, etc.). However, this way of aggravated circumstances can be interpreted differently by law enforcement authorities and may not always be unambiguous.

Another reason for creating a separate category of CBRN-E crimes is a specific approach to their investigation and criminal assessment of the circumstances in which hazardous materials have been used or misused. For security forces, it is primarily a matter of recognizing the special responsibility and importance of particular procedures related to intervention under CBRN-E conditions, e.g., detection of threat, risk assessment, the collecting of evidence at the crime scene, the forensic analysis, but also the protection of the health and life of investigators and other intervening forces. Whether it is intervening SWAT teams, K9, EOD, undercover intelligence teams, special operation teams, special security and protection forces (body guards), public order police, CBRN units or on-site investigators, procedures and tactics for various situations and scenarios must be adequately set up and put into practice. Equally important is the interaction with other non-police forces such as fire fighters, civil protection agencies, civil defence, environmental agencies, public health authorities, nuclear regulatory bodies, radiological institutes, biological and chemical laboratories, military CBRN protection battalions, international non-profit organizations like Red Cross, Red Crescent, Médecins Sans Frontières, International Security and Emergency Management Institute – www.isemi.sk, etc. Mutual cooperation and training of the police, rescue service and fire brigade, are the bases of success for a timely response to a CBRN-E incident. Each agency must have information on the roles of the other agency in order to make synergies as effective as possible and to avoid the implementation of malpractices that would slow down or prevent the spread of CBRN-E threats, save lives and secure the scene of a crime for the following

investigation. The specialization of security forces, the prosecutor's office and the judiciary in this area would also have a significant positive impact on the proceedings and the delivery of judgments that reflect the substance of the offence to punish perpetrators.

Eurojust is the only EU institution that officially registers a separate category of CBRN-E crimes and pays them due attention at the European level. In general, it divides crimes into ten categories (**33**):

• CBRN-E
• Core international crimes
• Crimes against children
• Cybercrime
• Drug trafficking
• Economic crimes
• Migrant smuggling
• PIF crimes
• Terrorism
• Trafficking in human beings

As we can see, CBRN-E crimes figure among them in a separate group for their specificity and severity with an impact on society, public health and the environment. Eurojust has produced a very comprehensive guide called the EUROJUST CBRN-E Handbook, which provides an overview of the international legislation applicable to the CBRN-E (https://www.eurojust.europa.eu/sites/default/files/Publications/Reports/2017-06_Eurojust-CBRNE-Handbook_EN.pdf).

It is important to note that some CBRN-E offences are conditional and interconnected. In addition to producing CBRN-E weapons, a terrorist group can specifically obtain CBRN-E materials from an unauthorized landfill, steal them from industrial warehouses or during transport, and use them to attack. It is worth mentioning the fact that in many countries there are different types of illegal landfills for hazardous waste and they are easily accessible. These are surface landfills in forests, in meadows in the peripheral parts of villages, in abandoned buildings, old farms, or below the surface in old disused mining tunnels, etc.

Therefore, in this context, we are also talking about a close link between CBRN-E crime and environmental crime, as we have indicated above.

1.3.1 Environmental crime and links to hazardous materials

The link between environmental crime and hazardous substances characterizes the impact on the environment and the health of the population. From a legal point of view, environmental crime is incorporated in several international documents. It is being addressed by both the European Union and the United Nations.

This type of crime involves a wide range of malicious acts. It is worth mentioning the five basic areas of environmental crime defined in the framework of the United Nations

Environment Program and the initiatives of the United Nations Interregional Research Institute for Crime and Justice. It is about (**64**):

- Storage and illegal transport of various types of hazardous waste in breach of the 1989 Basel Convention on the Control of Hazardous Wastes and Other Wastes;

- Illicit trade in ozone-depleting substances (ODS) in violation of the Montreal Protocol of 1987;

- Illegal trade in wild animals in violation of the Washington Convention on International Trade in Endangered Species of Fauna and Flora (CITES) of 1973;

- Illegal, unregulated and unreported (IUU) fishing in contravention of controls imposed by the RFMO's various regional fisheries management rights;

- Illegal logging and timber trade under national law.

From the above categories, we can include the first two in CBRN-E crime.

In its Directive 2008/99 / EC of 19 November 2008 on the protection of the environment through criminal law, the European Parliament and the Council instruct EU member states to criminalize the intentional or grossly negligent conduct described below (**65**):

- *"the discharge, emission or introduction of quantities **of substances or ionizing radiation** into the air, soil or water which causes or is likely to cause **death or serious injury or substantial damage** to air quality, soil quality, water quality or to animals or plants;*

- *the collection, transport, recovery or disposal of **waste**, including the supervision of such operations and the after-care of disposal facilities and the action taken by traders or intermediaries (waste management) which cause or are likely to cause **death or serious injury or damage** to air quality, soil quality, water quality or animals or plants;*

- *the operation of a plant in which a hazardous activity is carried out or in which **dangerous substances** or preparations are stored or used and which, outside that plant, cause or are likely to cause death or serious injury or significant damage to air quality, soil quality, quality water or on animals or plants;*

- *the production, processing, handling, use, holding, storage, transport, import, export or disposal of **nuclear material** or other **dangerous radioactive substances** which cause or are likely to cause death or serious injury to health or substantial damage to air quality, soil, water quality or on animals or plants. "*

As stated on the Europol website (**66**), environmental crime is very lucrative. It can generate the same benefits as, for example, drug trafficking. At present, however, the sanctions are much lower and it is very difficult to detect. To this end, EnviCrimeNet has been set up as an informal network linking EU police and other anti-crime organizations.

Individual countries decide on sanctions for environmental crimes with the same penalties as for traditional crimes. In reality, however, in court judgments we very often encounter only fines and, rarely, convictions (**67**).

As we have already mentioned in the previous subchapters, the illegal trade in waste containing CBRN materials has its background in criminal groups. The perpetrators of these

crimes are mainly persons who are able to control the entire cycle of processing and transport of waste up to the landfills themselves. Trade between countries takes place through legal structures which, thanks to their networks of companies, which often have just one owner, can ensure a smooth transport to the destination. Other criminal offences, such as forgery of documents, money laundering, corruption, tax fraud, etc., are subsequently associated with this criminal activity (**68**).

1.3.2 Legislative overview and categorisation of CBRN-E crimes

Each country has different categories of crime defined in its criminal code or other connected codes. Some countries specifically mention CBRN-E and / or hazardous materials in their individual criminal codes, and some laws do not mention them at all. As an example, for comparison, we present a review of criminal and other similar laws (environmental codes, nuclear energy acts, war weapons control acts, counter-terrorism acts, etc.) from selected 40 countries in America, Europe, Asia and Africa. We drew information from Legislation Online, CBRN CoE Project 61 (**69**) and directly from colleagues from many police agencies. However, at the time of publication of this article, some of them may have been updated and the information below may no longer apply.

With regard to offences related to explosives (E), all of the criminal and similar laws we studied contained paragraphs relating to explosives, whether they were definitions or a specific description of the offences.

Terms such as CBRN, toxic substances, asphyxiating gases, suffocating or burning substances, toxins, pathogens, dangerous infectious diseases, bacteriological and toxic weapons, chemical weapons, radiological and nuclear weapon, radiation sources, poisons, dangerous substances, hazardous material, destructive, injurious, obnoxious, noxious or harmful substance, lethal device, harmful industrial or domestic waste, etc. were contained individually or in combination in the criminal and related codes of those countries. They were found in the section on general terms and definitions, in the sections relating to aggravating circumstances and / or in the characterization of individual offences within the relevant categories of offences, or in reference to other related laws. They were automatically included in laws banning chemical, biological and nuclear weapons. Some, mostly large countries, deal with CBRN materials as part of separate terrorism-related laws. In some criminal codes, these terms have been described in detail or their definitions have been found in the associated legal norms in order to avoid double interpretation. The most detailed interpretation of the above-mentioned terms was found in the US Criminal Code.

Albania

Albania has accurately incorporated the terms CBRN, bacteriological, poisonous, toxic waste, hazardous and dangerous substances into several sections of its criminal law. In most cases, they relate to terrorist offences, the manufacturing of military weapons and training to commit acts of terrorist intent (Chapter VII - Acts of terrorist intentions: Articles 230, 232, 234). In Chapter VIII, Section III on criminal offences against public order and security, the term CBRN and dangerous substances is mentioned several times, eg: Articles 282 / b - Training on unlawful manufacturing and use of weapons and other dangerous substances, Art. 285 -

Keeping, producing, and transporting chemical substances, Articles 288 - Producing and selling food and other substances dangerous to the health. We cite the last-mentioned article: *“Producing, importing, storing or selling foods, drinks and other substances, or drugs which are dangerous or harmful to life or health, as well as introducing chemicals, materials or additive substances into the production and processing of food and drinks, when those acts led to death or serious harm to the health of an individual, is punishable by fine or up to ten years of imprisonment.”*

It is also necessary to mention environmental crimes. They are found in Chapter IV, which deals with toxic radioactive substances and toxic waste in several paragraphs.

Belgium

Belgium also broadly includes the terms CBRN and dangerous substances in several sections of the Penal Code. For example, Article 137 contains both terms in the two paragraphs of paragraph 3, which define terrorist offence:

“3 ° the manufacture, possession, acquisition, transport or delivery of nuclear, biological, radiological or chemical weapons, the use of nuclear, biological, radiological or chemical weapons, as well as the carrying out of research into and the development of radiological or chemical weapons;

4 ° the release of dangerous substances which endanger human life.” Terms such as bacteriological weapons and toxins also appear in this section.

The act of poisoning is punishable by life imprisonment according to Article 397 and it is explained as *"the killing by means of substances that can more or less quickly cause death, in whatever way these substances are used or administered."*

Belgium has created a separate chapter in the Criminal Code dedicated to THREATS OF ATTACK AGAINST PERSONS OR PROPERTY, AND FALSE INFORMATION RELATING TO SERIOUS ATTACKS. Article 331 specifically mentions radioactive and nuclear substances or devices, chemical and biological weapons and substances in connection with threats of the use of these substances or attacks on nuclear installations or their theft. A separate section 477 is devoted to the theft of nuclear material. Section 488 deals with the unauthorized use of radioactive and nuclear materials. The term toxic substances is used in connection with the aggravating circumstance of theft in Articles 472 and 477.

Article 140 further deals with criminal offences related to the instruction and education of the production and use of hazardous materials. We can also take into account Articles 454 to 456 on selling poisoned food.

The Kingdom of Belgium also adopted a law in 2006 entitled Law on Weapons, which deals with prohibited weapons in Art 3:

"10 ° objects intended to hit persons with poisonous, asphyxiating, tear-producing or similar substances, with the exception of medical devices." In 2007, the act was amended where uranium munitions were included together with other types of weapons.

Canada

In Canadian criminal law, CBRN materials are also included in several crimes. However, great emphasis is placed on radioactive and nuclear materials. For example, in "*Wilful and forbidden acts in respect of certain properties"*, the following definition of lethal device is given under Article 431-2: *"weapon or device that is designed to cause, or is capable of causing, death, serious bodily injury or substantial material damage through the release, dissemination or impact of toxic chemicals, biological agents or toxins or similar substances, or radiation or radioactive material (Explosive or other engineered engine)."* This definition applies to the offence attack on premises, accommodation or transport of United Nations or associated personnel. The Canadian Criminal Code further defines hazardous materials and devices with appropriate sanctions (nuclear explosive device, radioactive material disperser or device emitting radiation) in Part II - Offences against public order. Possession, use, alteration of radioactive and nuclear material or device and commission of indictable offence to obtain nuclear material are also punished under Articles 82.3 82.4 and 82.5. Interestingly, the general part of the law separately mentions nuclear terrorism offences committed outside Canada (2.21) in connection with the navigation of vessels under the flag of Canada or on an aircraft.

China

Chinese criminal law explicitly mentions only nuclear and radioactive materials. Specifically, Paragraph 187. We quote: *"A person who manufactures, sells, transports, or possesses nuclear raw material, nuclear fuel, nuclear reactor, a radioactive substance or its raw material not according to the law shall be sentenced to imprisonment of not more than five years. A person who uses radioactive without a justified season and causes damage to another's body or health shall be sentenced to imprisonment for not less than three years but not more than ten years."*

In addition, Article 150 on public threats mentions hazardous materials in connection with committing an offence.

Croatia

In its criminal law, Croatia mentions both CBRN materials and hazardous substances, poison and contagious disease. They are mainly contained in the following categories: Crimes against humanity and human dignity - Section IX, in which terrorism is also found. They are further: Criminal offences against the environment - Section XX, Criminal offences against the health of people - Section XIX and Offences against general safety - Section XXI.

Czech Republic

The Criminal Code in the Czech Republic, specifically in Title VII - General Dangerous Crimes, in paragraphs 280 to 286, lists criminal offences related to the production, import, export, transport, storage, or procurement of radioactive substances, nuclear materials, highly dangerous chemical substances or their precursors, as well as poisons. In the sections of Title VIII on environmental crime, terms such as dangerous and noxious substances appear. The Criminal Code of the Czech Republic also mentions CBRN substances in paragraph 311 concerning terrorism.

Estonia

In Estonian Penal Code, we can find two paragraphs mentioning chemical, toxic biological and bacteriological weapons.

Development and handling of prohibited weapons (§ 93):
"(1) Designing, manufacturing, storing, acquiring, handing over, selling or providing or offering for use in any other manner of a chemical, biological or bacteriological weapon or any other internationally prohibited weapon of mass destruction or other weapon, or essential components thereof, is punishable by three to twelve years' imprisonment." The penal code also allows pecuniary punishment in case if the act was committed by a legal person.
Another paragraph (§ 103) relates to the use of prohibited weapons including chemical, bacteriological and biological material, and expands the description to a wider range of weapons of mass destruction like *"toxic weapons, toxic or asphyxiating gases, booby traps, i.e. explosives disguised as small harmless objects, expanding bullets, weapons injuring by fragments which escape X-rays, or other internationally prohibited weapons, or large-scale use of incendiary weapons under conditions where the military objective cannot be clearly separated from the civilian population, civilian objects or the surrounding environment."*
Dangerous infectious diseases are mentioned in § 192 and 193.
Some paragraphs also describe the offences connected to radiation sources: § 199, 200, 218, 237, 411, 412.

Section 22 describes the offences dangerous to the public. Especially in § 403, the act of dangerous poisoning the/in public related to the "*intentional poisoning of air, public water supplies or an object intended for transfer or grant of use, or knowing delivery or handing over of a poisoned object."*

Finland

Finland uses a wide range of definitions and offences in criminal law in relation to CBRN, including poison, poisonous, hazardous, dangerous, noxious substances, etc.

A special category is war crimes: Chapter 11 - War crimes and crimes against humanity. CBRN materials and weapons are cited in the crimes *"Breach of prohibition of CBRN weapons in several sections"*. Offences related to health threats using hazardous substances are incorporated in up to two chapters. Chapter 34 - Endangerment and Chapter 44 = Offences endangering health and safety. Examples are Section 9 - Genetic technology offence (848/2004) and Section 13 - Transport of dangerous substances offence.
Chapter 48 deals with environmental offences with the incorporation of several crimes using hazardous materials.
Very interesting is Chapter 15 - Offences against the administration of justice, which includes in Section 10 the offence *"Failure to report a serious offence"* (563/1998). This crime is related, inter alia, to the aggravated endangerment of health and nuclear device offences.
Another important category is the crimes of terrorism in Chapter 34a, where the law mentions CBRN materials several times.

France

In the French Criminal Code, in Section 2, entitled Destruction, degradation and deterioration dangerous for people, there is a paragraph 322-6-1 which explicitly includes CBRN materials. *"The fact of disseminating by any means, except for by professionals, processes allowing the*

manufacture of destructive devices made from powder or explosive substances, nuclear, biological or chemical materials, or from any other product intended for domestic, industrial or agricultural use, is punishable by three years' imprisonment and a fine of 45,000 euros." It is interesting to cite another part of paragraph: *"The penalties are increased to five years' imprisonment and a fine of 75,000 euros when an electronic communication network intended for an undetermined audience has been used for the dissemination of the procedures."* In Paragraph 421-2-6, the term CBRN is also used. Paragraph 412-5 penalizes the offence of participation in an insurrectionary movement if explosives and hazardous materials are used.

The term dangerous materials or items is mentioned in the category of offences against the nation, state or public policy (R 641-1).

In France, starting in 2002, and later, after a major reform in 2012, environmental crime has been regulated under the Environmental Code, which also includes several references to hazardous but also chemical, biological, nuclear and radioactive material in relation to transport and environmental impacts. Several law enforcement agencies are involved in investigating this type of crime (e.g., OCLAESP – Gendarmerie Nationale).

Georgia

Georgian criminal law includes both CBRN and hazardous substances in several categories of crime. For example, Article 288 - Violation of the procedures for handling environmentally hazardous substances or waste or Article 289 - Violation of the procedure for handling microbiological or other biological agents or toxins under CHAPTER XXXVI - Crime against Environmental Protection mentions toxins, bacteriological, biological, chemical, toxic or environmentally hazardous substances or waste in connection to violation of procedures for handling those substances. Act of *Making land unfit for use* under Article 297 is defined as: *"1. Poisoning, degradation or making land otherwise unfit for use with harmful substances during entrepreneurial, economic or other activities caused by the breach of the procedure for handling fertilizers, plant growth stimulants, pesticides, other chemical or biological substances during their storage, use or transport that results in damage to human health or damage of the environment. "*

Acts related to the use of substances harmful to the health are provided in Articles 292 - 295 under the same chapter related to environmental protection.
Nuclear and radioactive materials are mentioned in Articles 230; 231, 232; 233 and 234, toxic chemical and chemical weapons in Article 235.
Finally, we can find a description of acts using CBRN materials under Chapter XXXVIII related to terrorism -
Article 324 - Technological Terrorism.

Germany

Germany has incorporated the concepts of CBRN and hazardous materials into the two main standards of law enforcement and addresses the issue very comprehensively.

Chapter 28 in the criminal code, named as offences constituting public danger, includes in Section 307 the offence - causing (a) nuclear explosion. It covers both intentional and negligent offences. The law similarly in Section 309 includes Misuse of ionizing radiation. This part is interesting mainly because it concerns not only the threat to human health but also the negative impact on the environment, plants and animals. We quote: *"(1) Whoever, with the intention of damaging the health of another person, undertakes to expose that person to*

ionizing radiation which is capable of being damaging to health, incurs a penalty of imprisonment for a term of between one year and 10 years."
(6) Whoever, with the intention of
1. impairing the usability of property of significant value belonging to another;
2. permanently altering the properties of a body of water, the air or soil in a negative manner or;
3. damaging animals or plants of significant value belonging to another, exposes the property, body of water, air, soil, animals or plants to ionizing radiation which is capable of causing such impairments, alterations or damage, incurs a penalty of imprisonment for a term not exceeding five years, or a fine. The attempt is punishable."
Paragraphs 310, 311, 312 also deal with radioactive sources and include offences called *"Preparing explosion or radiation offence", "Releasing ionizing radiation" and "Faulty construction of a nuclear facility".*
Section 89a defines the preparation of a serious act of violence endangering the state. It contains *"instructs another person or allows himself to be instructed in the manufacture of or in handling dangerous material",* like explosive devices, nuclear fuel, radioactive devices, poisonous substances, or other substances harmful to health.

Chapter 29 of the criminal code focuses on environmental crime and it includes terms characterizing hazardous material such as poison, toxic, disease agents, etc.
"(1) Whoever, without being authorized to do so, outside a facility which is authorized therefor or in substantial deviation from the prescribed or authorized procedure, collects, ships, treats, utilises, stores, deposits, discharges, disposes of or trades in, brokers or otherwise commercializes waste which:
1. contains or can produce poisons or disease agents which constitute a public danger and can be communicated to humans or animals;
2. is carcinogenic, mutagenic or toxic to reproduction in humans;
3. is prone to explode, is spontaneously combustible or of more than merely minor radioactive quality or;
4. because of its nature, composition or quantity is capable of
(a) permanently contaminating or otherwise negatively altering a body of water, the air or soil or
(b) endangering an animal or plant population, incurs a penalty of imprisonment for a term not exceeding five years, or a fine. "
Section 328 deals with unauthorized handling of radioactive substances and other hazardous substances and goods and Section 330 includes especially serious offences against the environment, like causing severe danger by releasing poisons.

Another law called the War Weapons Control Act deals primarily with crimes related to the development, producing, trading, acquiring, transferring, importing or exporting chemical, biological and nuclear weapons. It also covers the act of inducing or encouraging another person to commit the above-mentioned acts.

Hungary

The Hungarian criminal code includes a reference to CBRN materials in several articles. These are, for example, criminal offences with military items and services under Section 329. We quote: *"(2) Any person who: a) provides technical assistance for the development, production, handling, operation, maintenance, repair, detection, identification or*

dissemination of chemical, biological or nuclear weapons or other nuclear explosive devices, including the missiles capable of delivering such weapons."

Section 330 - Criminal Offences with dual-use items further includes a reference to chemical weapons or instruments. Bacteriological, biological and toxin weapons are also mentioned in the closing provisions under Section 459. The criminal code also lists offences such as illegal operation of nuclear installations and crimes in connection with nuclear energy. Section 248, devoted to the violation of waste management regulations, contains terms related to hazardous waste and hazardous radioactive substances.

An interesting crime related to hazardous materials in Hungarian criminal law can be found in the chapter *Crime against consumer rights and any violation of competition laws*. This is a criminal offence under Section 417 *Misleading consumers*. This section describes the felony of misleading information as an act committed in connection with certain properties of the goods having an impact on health or on the environment, or it is considered as hazardous, dangerous or risky.

Iceland

The Icelandic penal code doesn't provide any terminology related to CBRN substances. However, the hazardous and toxic substances are mentioned in connection to terrorism (Article 100/a), offences involving the danger to the public within the Chapter XVIII (Articles 171 and 172) and miscellaneous offences against the public interest under Chapter XIX (Article 179). Article 169/a refers to nuclear material in connection to an act of its illegal possession, use, transport, modification, release or dispersion.

India

Indian criminal law does not use the terms CBRN. However, in several chapters it includes similar terminology relating mainly to chemical and biological substances. In the version available to us (**70**), there is no mention of radioactive or nuclear materials. Chapter XIV - Offences affecting the public health, safety, convenience, decency and morals contains several terms of infection or disease dangerous to life, poison, noxious food and drink, etc. For example, Section 326A is included in Chapter XVI - Offences affecting the human body. Voluntarily causing grievous hurt by use of acid, or Section 324, which describes the crime of "*Voluntarily causing hurt by dangerous weapons or means - whoever, except in the case provided for by section 334, voluntarily causes hurt by means of any instrument for shooting, stabbing or cutting, or any instrument which, used as a weapon of offence, is likely to cause death, or by means of fire or any heated substance, or by means of any poison or any corrosive substance, or by means of any explosive substance or by means of any substance which it is deleterious to the human body to inhale, to swallow, or to receive into the blood, or by means of any animal, shall be punished with imprisonment of either description for a term which may extend to three years, or with a fine, or with both."*

Ireland

There is a similar legislative system in Ireland as in the UK. Criminal Justice (Terrorist Offences) Act 2005 cites CBRN and hazardous substances several times. For example, Article 1 defines terrorist offences and fundamental rights and principles. The following shall be considered as criminal offences, under point (f):

"Manufacture, possession, acquisition, transport, supply or use of weapons, explosives or of nuclear, biological or chemical weapons, as well as research into, and development of, biological and chemical weapons."
Or under point (g):"*Release of dangerous substances, or causing fires, floods or explosions the effect of which is to endanger human life."*
Environmental crime is regulated by several acts, through which the EU Directives (Environmental Protection Agency Act 1992, Protection of the Environment Act 2003, Environmental (Miscellaneous Provisions) Acts 2011 and 2015, Waste Management Act 1996 (as amended) are implemented). There are also terms related to hazardous and CBRN materials.

Kazakhstan

Kazakhstan, as the largest country in Central Asia, has also incorporated CBRN terminology into many sections regarding crimes against peace and human security (Chapter 4), public security and public order (Chapter 10), and the environment (Chapter 13).

Kirghizstan

Kirghizstan has similar criminal law provisions as neighbouring Kazakhstan. For example, Article 266. Violation of the Rules for Managing Environmentally Hazardous Substances and Waste in Environmental Crime uses terms such as radiological, bacteriological, chemical substances and poisoning in connection to harm on human health and to the environment. In addition, Article 204 - Contraband within the category Crimes in Economic activity area describes the crime of transferring CBRN material through border to the territory of Kirghiz republic.

Lithuania

Lithuania has combined environmental and human health crimes into one chapter (XXXVIII) of the Criminal Code, using the terms hazardous substances and hazardous waste. Hazardous substances are subsequently cited together with CBRN materials in articles related to terrorism, e.g., Article 250 - Act of terrorism. Term toxic substances is also employed in the Article 111 - Prohibited military attack within the Chapter XV - Crimes against humanity and War crime, further in Article 199 - Smuggling within the Chapter XXXI Crimes and Misdemeanours against the economy and businesses order and, in the Chapter XXXVII, - Crimes and Misdemeanours relating to the possession of narcotics or psychotropic, toxic or highly active substances.

Luxembourg

Luxembourg uses the terms CBRN in its criminal law only in articles on terrorism. One of them Article 135/10 in the section *Terrorist attacks using explosives* even combines the use of explosives and CBRN materials, so we can officially see the meaning of using CBRN-E abbreviation. The article also talks about a separate device that has the capacity to distribute CBRN materials. The terms harmful and dangerous substances are also used in Art. 135 related to *Crimes in connection to terrorist activities*. In Luxembourg, there is also the so-called legislation on environmental offences, where several laws regulate sanctions, especially against infrastructure, where hazardous materials are also mentioned.

Moldova

Moldovan criminal legislation includes CBRN terminology and a large number of related terms in many crimes: economic, environmental and public security and public order.

One of the crimes that we have not identified in the criminal laws of other countries is worth considering. It is Article 225 categorized into Environmental Crimes. It is a data concealment or intentional disclosure of inauthentic data on environmental pollution. We quote: "*Data concealment or intentional disclosure by a person with a position of responsibility or by a person managing a commercial, public or other non-state organization, as well as by a legal entity, of inauthentic data on damage with excessive environmental pollution, with radioactive, chemical, bacteriological pollution, or with other dangerous consequences for the life or health of the population, as well as on the state of health of the population affected by the environmental pollution, if it is caused by imprudence: a) the mass illness of humans ; b) the mass destruction of animals; c) the death of the person; (d) other serious consequences."*

Mongolia

Mongolian criminal law is also richly represented by the terms CBR, including poisonous, hazardous and harmful material in several articles related to crimes against the environment (e.g.: Article 206. Violation of the rules for cleaning, transportation and dumping of chemical poisonous substances and industrial waste), crimes against security of mankind and peace. However, there is no mention of nuclear materials. Article 84 - Sabotage in the context of crimes against national security is also interesting. It contains several terms related mainly to biological and chemical threats. We quote: "... *spread of viral human, livestock or plant diseases, mass poisoning of people or mass death of humans, livestock and animals with a view of weakening the economic capacity of Mongolia shall be punishable by imprisonment for a term of 15 to 20 years. "*

Morocco

The Moroccan criminal law makes no mention of CBRN materials. Substances harmful to health and poisoning are mentioned in Chapter VII - Crimes and infractions against persons (Articles 398, 413). Article 218 in the first chapter related to terrorism mentions substances that endangers the health of humans or animals or the natural environment.

Netherlands

Dutch criminal law does not explicitly contain any terms such as CBRN substances. Article 385a on Serious Offences related to Shipping and Aviation mentions a hazardous load. However, in the Crimes of Terrorism Act, terrorism-related offences are referred to in the Nuclear Energy Act, the Biological Weapons Convention, and the Chemical Weapons Convention, which cover the area of CBRN materials. Terms like hazardous materials or toxic substances are covered by special Environmental law enforcement system (Environmental law and other relevant norms) (**71**).

Poland

Article 165 of the Polish Criminal Code refers to epidemiological hazard (BIO) in Article XX - Offences against public safety, Article 163 on the blast of explosives or flammable materials or any other form of a violent release of energy, or poisonous, suffocating or burning substances. Article171. § 1. specifically mentions: *"Whoever, without a required permit, or in breach of the conditions thereof, manufactures, processes, accumulates, possesses, uses or trades in an explosive substance or device, radioactive material, device emitting ionizing radiation or any other item or substance which may cause widespread danger to human life or health, or to property of a considerable extent shall be subject to the penalty of the deprivation of liberty for a term of between 6 months and 8 years."*

Chapter XXII - Crime against the environment, Article 183 paragraph 2 and paragraph 186 contain a reference to hazardous substances and radioactive material.

Russia

Russian criminal law deals with CBRN materials in many articles. For example, in Chapter 24, Crimes Against Public Security. Article 225/2 defines a criminal offence as: *"Improper discharge of the duties related to protecting nuclear, chemical or any other weapons of mass destruction, or materials and equipment which can be used in the development of weapons of mass destruction, if this has involved grave consequences or has created the threat of their onset. "*

Chapter 25. Crimes Against Human Health and Public Morality. It includes Article 226, which refers, inter alia, to stealing, smuggling and possession of superpotent, poisonous, toxic, explosive and radioactive substances, radiation sources and nuclear materials.
Article 247 within Chapter 26. Environmental crimes contains the offence of violation of the rules for dealing with environmentally hazardous substances and waste: "*Production of illicit dangerous waste, transportation, storage, dumping, use, or any other circulation of radioactive, bacteriological, or chemical substances or waste, with a violation of fixed rules, if these acts have created a threat of infliction of substantial harm on human health or the environment."* In the same Chapter, there are other articles where dangerous and poisoning materials are cited, as in Article 254. Deterioration of Land, etc.
Chapter 34, in Crimes Against the Peace and Security Mankind, there are also CBRN-related phrases in relation to the development, manufacture, stockpiling, acquisition or the sale of weapons of mass-destruction.

Slovakia

In Slovak legislation, the terms CBRN as well as HazMat are included in the category of intentional criminal offences. For this reason, a special police unit has been set up to combat environmental crime and crimes using hazardous materials. An example is Paragraph 295 on illicit armaments and arms trafficking, where chemical weapons are mentioned. Other examples are Sections 298 and 299 of the Criminal Code - illicit manufacture and possession of nuclear materials, radioactive substances, high-risk chemicals and high-risk biological agents and toxins, and Section 171 on the illicit possession of poisons in connection with narcotic drugs and psychotropic substances.
We quote Paragraph 298: *"Who, through negligence, without permission, manufactures, imports, exports, transports, buys, sells, offers, exchanges, modifies, uses, transports, stores, removes or otherwise procures or keeps nuclear or other radioactive material or a high-risk*

chemical, or a high-risk biological agent or toxin, or items intended for their manufacture, shall be punishable by a term of imprisonment from one to six years."

Another of the sections of the Criminal Code of the Slovak Republic concerns generally dangerous criminal offences. This is Paragraph no. 284. The offence of general threat includes the concept of a dangerous substance. We quote: *"Who intentionally puts people at risk of death or serious injury or property to the risk of large-scale damage by causing a fire or flood, or a breakdown or accident of a means of public transport, or the harmful effect of explosives, gas, electricity, radioactivity or other similarly dangerous substances or forces, or commits other similar dangerous conduct (general danger) or increases or makes it more difficult to avert or mitigate it, shall be punished by imprisonment from four to ten years."* CBRN materials but also dangerous substances are also explicitly cited in Paragraph 419 relating to terrorism. With regard to environmental crimes, CBRN or hazardous materials are not explicitly cited in them, but from the context of several paragraphs (300-309) it is possible to perceive the threat to the environment by actions that may involve the use of hazardous materials. In particular, however, the act of introducing and spreading a dangerous disease as a biological threat is cited.

Slovenia

In the Slovenian Criminal Code, Section 108, Article 1 and Section 111, Article 2 on terrorism, both CBRN materials and hazardous material are equally linked to intentional crime.

South-East Asia

Some countries in South-East Asia have consistently incorporated the concepts of CBRN and related terminology into criminal law. However, it mainly concerns terrorist offences or public threats. For example, **Cambodia** uses several standards to prosecute crimes: Criminal code (2011), Law on the prohibition of chemical, nuclear, biological and radiological weapons (2009), Law on Counter-terrorism (2007), Law on the management of weapons, explosives and ammunition and even in the Constitution of the Kingdom of Cambodia (1993), in which the manufacturing, use and storage of CBRN material is fully prohibited.

Malaysia deals in great detail with the concepts of CBRN and their equivalents in its legislation. This applies to more standards. For example, it incorporated into its Criminal Code (Act n. 574) several crimes using explosives, injurious, obnoxious, noxious, poisonous, corrosive materials, as well as against health and the environment. E.g..: Adulteration of food or drink which is intended for sale (Article 272) and the sale of noxious food and drink (Article 273), and negligent conduct with respect to any poisonous substances (Article 284).

In the **Philippines**' penal code, the term CBRN does not appear alone, but legislators have used the terms poisonous or corrosive substances and infection or contagion. These are the crime of murder in Section 52, serious damage to property in Section 75 and special cases of malicious mischief in Section 328.

Serbia

Criminal law includes the concepts of CBRN in several parts of Chapter 34 - Criminal offences against humanity and other rights guaranteed by international law. These are, for example, the crime of terrorism in Article 391 and related articles 391c and 391d, or War Crimes against Civilian Population - Article 372. A mention of nuclear fuel, hazardous material and waste can also be seen in Chapter 24 - Criminal offences against the environment. The terminology related to nuclear materials also occurs in other offences in Chapter 25 - Criminal offences against general safety of people and property (e.g.: Unlawful Acquiring and Endangerment of Safety with Nuclear Material - Article 287).

Spain

Spanish criminal law describes quite extensively the offences in which CBRN and hazardous materials are used. In the category of offences related to genetic manipulation, specifically in Article 160, the offence of using genetic engineering for the production of a biological weapon is described. In Article 566, within the category of offences against public policy, the term CBRN appears in relation to the production, sale and creation of CBRN stockpiles of weapons. Article 567 in the same category defines exactly what is meant by the development of CBRN weapons: *"The development of chemical, biological, nuclear or radiological weapons, anti-personnel mines or cluster munitions is understood to be any activity consisting of research or study of a scientific or technical nature aimed at the creation of a new chemical, biological, nuclear or radiological weapon, or antipersonnel mine or cluster munition or the modification of an existing one."*

Articles 574 and 575 on terrorism also mention CBRN materials. Article 359 further deals in criminal offences against public health with the illicit preparation of chemicals that may be harmful to health. Hazardous materials are incorporated in criminal law in connection with environmental crimes (Articles 325, 326, etc.).

Sweden

CBRN terminology is not explicitly included in Swedish criminal law. However, in Chapter 22 defining the treason crime, there is a reference to chemicals, nuclear explosions and weapons. Chapter 3, Offences against life and human health, includes only the concept of danger to life or a danger of severe bodily injury or serious illness without mentioning hazardous substances or CBRN material. The phrase "*dangerous nature*" is used in many paragraphs and could include the use of CBRN materials. It all depends on the substance of the crime. However, Sweden has incorporated CBRN terminology into the Act on Criminal Responsibility for Terrorist Offences and, in part, into the Environmental Code, which also includes the terms hazardous waste.

Switzerland

The criminal code deals with CBRN materials only very briefly. The terms chemical and biological materials together with others such as poison, poisoned weapon, including poisonous or asphyxiating gases, substances and liquids occur in Chapter XXII related to war

crimes, Article 264h - Use of prohibited weapons. Radioactive and nuclear material are an integral part of (the article) Felonies constituting a public danger.

Tajikistan

Tajikistan, as well as the other Central Asian countries mentioned above, have thoroughly included CBRN terminology in the individual articles of the criminal law. In Chapter 21 - Crimes again public security, CBRN but also hazardous material is mentioned in addition to Articles 194 (4), 195, 198, 199 and Article 194 (5) - "*Unlawful use or dumping from a ship or stationary platforms located on the continental shelf, explosives, biological, chemical or nuclear weapons, dangerous and noxious substances*."

CBRN materials are also mentioned in environmental crimes. Compared to most criminal laws, this is unique, as others are dominated by the terms hazardous material and waste. Chapter 24 - Crimes against ecological security and the natural environment, includes a reference to CBRN in Articles 221, 223, 228. Article 228 allows us to quote: *"1) Poisoning or contamination of the land with harmful products of economic or other activities due to the violation of the rules for handling pesticides, fertilizers, plant growth stimulants or other hazardous chemical or biological substances during their storage, use, transportation, as well as other damage to the land, resulting in harm to human health or significant harm to the environment."*

Equally important is Chapter 27 - Crimes in the sphere of economic activities, which includes the crime of smuggling - (Article) 289 with CBRN terminology.

Chapter 34 - Crimes against peace and security of humanity contains other important articles aimed at combating CBRN threats. For example, Article 397 - Illicit traffic and financing of proliferation of weapons of mass destruction, or Articles 399 - Act of Biocide and 400 - Act of Ecocide, also contain CBRN terms including poisoning, climatic or other weapons of mass destruction.

Turkey

One of the weapons' definition in the penal code contains the mention of CBRN material: *"A nuclear, radioactive, chemical or biological substance which has burning, corrosive, harmful, suffocating or toxic properties, or is capable of causing permanent illness."* We can find the CBRN material in the whole penal code in connection to crimes against persons (Article 82 - Intentional killing using chemical, biological and nuclear material), Offences against property using exposure to radiation and CBN materials (Article 152 - Qualified damage to property), offences against the public - intentionally endangering public safety (Article 174 - Possession of hazardous substances). The law also contains sections on environmental crime which addresses the environmental pollution and the spread of incurable animal and plant diseases.

Ukraine

The Ukrainian Criminal Code deals with CBRN materials in some articles in Chapter IX - Crimes against public safety. This applies in particular to an attack using these materials, illegal possession, storage, transport, etc. radioactive and nuclear materials and illicit manufacturing, nuclear explosive devices, or device dispersing radioactive material, or

radiation emitting and violation of radiation safety rules and hazardous waste management rules. Interesting is Article 237 - Failure to eliminate consequences of environmental pollution, in the frame of crimes against the environment, where there is a reference to hazardous substances, as well as in other articles of the same chapter.

United Kingdom

In the UK, there are several acts regulating the control of hazardous materials (HazMat) and dealing with environmental protection. The legislation regulates the import/export, sale/purchase, transport, storage, use, management and disposal of HazMat. Therefore, the use of terminology related to hazardous and dangerous substances is mainly connected to all environmental acts.

The responsibility for investigating, enforcing and prosecuting offences that breach HazMat and environmental regulations belong to a variety of non-police law enforcement agencies. For example, the Environment Agency is primarily responsible for the protection of land, water, air and wildlife from pollution by HazMat; the Health and Safety Executive is focused on maintaining standards in all UK workplaces to protect workers from death, injury and ill-health; HM Customs and Excise and Border Force are responsible for the licensing, monitoring and inspecting of imports/exports of HazMat.

For HazMat cases, UK Police Forces may provide a support role to assist such agencies with their investigations such as a death occurring in a workplace, which may be a case of 'corporate manslaughter' due to an employer's negligence, or where an organised crime group may be involved in the illegal storage or disposal of HazMat.
In contrast to HazMat, the term CBRN has a very specific meaning and is almost exclusively used among UK law enforcement agencies to refer to the use of such materials for a terrorist purpose (e.g. Terrorism Act, 2006 - Offences involving radioactive devices and materials and nuclear facilities and sites, Paragraphs 9 – 12, or Serious Crime Act 2007 - SCHEDULE 1, Serious offences - Prohibited weapons, Paragraph 3 and 16C - firearms offences). UK legislation transfers the primary responsibility for the response and investigation of CBRN offences to the local Police Force due to their definition and crime status as terrorist offences. For example, the UK Fire and Rescue Services have primary responsibility for responding to and managing spillages of HazMat at an industrial site or on a road. In a case where the event was suspected or known to be a terrorist incident, the local Police Force would be the legal entity with the primary responsibility for securing, protecting and managing the 'crime scene', and the local Fire and Rescue Service would provide a supporting role with their capabilities.

United States

US criminal law deals with destructive substances - Paragraph 31. They are explained as *"an explosive substance, flammable material, infernal machine, or other chemical, mechanical, or radioactive device or matter of a combustible, contaminative, corrosive, or explosive nature."* CBRN substances are widely mentioned in many sections related to terrorism, crimes against the transport of CBRN and hazardous materials, or public transport. Hazardous and injurious devices are mentioned in the law in connection with crimes against the environment and soil. There is also a special Chapter 39 related to explosives and other dangerous articles. In this

context, several LEAs, including the Environmental Protection Agency, are competent in the US to deal with crimes using CBRN / hazardous material.

As another US example, California criminal law also mentions hazardous materials in connection with intentional conduct. This is Article 4.6. The Hertzberg-Alarcon California Prevention of Terrorism Act [11415 - 11419] (Article 4.6 added by Stats. 1999, Chapter 563, Section 1. 11417: "*The intentional release of a dangerous chemical or hazardous material generally utilized in an industrial or commercial process shall be considered use of a weapon of mass destruction when a person knowingly utilizes those agents with the intent to cause harm and the use places persons or animals at risk of serious injury, illness, or death, or endangers the environment"* (72).

Uzbekistan

Uzbekistan's criminal law is in some respects similar to the laws of neighbouring Central Asian countries and deals with CBRN materials, and also uses the terms poisonous, toxic, etc. under Chapter 17 - Crimes against public security, and partly in Chapter 14 - Crimes related to environment protection and conservancy, and Chapter 23 - Crimes against the procedure of keeping or use of military property.

Thanks to our practice at the international level, we can conclude that the incorporation of definitions and crimes with CBRN and hazardous materials into the criminal laws of individual countries was influenced by specific experiences of cases occurring in a given country. However, the exchange of information between security and judicial authorities at the international level also helped. The different countries inspired each other.

We believe that the sharing of such information is very important for rapid and effective criminal proceedings in the event that any of these crimes occurs for the first time—not just once but also repeatedly—in any given country. A study of the laws shows that there are several international streams of legislation that could be studied regionally. These are English-speaking nations', 'German-speaking nations', 'Southern European nations with Latin origins', and 'Central / Eastern European nations. Several Asian and African countries have evidently been influenced by some of these directions.

In the interests of sharing good practice and cooperation at the international level, we believe it is important to unify the terminology and talk about CBRN-E crimes, despite the fact that in some cases criminal law uses different terms for the HazMat category. However, as mentioned above, HazMat materials are, in our view, ultimately CBRN-E materials when it comes to incidents caused by humans intentionally or through negligence, and non-compliance with relevant standards with a serious impact on health and the environment.

As for our analysis 'conclusions, we dare to state that unless specific categories of CBRN-E crimes are created in individual criminal laws, their separate registration only for statistical purposes within the existing categories could significantly contribute to monitoring this type of crime and the subsequent adoption of preventive measures. Based on our experience, previous studies, different criminal / penal / counter-terrorism / environmental codes reviews, and the EP and Council Directive 2008/99 / from 19 November 2008, we suggest dividing

CBRN-E crimes into four main categories. As we have already mentioned, the proposed crimes are based on cases already recorded in the history of individual countries, with criminal and similar laws, or on the assumptions of potential future crimes.

(NOTE: Criminal liability for attempts in a criminal act which was not completed is described separately in all studied criminal codes and can be connected to all defined offences. However, in one case we included the assassination attempt, murder, etc., in our table because of known cases).

CBRN-E Crime categorisation

1. Directly affecting humans – risk or harm to human life or health

CBRN-E crime against human life and health

1.1. Assassination, murder, killing by negligence (intentional/unintentional) using CBRN-E material, e.g.: assassination/poisoning of Markov with Ricin in 1969 (UK), Yushchenko with Tetrachlorodibenzodioxin in 2004 (Ukraine), Litvinenko with Polonium 210 in 2006 (UK), Kim Jong with VX in 2017 (Kuala Lumpur airport)

1.2. Attempted assassination, murder, killing by using CBRN-E material, e.g.: attempt to assassinate Kalashnikov with mercury in 2010, Scripal with Novichok in 2018 (UK)

1.3. Injury, serious damage or damage to health using CBRN-E material (intentional/unintentional), e.g.: often acid and corrosive substance assaults in many countries (**73**)

1.4. Spread of contagious human diseases or threat of human immunodeficiency virus, e.g.: many worldwide cases of deliberate transmission of the HIV virus

1.5. Illegal experiments on humans using CBRN material

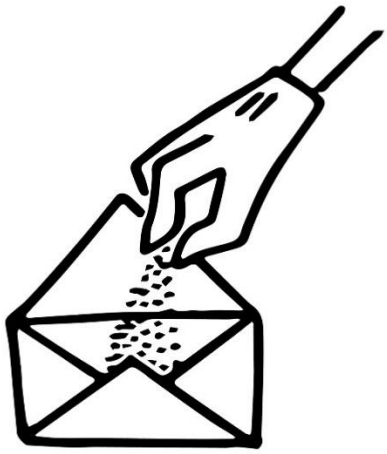
1.6. Introducing chemical agents into the body of another person to commit a crime on this person or to push the person to commit a crime

2. Affecting the environment – risk or harm to habitats, land, forest, water, air, animals and plant life

CBRN-E crime against environment

2.1. Environmental damage (illegal spillage, release and placement of CBRN material into environment – land, water, air, forest, during road construction)
2.2. Damage to plants, trees, bushes and animals using CBRN materials
2.3. Illegal extraction of fish resources, other aquatic animals or plants using explosive or chemical substances
2.4. Illegal dumping of hazardous CBRN-E waste
2.5. The criminal offence of arson in connection with CBRN-E materials and hazardous waste
2.6. The criminal offence of flooding a hazardous material storage facility or warehouse
2.7. The spread of contagious animal or plant diseases (agricultural biological crime)
2.8. Causing the escape of genetically modified organisms from enclosed spaces
2.9. The criminal offence of food poisoning or negligence in food safety
2.10. Data concealment or intentional disclosure of inauthentic data regarding environmental pollution or spread of disease
2.11. Failure to eliminate consequences of environmental pollution

3. Potentially directly or indirectly affecting human health, life and property



CBRN-E crime against public safety and security, administration of justice, consumer rights and property

3.1. General threat to the public using CBRN-E material for an offence (e.g., putting the unshielded sealed radiation source to the public place or release of chemical substance to the public place, preparing an explosion of a CBRN device, etc.)
3.2. Attack/threat on/to a public authority using CBRN-E material
3.3. Faulty construction of a nuclear facility or other facility using or producing dangerous CBR materials
3.4. Offence of damaging property or equipment by the use or release of CBRN-E material (e.g.: using chemical corrosive substance to destroy the server room equipment)
3.5. Illegal trafficking of hazardous CBRN-E waste
3.6. Illegal buying, selling, trafficking, production, loading, storage, or transporting of CBRN-E material (including chemical precursors for explosives, narcotic drugs, and psychotropic substances)
3.7. Development of CBRN weapons (any illegal activity consisting of research or study of a scientific or technical nature aimed at the creation of a CBRN weapon)
3.8. Illegal offering to sell CBRN-E material (directly/indirectly, e.g. via the Internet)
3.9. Theft or larceny of CBRN-E material from storage, training, production, testing, user or other facilities
3.10. Hijacking vehicles transporting CBRN-E material
3.11. The offence of negligence in the performance of tasks related to the transport, storage and production of hazardous CBRN-E materials
3.12. Illicit trafficking in ozone-depleting substances
3.13. The offence of intentionally damaging equipment/systems in an operation using, processing, storing, producing or transporting CBRN-E materials (this may also include cyber-crime, so-called CBRN-E cyber-crime where cyber-attacks are used to disrupt the IT system of any facility using or producing CBRN material)
3.14. The deliberate breach of safety regulation in premises dealing with CBRN-E materials

3.15. The offence of ransomware cyber-attacks forcing the targeted person working in premises and facilities using CBRN material to release the CBRN substances into the public by threatening the disclosure of sensitive information from collected data about the person or stealing money from his accounts
3.16. Failure to report a serious offence where CBRN/hazardous substances were used
3.17. Misleading consumers – providing misleading information related to food products where hazardous substances were used
3.18. Dissemination of a false alarm message in connection to the use of CBRN-E material

4. Risk or harm to communities and state system using CBRN-E terrorism

Any of the offences from the previous three categories could be considered as crime against community, nation and the state system if they are committed with intention to harm community, nation and state system.

In this category, we are proposing the seven main following sub-categories:

4.1. Using CBRN-E substances during an insurrectionary movement or public events with a mass gathering
4.2. The offence of the use of genetic engineering for the production of bio weapons
4.3. The offence of instructing another person or allowing himself to be instructed in the manufacture of or in the handling of dangerous materials, like explosive devices, nuclear fuel, radioactive devices, poisonous substances, biological agents, or other substances harmful to health
4.4. The offence of inducing or encouraging another person to commit any act where CBRN materials are used against the community, nation, or state system
4.5. The offence of the menace to use CBRN material against persons or community, or spreading false information about a CBRN threat
4.6. War crimes - the killing or wounding of people, or torturing them, or in violation of their interests, maiming them or subjecting them to a biological, medical or scientific

experiment using CBRN agents, or in another manner causing them considerable suffering, causing serious injury or seriously harming their health using CBRN agents in a time of war

4.7. Acts of terrorism - a terrorist plot or attack involving CBRN-E substances

- Lone wolf or terrorist group attacks by different means:

- The release, dissemination or dispersion of CBRN material towards a target in the form of gas, liquid or solid (RDD, CDD, BDD without explosives) - aerosols can be both small droplets of liquid or powder form when solids are used. It may be combined with explosives e.g.: RDD (dirty bomb), CDD, BDD using explosives or using different dispersion techniques like spilling the liquid, spraying aerosol, air conditioning… or using specific dispersion devices including UAV, UUV/AUV, AGV…)
- Contamination of surfaces or items (banknotes, etc.)
- Contamination of food or drinks
- Placing fully or partially unshielded sealed radioactive sources to target a place with the intention of irradiating people (RED – Radiological Exposure Device)
- Spreading of contagious human diseases (directly or indirectly via vectors, etc.)
- Attacking vehicles during the transport of CBRN substances
- Attacking or sabotaging storage, production or critical infrastructure facilities with the presence of CBRN material (e.g., a nuclear power plant) and use of NID or NED

- Agroterrorism – animal of plant pathogens could be harmfully used in the agriculture sector with serious consequences for the destruction of foodstuffs or the interruption of the food supply, including psychological effects. A number of different possible plant or animal pathogens could cause harm or loss of production, and even an act of agroterrorism that did not result in the destruction of foodstuffs or interruptions in the food supply, could have a psychological impact. (**74**)

2. Motivation, Motives, intent and the offender´s goal in CBRN-E crime

We can discover a number of different theories about the motives and influences on criminal behavior in professional literature. Many of them present the personal internal motives of the perpetrators and the external conditions affecting the individual. We know from the past, for example, the psychobiological theory of the 19th century represented by Lombros, which introduced the existence of more primitive forms of individuals with a genetic predisposition to violence. This theory was later developed by Morel at the end of the 19th and the beginning of the 20th century (**75**).

Sociological theories addressed the influence of peers on the formation of criminal behavior (**76**). Based on other studies, Sutherland argued that criminal behavior is learned from close intimate groups and is not conditioned by heredity (**77**). Several authors such as Buehler, Farrington DP, Jolliffe D, Loeber R, Stouthamer-Loeber M, Kalb LM, point out that an individual may also be led to criminal behavior by a problematic family environment (hostile conflict patterns) and mutual relationship structures (**78**). Several studies, such as the International Islamic University in Islamabad, have also pointed to the influence of peer groups in connection with the motive of revolt against state institutions and courts, where the existing system allowed, and, in many cases, inspired crime (**79**). In this context, we can talk about the impact of poverty in backward countries with a dictatorial regime, or, conversely, the impact of corruption in more developed countries, where it is common practice to participate in the corruptive system. In the above-mentioned study, most respondents—-prisoners—stated that the primary motive for committing crime was to become rich quickly and easily.

The classical model of experimental psychology was based on the theory that human beings learn on the basis of their own experience from the environment in which they move, whether it is positive or negative, and this in turn influences their behavior (**80**).

The prevalence of CBRN-E crime in a particular community, city, region, or country is influenced by several factors. These are mainly opportunities to commit a CBRN-E crime, offender capabilities and knowledge, existing vulnerability of targeted places, persons and / or environment, individual or criminal group goals, motives and rationalization for committing crime.

That is, if, for example, the perpetrator S.K. in the Slovak case "Radioactive Letters - Americium 241" had the opportunity to obtain Americium 241 and send it by post to the courts, police and the Ministry of Justice of the Slovak Republic, at the same time necessarily needed some ability and knowledge of how to obtain it, weaponise it, and to be protected from internal contamination and health side effects. He had to anticipate the vulnerabilities in the relevant state authority in relation to receiving and opening mail. He also had to set a goal based on a motive and rationalize that such a form of attack would be adequate for the perceived alleged injustice he had suffered based on his statements. As in many other cases, the implied motive for revenge was influenced by several factors.

Therefore, in general, we must assign to the perpetrators' motives both motivation and intent, respective to the perpetrator's goal, and talk about various related factors. Information on

motivation, motive of the committed crime, and the intent can help in pairing crimes and their linkage (case linkage), comparing several cases and assist in the possible prediction of future behavior of perpetrators in similar crimes.

Motivation in this context can be understood as the perpetrator's permanent orientation towards certain values or opinions in his individual situation (**81**). By individual situation we can understand a number of influencing individual and situational factors, such as family, work and social background, financial and mental problems, criminal history, etc.

Brandt (**82**) states that in the sense of the psychological theory of motivation, a person acts at a certain moment on the basis of a concurrence of five variables. These are: beliefs, which can also reside in the subconscious. It is a belief in the views available to the offender. Then there are the beliefs related to the situation in which he finds himself. The third variable is the belief in the consequences of adopting one of the solutions available to it and its strength. The fourth is the vividness of his representation in a certain time interval, and the last are the desires and antipathy towards the consequences.

Turvey (**83**) developed a theory of *Contributing motivational factors*, using the table *Proximate Cause Factors Relevant to the Study of Homicidal Behavior* by Yarvis (**84**). Contributing motivational factors are, according to Turvey, conditions that may influence the perpetrator's behavior, although they may not necessarily be among the primary aspects initiating the acts themselves. Proof of the existence of these factors is possible only through thorough and professional investigation and analysis of the crime scene.

From Turvey's factors, we selected some relevant for CBRN-E crimes and supplemented them based on our experience and examination of 24 CBRN-E cases with others we consider important for CBRN-E crime (**83**):

- Mental illness and physical disabilities
- Psychotropic substances and alcohol use
- Pathological gambling
- Significant stress
- Fear
- Financial problems
- Submissive tendencies
- Low self-esteem
- Self-preservation
- Zeal / bias
- Belonging to a radical group and its pressure to achieve goals
- Long-term pressure caused by previous criminal history
- The existing corruption system of the state
- Social or group pressure to achieve research success (in the laboratory)
- Social group pressure to achieve higher earnings and social identity
- Long-term resistance to certain groups and minorities
- Opposition to the state and the system
- Persistent feeling of injustice

At the same time, however, it should be noted that the offender's motivation to act in a certain way in the long term may change over time (**83**). This change may be related to a number of variables that result from the personal life, experience and development of the offender's mental and physical health.

The motive of the perpetrator responds as a certain impulse for crime, in order for the execution of an act to achieve a psychological or material goal based on that motive. It is important to mention that the criminal laws of many countries refer to crimes with a specific motive. These are mostly related to the participation in actions of a very serious anti-social nature, extremist and radical groups, including terrorist organizations. However, proving a specific motive in court proceedings is often very difficult.

Among the main motives of a terrorist group for committing a terrorist attack are religious, ideological and political motives, such as the holy war declared by Osama bin Laden against the United States. Motives for participation in terrorist activities by individuals have been explored by several authors. As Borum points out, one of the very significant motives for participating in terrorism is the desire for revenge (**85**). In this context, we can talk about revenge against the world, society and the state, where motivation comes from a sense of injustice. Martha Crenshaw proposes four categories of motivation for individuals to engage in terrorist activities. The first is the opportunity to perform an act. The second is the need to be part of something. The third is the desire to obtain the needed social status, and the last is the acquisition of material remuneration (**86**).

Smith conducted a study examining two main motives related to terrorist behavior, where the main motive is affiliation or the acquisition of power (**87**). From the history of many criminal cases of gangs and criminal groups, it is known that belonging to this group is achieved by committing a crime, and so it is in the case of trying to gain power and control others.

Knowing the motive in criminal proceedings is an advantage, but not a necessity. Plus, it's not easy to prove it directly. It depends on many variables. The clarified motive can significantly help the decision of the tribunal, but in no case can it replace criminal intent. Only a thorough investigation, which includes an analysis of the crime scene, the victim and his life, and the perpetrator's known behavior, can help to clarify the motive (**83**). Freeman and Turvey further (**83**, p. 312) characterize a motive as a need with a material, psychological and emotional background that leads a person to a certain behavior or is satisfied with behavior. Sometimes a motive that directly leads the perpetrator to criminal proceedings is revealed immediately, but it is more difficult to identify the background of the motivation in the long run. The motive clearly generates an intention to commit a crime.

Intent can be understood as a specific desired output from a targeted activity or several consecutive activities (**83**). The criminal laws of each country specify exactly how the motive is assessed in criminal proceedings.

So, if the intent is part of every intentional crime, then the motive allows us to explain why the perpetrator committed the crime. This is an important examination of the answer to one of the many questions in a criminal investigation: who, to whom, where, when, how, by what, for what purpose and WHY? Proving the perpetrator's intent through material evidence, witness statements and forensic assessments automatically enables prosecution as an

intentional crime. If the intent has not been proven, it may be an accident or an unintentional crime committed through negligence.

As mentioned above, it is not necessary to prove the motive of the perpetrator in criminal proceedings. However, in court proceedings, prosecutors often present a motive to convince the jury, and forensic experts from the field of psychology and psychiatry or criminal profiling, depending on the country, are summoned for this purpose. As Hessick (**88**) points out, the Criminal Court may ultimately decide, by a proven motive, to tighten or refine the sentence. The following arguments can be used in the decision: *"because he was acting with good motives, or a rather high sentence because of his bad motives"* (**89**).

As Leonard (**90**) points out, a person who decides to act in a certain way under the influence of a specific motive draws up a plan to achieve the objective. When the act is completed, the investigators can deduct from the knowledge of this motive that it was the intention to achieve the set goal influenced by the motive. On the contrary, secured and documented evidence that the perpetrator acted in accordance with a pre-prepared plan and strategy can lead us to the motive that served to create the plan. It can also move us to the intent the perpetrator followed when committing the crime.

In the following section, we present a few examples of CBRN-E crimes and the identified intent, motivations and motives of the perpetrators.

THE CASE OF OPERATION "CURY" (CZECH REPUBLIC)

This was the case of a planned use of the dangerous substances dimethylmercury and abrin by an offender from the Czech Republic with a probable motive of revenge (**91**).

Figures 10, 11, and 12: Czech police

In 2017, the perpetrator M.H. tried to get dimethylmercury via darknet, which he failed to do. Between February and March 2018, he again virtually moved to the Dream Marketplace server within the darknet in order to obtain a small amount of C4 plastic explosive. He discussed with the potential seller the price and method of transport to the European Union. He then sent the seller the value of $330 via Bitcoins. However, the seller announced that he could not send M.H. the explosive for certain reasons. M.H. then investigated whether it was possible to send another type of explosive, such as "emulex". Subsequently, he also investigated the possibility of purchasing the highly toxic biological toxin abrin.

During the trial, the court examined the content of M.H 's communication, and sought to identify the purpose and goal of the use of these substances. It was not possible to sufficiently determine the true purpose of the use of all substances from the evidence obtained. As far as dimethylmercury was concerned, M.H. in communication with the seller on the darknet, stated that he needed it for laboratory purposes. The seller then set the price at $120 per 100 grams. In connection with the acquisition of abrin, M.H. told the seller that he needed it for research purposes and not for murder or poisoning. In a later communication, he told the seller that he needed it as a birthday present for his brother, who is a chemist. The price for abrin was eventually set at $500 per 200 milligrams, with the seller warning that the amount could cause the death of 40 adult men. As a result, a quantity of 100 grams of dimethylmercury was ordered, which, according to the opinion of the relevant forensic institute, could kill 750 people and an order of abrin in a volume of 200 mg was made as well.

Thanks to the successful police operation of the security forces of the Czech Republic in cooperation with foreign forces, the perpetrator was detained and several ampoules with the inscription dimethylmercury and abrin were seized. These were hidden in a toy and in a clock as part of the packages M.H. received. Based on a laboratory examination, it was found that the substances in question were not present in the ampoules, i.e. the seller had sent counterfeit substances. Further information on this part of the case is contained only in the non-public version of this article (classified) available only for law enforcement agencies.

In examining the motive and intention of the court, several pieces of evidence and modus operandi, (i.e. individual procedures for procuring highly dangerous substances), were considered. Finding out the motive and intent was very important for determining the legal qualification of the criminal proceedings. Unfortunately, the motive was not identified during the proceedings, although it could be assumed that it was either revenge or making a financial profit.

According to convict M.H., he had wanted to use the ordered substances for suicide, which, however, precludes the examination of the evidence and the very fact that the effect of dimethylmercury on the organism is not immediate. After its administration, it would have a torturous and painful effect over a long period of time. The court considered that the perpetrator would not have used the substance to commit suicide, which after application would have irreversible effects with a gradual destructive and certainly not immediate effect. The refutation of the motive for suicide was also confirmed by other researched connections and behavioural evidence.

The court also refuted another hypothesis of the motive, namely the use of substances for scientific and research purposes, as the perpetrator had claimed in the communication on the darknet. His education and expertise did not confirm such a hypothesis.

The expert opinion of the psychologist also clearly ruled out that it could be motivated by a psychotic illness. However, M.H. was diagnosed with a severe mental illness, paranoid schizophrenia. He was also diagnosed with an impulsive disorder called pathological gambling, as well as harmful cannabinol use. As further stated in the expert opinion from the field of health care, the field of psychiatry and clinical psychology, despite the mentioned diseases, the perpetrator was able to recognize the danger of his actions. At the critical time, in the psychiatrist's expert opinion, he did not suffer from a de facto mental illness because he was in remission and was fully aware of his actions. On the other hand, it has been demonstrated that M.H. committed the crime under the influence of a mental disorder, which caused his negativistic and aggressive attitudes and had a decisive influence on the crime.

In its further investigation, the court did not agree with the prosecution’s conviction as to the motive for proceeding in order to obtain a profit from the sale of dangerous substances or from extortion under the threat of the use of these substances. The prosecutor based this hypothesis on the allegations of a witness who stated that the perpetrator had mentioned to him substances on which he would either earn a large sum or end up in prison. The prosecutor also based this hypothesis on other findings. These were related to pathological gambling and financial debts. The court ruling also states that the perpetrator intended to kidnap an acquaintance and subsequently blackmail his parents and demand a ransom.

In the decision, the court states that the perpetrator knew exactly what type of substances he was looking for on the darknet because he had studied the relevant information about them, which resulted from communication with a potential supplier. The court also stated in the decision that, based on the long-lasting chaotic communication via the darknet, the perpetrator did not intend to trade in substances and make a profit, but rather to use the toxic properties of these substances for dangerous conduct.

The court therefore considered a possible motive that would lead to the intention of using toxic substances to kill people. The content of the false communication with the supplier concerning the use of the substances in a non-existent laboratory suggests such a motive. The message sent to the supplier from the darknet also suggests that he needed the amount of abrin required for a person with a height of 185 cm and a weight of 90 kg. Another element confirming the potential motive of revenge we can see in the court decision is the fact that he prepared the supply of toxic substances exactly before the date of the trial against the offender in the previous criminal case, in which he was also charged. In the end, the court did not confirm the motive of revenge with the intention of causing the death of other persons, because the hypotheses were not confirmed by specific findings and evidence, although they could be logically explained. As the motive of revenge and intent were on the verge of speculation, they could not be used in the legal classification of criminal conduct, but nevertheless, according to the court, they showed a certain degree of probability.

If these materials had been found on the offender during the trial, not only the intention but also the motive could have been confirmed. The perpetrator was apprehended and at the same

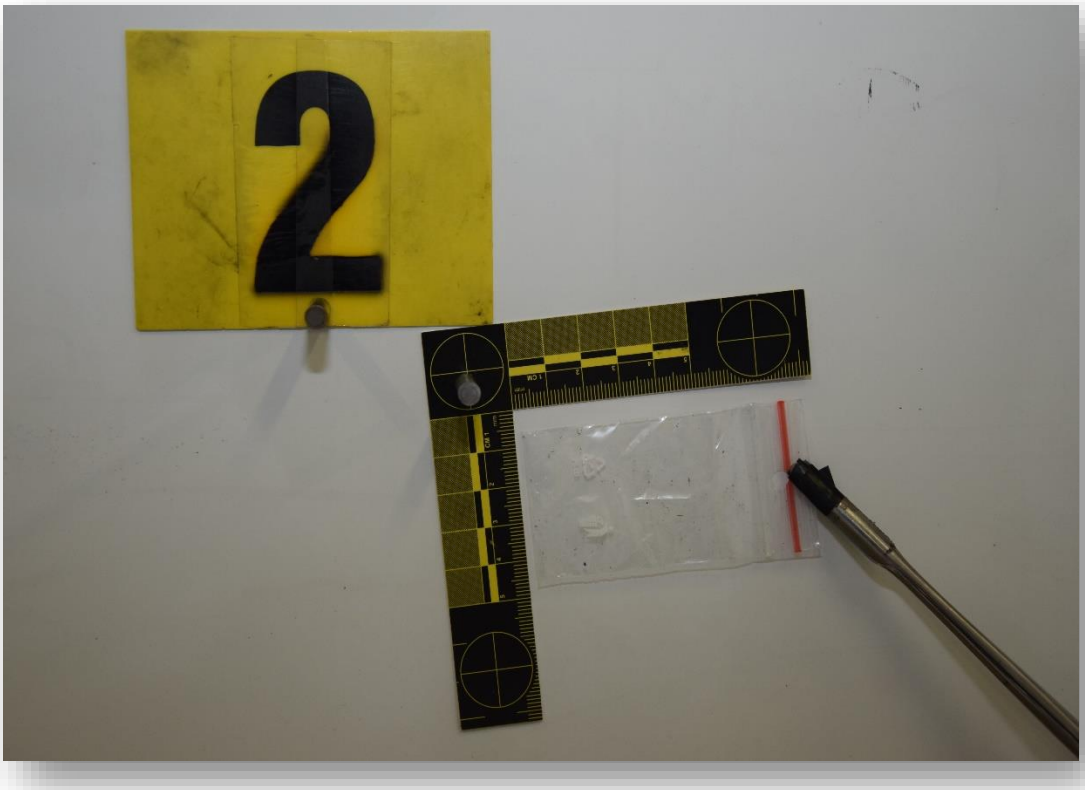
time a search of the house was carried out where false toxic substances were discovered, and it was obvious that he was handling them.

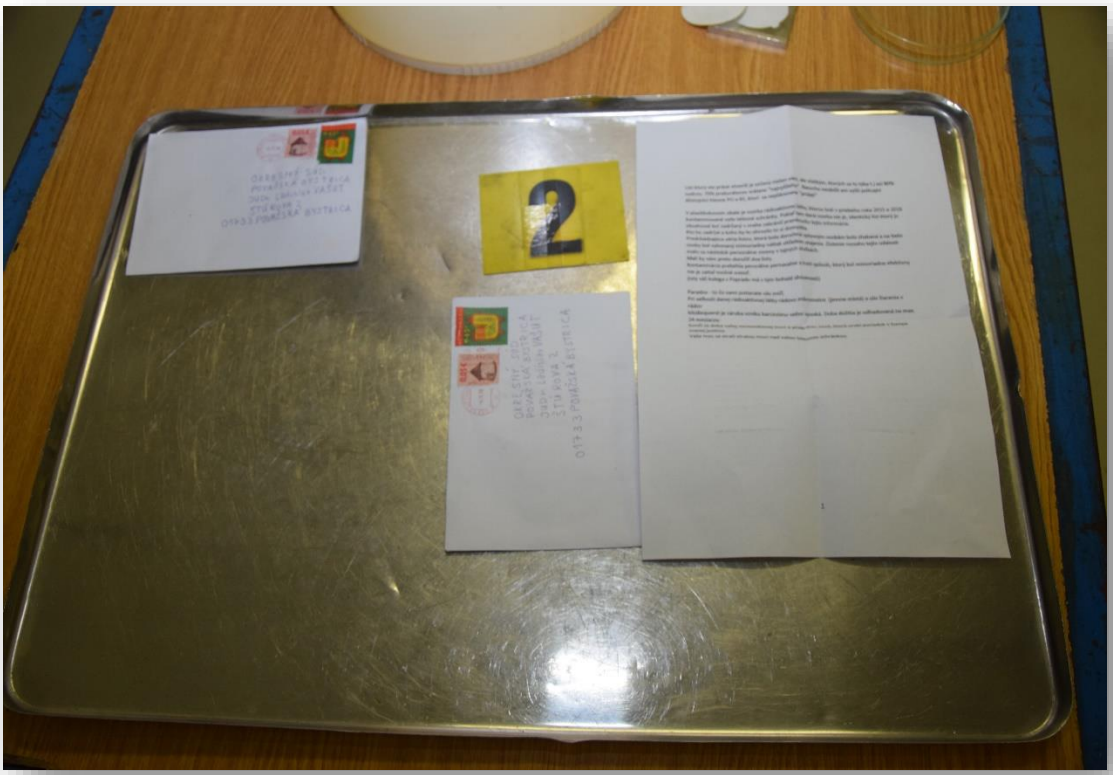
M.H. was convicted under § 21 par. 1 - § 284 of the Criminal Code for the attempted crime of possession of narcotics, psychotropic substances, and poisons, and according to § 21 par. 1 - § 272 par. 1 for the attempted crime of public menace. As no intention or motive could be proven, the perpetrator could not be convicted of other crimes, such as attempted murder or even terrorism.

As we can see in this case, the perpetrator's most likely motive may have been revenge for the prosecution. His probable intent may have been to cause personal injury or to kill the members of the judicial panel in order to obtain psychological satisfaction; satisfaction based on the motive of revenge.

THE CASE OF RADIOACTIVE LETTERS - AMERICIUM 241 (SLOVAKIA)

Another case mentioned above, "Radioactive Letter - Americium 241 (**92**), which took place in 2016 in Slovakia, had similar features in terms of motivation and motive as the case of "Mercury" from the Czech Republic.





Figures 13, 14 and 15: Slovak police

The perpetrator S.K., who had been convicted in the past of extortion, injury and restriction of personal liberty, had sent several letters to various public administration institutions. The first three were sent to the two regional courts, and the Ministry of Justice actually confirmed the presence of a certain amount of Americium 241 coming from fire detectors, which was confirmed by the appropriate forensics' laboratory. Neither gamma nor alpha rays were detected inside the bag at the crime scene when placing an alpha-probe within the field-handled detection equipment. The presence of radionuclides was confirmed later on only under laboratory conditions.

The forensics expert further specified that the radioactive material had been removed from the detectors by a method of intentional disassembly and adapted for use, i.e., it was not a question of removing the material from the damaged fire detector. These detectors came from the workplace where the perpetrator had been working. In the letters sent to the two district courts, Americium 241 was stored in plastic bags, and, in a letter addressed to the Ministry of Justice of the Slovak Republic, kept directly in an envelope without being placed in a bag. In addition, the perpetrator had sent letters of threat (dissemination of an alarm message) to another district court and the regional police directorate, but without the radionuclide. Dozens of people were potentially endangered, but their health and lives could only be endangered by internal ingestion, contamination, or direct contact through open external skin injuries. Fortunately, no such event occurred and all persons potentially endangered were not contaminated with this hazardous material. Several pieces of evidence seized during a home search of the offender S.K. (gloves, contents of electronic devices, etc.), as well as forensics opinions, clearly showed that the perpetrator S.K. had committed this act.

A specialized criminal court convicted the offender S.K. for the crime of terrorism and certain forms of participation in terrorism according to § 419 par. 1 letter a), par. 3 letter b) of the Criminal Code of the Slovak Republic. The court´s decision states, that the intention was to intimidate police and judicial staff, seeking to destabilize the legal system through serious harm and deaths of the recipients of the letters, and the persons who were to be in contact with the letters. The court of first instance also convicted the perpetrator of a criminal offence under § 298 para. 1, par. 2 letter a), letter b) of the Criminal Code for the act of illicit production and possession of nuclear, radioactive substances, high-risk chemicals and high-risk biological agents and toxins.

Following a subsequent appeal by the offender´s defence team, the Supreme Court of the Slovak Republic reclassified the crime. Although the act was unequivocally upheld by the Supreme Court on the basis of a range of secured and established evidence, the intention to commit a crime such as terrorism and the crime of producing radioactive substances was not acknowledged after a thorough examination of the evidence. The Supreme Court therefore finally convicted S.K. of the continuation of a particularly serious crime of general danger because he *"intentionally put people at risk of death or serious injury by causing harmful radioactive effects"* at the trial stage, as well as for the continuing offence of assault on a public authority in a single action with the dissemination of a false alarm.

Returning to the perpetrator, according to the conclusions of expert psychiatrists and psychologists, S.K. suffered from a mental disorder (dissociative amnesia and motor disorder) within the so-called "prison psychosis", which he was diagnosed with only after the crime had

been committed. According to the experts at the time of the crime, he did not suffer from any mental disorder that could significantly affect his control and cognitive abilities. Furthermore, memory disintegration was found in the perpetrator and abnormal personality structure and criminal history were stated as possible motivating factors. Experts also identified revenge against public authorities without any pathological condition as the most probable motive. The judgment of the Supreme Court is valid, but an appeal has been lodged against it. At the time of this writing, we do not yet know the final result.

CASES OF CORROSIVE ASSAULTS (UNITED KINGDOM)

In many countries around the world, we often encounter attacks on the streets, near homes or in shopping malls using corrosive chemicals, which, in terms of our categorization, classifies them as crimes against health and life, where the intention is to harm another's health or take someone’s life. In certain cases, depending on the motivation, such acts are included in the category of property crimes. These are many cases of robberies where chemicals are used as a threatening weapon and the intention is to commit theft.

Figure 16: ISEM Institute

According to a University of Leicester study (**93**), the most commonly used substances in attacks (35%) were household chemicals such as bleach, followed by ammonia (32%), and then corrosive substances (acids / alkalis - 15%). Ammonia was used in up to 51% of thefts. Interestingly, up to 52% of victims of corrosive crimes were strangers, 13% acquaintances and friends, 12% partners or ex-partners and 6% criminal rivals. The results of the research also show that the use of these substances in attacks is explained by the perpetrators for six main reasons. First, there is a low risk of carrying this weapon compared to a knife, if caught by the police. Another argument was the easy availability in stores or on the Internet, and the low price. The fourth argument was to easily disguise the carrying of corrosive substances so that no one would recognize them. The fifth reason was carrying the substance in case of need as protection against attacks by others. The last argument of the respondents spoke about the need to wear corrosive substances in order to increase the reputation in social groups and gain credibility.

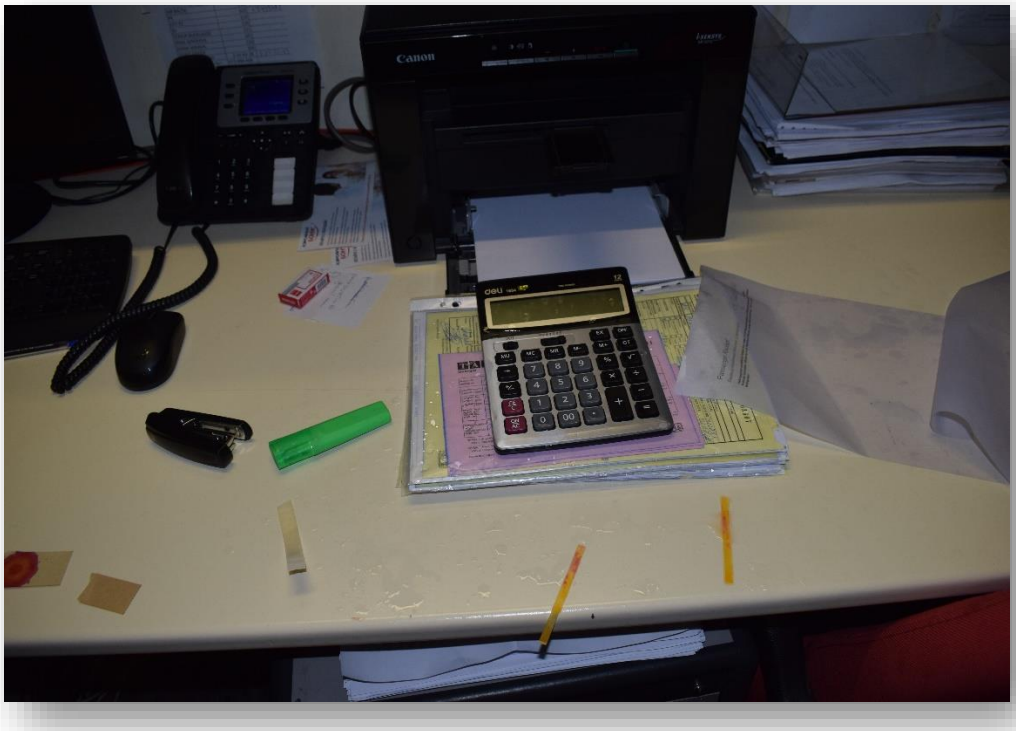
Offenders as responders in this study pointed out several aspects of the benefits of using corrosive chemicals. These were:
1. Physical harm (control) *(not clear why this is here in conjunction with "harm")* during the attack
2. Adaptability for any type of attack
3. Surprise, silence, and speed of the weapon (an unexpected rapid release of the substance)
4. Instant incapacitation of victims
5. Keeping a physical distance between the offender and the victim
6. A quick conclusion of the crime

In this context, however, it should be added that out of the 648 cases of corrosive attacks examined, up to 54% also used other forms of violence, such as stabbing, blunt striking, kicking and hitting.

The main motives of the perpetrators in the above research were revenge and punishment. However, from the respondents' answers, it is very difficult to clearly confirm the intention to cause serious or permanent injury. Furthermore, it was a motive for financial gain in a specially planned attack with the use of the chemical either as a threat, or even as a direct attack, during the robbery. Other motives included fear of attack, so they used the substances preventively as kind of protection. The last group of motives was the pressure of the peer group to meet its expectations.

THE CASE OF YPERIT AT THE AIRPORT (GEORGIA)

A chemical attack with mustard gas at the departure terminal of Tbilisi Shota Rustaveli International Airport occurred in July 2018.



Figures 17 and 18: Ministry of Interior – Georgian Police

People present at the ticket desk of Aeroflot Airlines detected an unpleasant smell reminding them of garlic, and they suddenly started to feel sick, having symptoms such as lachrymation, increased nasal secretion and sneezing, sore throat, coughing, hoarseness, and dyspnoea. In addition, the police officers working in the airport and providing first response developed blisters on their skin.

Figure 19: Ministry of Interior – Georgian Police

The case was immediately dealt with by State Security Service (SSG), suspecting that it may be an attack using an unknown dangerous substance. The SSG investigator immediately contacted the Emergency Management Service (EMS) and Forensic-Criminalistic Department (FCD). After consultations with the EMS and the FCD, it was decided to evacuate people from the area of the departure terminal. At the same time, HazMat and CBRN CSI teams were sent to the airport. The EMS HazMat team performed the first site inspection, with threat recognition in the appropriate A-level protective clothing. They found traces of suspicious liquid at the ticket counter, and a quick on-site test revealed the reaction as a dangerous chemical agent. Afterwards, the CBRN CSI team provided the crime scene reconnaissance, documentation and collection of evidence under CBRN conditions. Samples were sealed and sent to the forensics laboratory for further analyses.

Figures 20 and 21: Ministry of Interior – Georgian Police

Due to the specificity of the case and the potential threat coming from the samples taken, the preparation of the samples was maintained under special conditions, out of the regular laboratory procedures following health and safety requirements. The laboratory analysis showed that the sample from Tbilisi International Airport was high quality mustard gas (yperite).

The team of investigators collected evidence from victims affected at the airport, analysing CCTV camera recordings, and identifying potential suspects. CCTV recordings unfortunately did not provide a clear picture who spilled the liquid at the ticket counter. This behavior and modus operandi could indicate the skills of perpetrator to act in secrecy.

After several hours of CCTV analysis, one airport visitor drew attention to himself and therefore the experts were able to make a more detailed behavioral analysis. A suspect visiting the ticket counter prior to the attack was again detected outside the airport by CCTV shortly after people started to experience strange symptoms. This time he was dressed in different clothes.

This behavior may indicate an interest in monitoring and confirmation of the effects and impacts of a dangerous substance that he had previously applied at the ticket counter and / or in finding out how the local security forces would react. At the same time, it may tell us about several probable motives, which, however, should be confirmed by further examination of the evidence and also the victimology of the affected persons. Based on the above, several hypotheses come into play, including revenge or hate of specific individuals, which was confirmed in the official investigation. However, the motive for achieving a political or ideological goal in the form of testing the modus operandi, the effects of the mustard gas used in liquid form, and the reactivity of the security forces before a potentially larger attack, may also be considered.

Finally, the investigation team identified a middle-aged man from abroad, who was taken under operative surveillance. It appeared this person was renting a small room in Tbilisi, living in ascetic conditions. A decision was made to detain the suspect and search his place of residence. During the search, the team of investigators found a high-volume syringe, gloves, and other belongings which could have been used in the spilling of the chemical agent at the airport ticket counter.

During the interrogation, the suspect confessed that he spilled yperite on the table of ticket counter, using a syringe. He also admitted that he left the airport afterwards, changed clothes, and returned to the airport. According to his confession, the motive of the act was a personal disagreement with the woman working at the ticket counter, with whom he had been involved in a relationship for a while.

Further investigation assigned a psychiatric examination of the suspect, after which he was recognized as mentally ill. As a result, the case was closed, and the intruder was extradited to his country of origin.

This case is very interesting and raises many questions. On the one hand, there was the use of high-quality mustard gas in a place with the movement of a large number of people which could be cross-contaminated. This indicates the intent and potential for endangering several people, and not only one airline employee, who, according to the detainee, was the target. On

the other hand, he was diagnosed with mental illness, and without more details about his illness and the mental conditions before and during the attack, therefore it is difficult to make any expert findings. Due to the sensitivity of the case, no more information can be provided, but the mode of attack indicates that the detainee must have had easy access to mustard gas (chemical warfare agents) either from an old abandoned military warehouse, a current legal or illegal laboratory, or from the black market. From the information obtained, it is unlikely that the perpetrator had insufficient knowledge of the potential effects of the chemical agent. Rather, it could be assumed that he had perfect control of the causes and effects of mustard gas and acted with a clear goal. However, due to the lack of physical evidence of a possible act of terrorism, the perpetrator's declaration, and the psychiatric confirmation of mental illness, the Georgian authorities were not able to convict the perpetrator. The investigation was closed, but many questions still remain unanswered and still need to be clarified.

At the same time, it is necessary to state that the Georgian police carried out exemplary work in crime scene investigation under CBRN conditions and laboratory testing. Nevertheless, one positive lesson learnt shows that efficient training and preparation of CBRN-incident agencies, well established SOPs, and interagency cooperation can avoid or drastically decrease the number of casualties.

CASES WITHOUT IDENTIFIED INDIVIDUAL PERPETRATORS (FRANCE AND CZECH REPUBLIC)

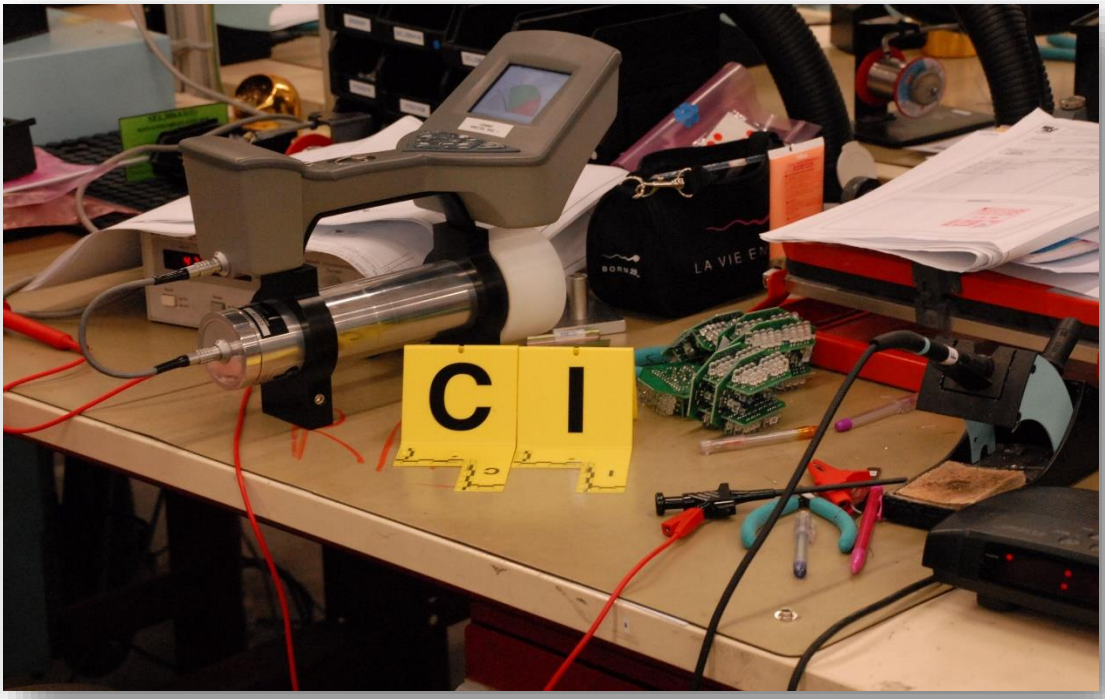
One of the special categories of CBRN-E cases are those without officially identified individual perpetrators. There are a large number of them worldwide, and although there are indications as to who might be behind the crime, there is not enough evidence to accuse, charge and convict them. They are often not even referred to as criminal cases because at first glance they do not look like that. In any case, they fall into this category because they are dealt with by the relevant law enforcement authorities as possible offences, whether intentional or unintentional. Revealing a motive without identifying the perpetrator and knowing the modus operandi become all the more challenging. In any case, there are certain elements and evidence obtained on a case-by-case basis, indicating at least in part the possible motives of the perpetrators. In our opinion, it is necessary to analyse and record these cases as well, because they can help in the future in case of linkage if similar ones occur and subsequently, they could help to identify the same perpetrators or to help in identifying similar offenders 'profiles.

Radioactive elevator buttons in France

This case in France dates to the year 2008. The French company M. manufacturing elevator buttons for an important worldwide producer of elevators regularly received the components for production from India.

In September 2008, the established detection system for radioactive material at Paris Roissy Airport detected the cobalt-60 ionizing radiation. Company M. was alerted by the relevant authorities and also by their client from the US, because the delivery was also made to the US. On the same day, more than 200 company employees were evacuated from the site

because of the potential presence of danger at the work place, and due to the investigation lead by relevant law enforcement and health agencies.



Figures 22 and 23: Gendarmerie Nationale, France

All components and final products from the stock were inspected and radioactive activity measurements at all workstations were made. The Institute for Radiation Protection and Nuclear Safety (IRSN) carried out an assessment of the dose rates and doses potentially received by company employees and the public when using the elevators in question. All staff was subjected to control measures. This operation lasted several days and consequently the whole company site closed.

The incident was also investigated as a potential CBRN crime and was finally classified at level 2 on the INES scale. This had never happened before to a company not belonging to the nuclear sector. The recorded levels of thirty people exposed to radioactive doses ranged from 1 mSv to 3 mSv, approximately compared to the exposure limit set by the regulations which is 1 mSv/year.

The case had taken on an international dimension, ultimately because it concerned other countries. Although the buttons were manufactured in France, they were mainly intended for sale on the international market. All the necessary steps were taken by French authorities and the company was to inform their partners and international authorities. From 2008 to 2009, inspections carried out in many European countries revealed a series of contaminated elevator components in Germany, the Czech Republic, the United Kingdom, Ireland, Italy, Switzerland and Belgium. All were taken out of circulation without damage to the public or the employees concerned.

The public health division of the specialized interregional jurisdiction (JIRS) of Marseille started to carry out the investigation because several violations of the public health code were suspected, among others *"the use of materials and waste from nuclear activity for the manufacture of construction goods"* (**94**). As mentioned, the investigation in this context was also carried out by the Gendarmerie Nationale. Special Gendarmerie units - National CBRN cell (C2NRBC), the Criminal Research Institute of the Gendarmerie (IRCGN) and the Central Office for the Fight Against Environmental and Public Health Attacks (OCLAESP) performed the crime scene/site inspection and reconnaissance, and conducted further steps in the investigation.

Cobalt-60 is used in different industrial and medical activities, such as levelling gauges, X-ray welding, food irradiation as the sterilisation process, and in radiation therapy. It is important to highlight that it can also come from nuclear reactor operations as a secondary product (**95**). We know about many cases worldwide when cobalt 60 contaminated stainless steel during production and this case marked many entities in several countries, and was one of many warnings to pay attention to in international regulations dealing with radioactive and nuclear material waste. People who were in charge of dealing with radioactive waste or contaminated metal scrap in India could unintentionally cause contamination during the production of the elevator button components, but also intentionally to avoid national and regulations to save money, so the main motive in such a crime could be considered as profit or financial gain. The French Gendarmerie finally succeeded in identifying the responsible company from abroad, however more information cannot be provided publicly.

The lesson learnt highlights the necessity to investigate illegal channels for the export of dangerous products, including scrap metal, which may contain dangerous radioactive material.

Sarin case in Czech Republic

This case has a very specific character, but it is not unique, especially in the countries of the former Soviet Union and in Central and Eastern Europe.

During the reconstruction of an old cottage after its purchase in 2019, its new owner discovered an aluminium tube with the inscription "Sarin" containing a glass bank (see pictures from the criminal file below – Figures 24 and 25). This type of tube with sarin was normally part of a tin can that in the past commonly contained several chemical warfare agents (see illustration picture below – Figure 26). The owner then contacted the police who then immediately seized the material on the spot under the highest security measures. After a specialized laboratory examination by SUJCHBO (National Institute for Nuclear, Chemical and Biological Protection), an operational and authentic live sarin agent was confirmed. All the necessary steps to ensure safety were taken by the relevant authorities due to the nature of the material.

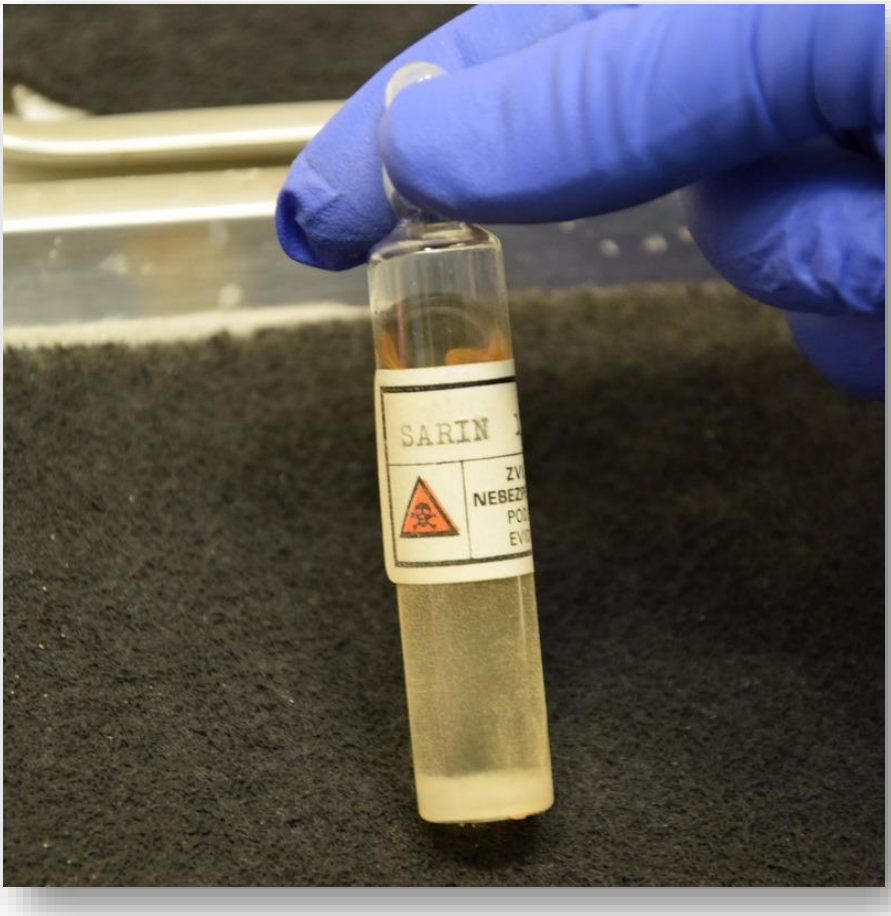


Figure 24: Czech police

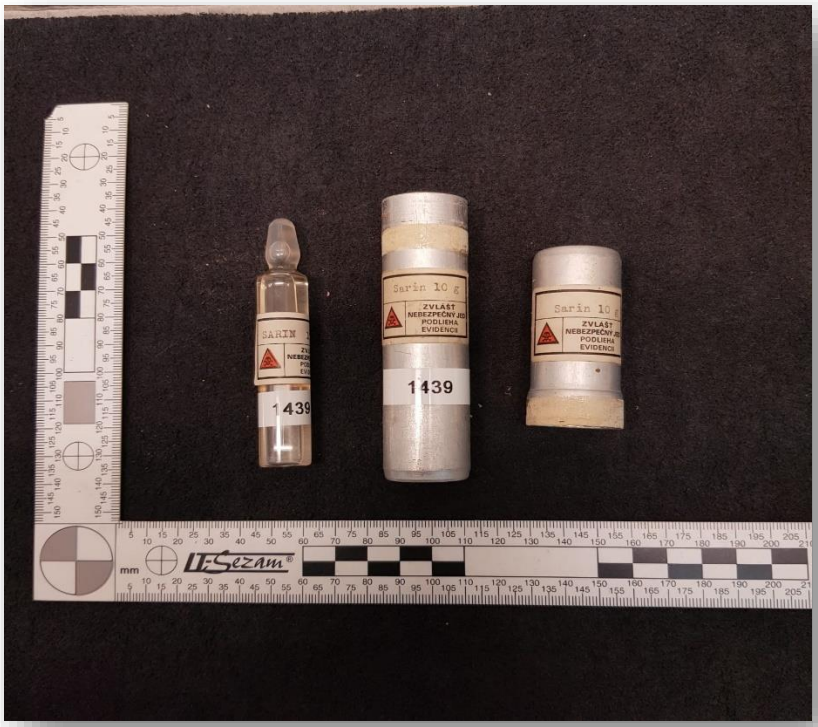


Figure 25: Czech police

Figure 26: Czech police

A complex search of the cottage was carried out under extreme secure conditions by the special Czech CBRN police unit within the counter-terrorism department in cooperation with SUJCHBO. No other ampoules or contamination were detected at the place. At the same time, the police immediately carried out a record check of warehousing chemicals in the existing military units, and from a formal point of view, everything was in order. It follows that from past times in the presence of Soviet troops in Central and Eastern Europe, there may be an indefinite number of dangerous chemical warfare agents freely circulating in unknown places. Unfortunately, the non-existent evidence could not confirm nor prove who committed the crime of the unauthorized handling of such a highly toxic chemical.

These chemicals date back to the Cold War where such types of CWA were used for training with live agents at the Soviet military bases. The cottage is located near a former military base and the former owner of the cottage was a member of the chemical battalion.

If we wanted to deduce a motive and intent related to the illicit handling of hazardous chemicals, or possibly another vague motif, we would have to have a far greater amount of information and evidence and, of course, a detained suspect. Unfortunately, despite the huge effort of Czech police force, any other evidence leading to the perpetrator was not found. One of the many motives, which could be identical to similar cases involving the sale of illegally obtained CBRN materials in the past, may be that of financial profit. However, other potential motives related to harming or killing people cannot be ruled out.

Based on the examination of 24 CBRN-E cases, we compiled a table of possible motives and intents of perpetrators of intentional CBRN-E crimes, which we divided according to the categorization of crimes from the previous subchapter. It is not an exhaustive list and can be extended according to experience from various cases and in accordance with national legislation. It is important to emphasize that the motive can sometimes be the same as the intent, and their definitions differ according to the legislative routine and legal norms of individual countries. Although the motives were not proven in many of the cases considered, they could hypothetically be deduced from investigation files, court decisions, discussions with fellow investigators and prosecutors, or from open sources available to us. Some cases are under investigation at the time of writing. We are still investigating these cases and this chapter will be updated in the future. We also supplemented the table with the results of the University of Leicester study (**93**).

Intents and Motives in CBRN-E Crimes

1. CBRN-E crime against human life and health

Intent 1.1: Causing serious injury, infecting others by disease, or intending to kill
Motive 1.1.1 Revenge
Motive 1.1.2 Lessons / Warnings for Others
Motive 1.1.3 Crime concealment
Motive 1.1.4 Power
Motive 1.1.5 Affiliation and social status
Motive 1.1.6 Protecting family members

Motive 1.1.7 Coercion
Motive 1.1.8 Mental illnesses, hallucinations, delusions
Motive 1.1.9 Anger / hate / obsession, toward a certain group of society
Motive 1.1.10 Political, religious goals and ideology
Motive 1.1.11 Jealousy
Motive 1.1.12 Thrill / Passion / Pathological desire for CBRN-E crime
Motive 1.1.13 Financial gain
Motive 1.1.14 Empathy (administering lethal dose of CBR material to dying person or person in terminal illness phase)

Intent: 1.2 Intention to put people at risk of death or serious injury
Same motives as in 1.1.

Intent: 1.3 Intimidation by injury
Motive: 1.3.1 Fear triggering preventive measure as self-defence
Motive: 1.3.2 Financial gain
Other motives as in 1.1.

Intent: 1.4: To become famous or develop an innovative approach in medicine production or medical treatment despite direct or collateral victims (taking into account damage to health and death after using the CBRN material)
Motive 1.2.1 Excitement / thrill / passion
Motive 1.2.2 Profit

2. CBRN-E crime against the environment

Intent 2.1: To damage or degrade the environment
Motive 2.1.1 Revenge
Motive 2.1.2 Lessons / Warnings for Others
Motive 2.1.3 Crime concealment
Motive 2.1.4 Power
Motive 2.1.5 Affiliation and social status
Motive 2.1.6 Mental illnesses, hallucinations, delusions.
Motive 2.1.7 Anger / hate / obsession, toward a certain group of society
Motive 2.1.8 Political, religious goals and ideology
Motive 2.1.9 Jealousy
Motive 2.1.10 Thrill / Passion / Pathological desire for CBRN-E crime

Intent 2.2 Bypass laws and regulations on hazardous waste management and / or environmental protection, resulting in environmental damage due to unauthorized storage or disposal of hazardous materials
Motive 2.1.2 Financial and other profit (saving the costs of legal waste disposal and obligatory filtering the discharge and release of pollutants into the air, water and soil)

Motive 2.1.3 Financial and other profit in saving road construction costs (use of hazardous waste instead of construction material)

Intent 2.3 Temporarily or permanently degrade arable land or orchards
Motive 2.3.1 Profit from the cheap purchase of land for the construction of buildings and infrastructure
Motive 2.3.2 Profit in eliminating agricultural competition

Intent 2.4: To eliminate inconvenient animals or plants occurring in a certain area or to deteriorate the breeding of live-stock and crops by infecting them with a disease or using forbidden GMOs
Motive 2.4.1 Aversion to animals and plants in the area
Motive: 2.4.2. Animals interfere with human activity in the area
Motive 2.4.3 Revenge
Motive 2.4.4 Profit in eliminating agricultural competition

Intent 2.5: Simplification of fishing for animals and animals using hazardous materials
Motive 2.5.1: Faster profits from fishing and livestock

Intent 2.6: Intention to spoil food by poisoning
Motive 2.6.1 Profit from saving costs for food preparation and production using spoiled biological or unauthorized chemical additives
Motive 2.6.2 Profit from the restriction or elimination of competition
Motive 2.6.3 Revenge against a particular business operation
Motive 2.6.4 Crime concealment
Motive 2.6.6 Jealousy
Motive 2.6.7 Warning, lesson

Intent 2.7 Retain or camouflage data on negative environmental effects
Motive 2.7.1 Profit obtained by not paying a fine or not deteriorating the company's rating

3. CBRN-E crime against public safety and security, administration of justice, consumer rights and property

Intent 3.1 To put people at risk of death or serious injury as a public threat or as a threat to public authority or breach of safety regulation in premises dealing with CBRN-E materials (this applies to many crimes listed in the category 3.)
Motives from category 1

Intent 3.2 Procurement of CBRN-E material in exchange for criminal commodities i.e., drugs or firearms
Motives: 3.2.1 Profit

Intent 3.3 Procurement or development or offering of CBRN-E material for illegal sale
Motives: 3.2.1 Profit

Intent 3.4 Illegal use of CBRN material in illegal production of any products
Motive 3.4.1 Profit from business with produced articles

Intent 3.5 Damaging property or equipment with CBRN-E material
Many motives from category 1 can be applied.

Intent: 3.6 Forcing the targeted person working in premises and facilities using CBRN material to release the CBRN substances into the public by threatening the disclosure sensitive information from collected data about the person or stealing the money from his accounts
Many motives from category 1 can fit to this category.

4. CBRN-E crime against community, nation, humanity and state system

Intent 4.1 Intention to put people at risk of death or serious injury
Many motives from category 1 can be applied.

Intent 4.2 Intention to build capacities of persons in the use of CBRN material for malicious purposes
Many motives from category 1 can be applied.

Intent 4.3 Intention to kill people or / and to cause injuries within a terrorist act or during a war
Motive 4.3.1 Desire to defeat the system or enemies
Motive 4.3.1 Political, religious goals and ideology
Motive 4.3.2 Affiliation
Motive 4.3.3 Power

As we can see, there is a wide range of intents and motives, and we have not mentioned all of them. In this context, it is important to note that knowing the motives and intents makes sense when adjusting the legislation, pairing, comparing and associating CBRN-E crimes with their prevalence in a particular area or region. In conclusion, we would like to state that among the examined cases, the motives of revenge, protest, financial gain, and desire to defeat the system were the most represented.

Conclusions

We have been involved in CBRN-E crime fighting for several years, but we are still finding that there are countless new things to learn. This is mainly related to the progress and development of society and technologies, but also to the discovery of new practices and motives of perpetrators.

With this article, we wanted to emphasize that there are certain shortcomings in the assessment and perception of CBRN-E crime at the international level, or in the underestimation of a certain category of CBRN-E crime. This is mainly due to inconsistent terminology and differing legislation. We understand that there are different legal customs and systems of other countries, but if we want to fight the CBRN-E threats together at the international level, we must at least try to unify the procedures and also be familiar with the systems of other countries. The exchange of good practice will thus enable us to speed up and streamline joint investigations in cases of international scope. As we can see from the cases we considered, most of them had a cross-border or international impact.

The real criminal cases that we have assessed, as well as the examined literature and legislation, clearly point not only the shortcomings in the different perception of terminology, but in particular in assessing the seriousness of CBRN-E crimes. Countries with highly developed institutional and legislative systems for environmental protection highly take into consideration the crimes of illegal storage of hazardous waste as well as other serious crimes that harm human health and endanger society and the state. But this is not the case in countries where awareness of environmental protection is not even developed. After several interviews in unnamed countries, law enforcement colleagues were surprised to present scenarios about the possible misuse of hazardous materials from illegal landfills by, for example, terrorist organizations.

With this article, we therefore wanted to share experiences from some cases as well as the existing criminal legislation of several countries in order to compare and initiate discussions at national and international levels regarding common practices. We also wanted to achieve this with the final subchapter devoted to the motivation, motives and intents of the perpetrators. We believe that the presented motives and intents in CBRN-E crime in specific cases can help in the future investigation of similar cases, in the profiling of perpetrators, and also case linkage.

Finally, we would like to state that this article will be updated and we plan to follow it up in other similar articles in the near future.

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