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RESEARCH OF MILITARY AMMUNITION IN PREPARATORY PROCEEDINGS

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Abstract:

The article presents methods for the evaluation and testing of munitions of military origin carried out at the investigative stage in the Research and Testing Department of Explosive Ordnance of the Military Institute of Armament Technology (MIAT) in Zielonka. MIAT, due to the profile of activity, qualified personnel and laboratory facilities often receives orders for ammunition expertise, including military origin ammunition of the various services responsible for State security. The article cited laws related to illegal possession of ammunition and explosives, defined the concept of preparatory proceedings and expertise and provided the definitions of ammunition and explosives. The article describes the differences in expertise carried out on ammunition in police laboratories and in MIAT. Furthermore, it provides a diagram with stages of MIAT expertise on military origin ammunition. On the basis of the specified proceedings, answers are obtained to the questions. Test methods have been described on the basis of faulty examples of executed expertise. For law enforcement authorities the results provide knowledge, as to the validity of charges relating to offenses.

Keywords:

ammunition, explosive, expertise, preparatory proceedings

INTRODUCTION

Intense warfare which took place within the Polish territory resulted in an enormous amount of military munitions left in the ground. This situation poses a threat of an easy access to munitions by the bystanders. From the view of national security, access to munitions by unauthorized persons entails risk of explosives being extracted from

munitions. These explosives could be used for criminal purposes, and ordnance could be disassembled (defused) by the collectors, and that poses risk as well. The threat of property damage and bodily harm exists due to the possibility of an explosion.

Police statistics and press reports confirm the phenomenon of unlawful possession of ammunition and explosives by the citizens. In the report [1] by Central Bureau of Investigations of the National Police Headquarters for the year 2012 (01.01.2012-31.12.2011), it was found that there were 12 cases (in comparison with 25 cases in 2011) of explosions caused by the unauthorized use of explosives and hazardous objects, including 4 (7)* cases which may have had traits of criminal terror acts. 81 (98) persons suspected of criminal activities relating to explosives and explosive devices have been apprehended in 2012 as the result of police operations. The following objects were found and secured and as the result of the search:

- 18 (22)* self-acting explosive devices and 1 280 kg (1 775 kg) of various types of explosives;
- 179 (153)* various types of grenades;
- 405 (354)* firecrackers and other pyrotechnic materials;
- 1939 (2368)* fuses, , detonators and primers;
- 4 (46)* kg of black powder;
- 376 (314)* various types of unexploded ordnance (UXO).

* - the values in brackets are the data from 2011

1. LEGAL REGULATIONS AND DEFINITIONS RELATIVE TO PREPARATORY PROCEEDINGS AND EXPERTISE; DEFINITION OF MUNITIONS AND EXPLOSIVES

Preparatory proceedings are the first stage of criminal proceedings (Figure 1) in cases brought by public prosecution. As is indicated in its very name, this stage is to prepare the case which later on is to reveal the offence and the person committing it, revealing and securing the material evidence of the offence an prepare other materials enabling the judicatory organ (the court) to rule justly in a given case.

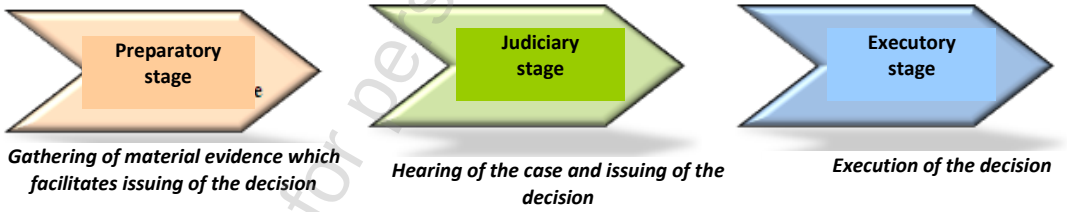


Fig. 1. Stages of criminal proceedings

Source: Own work

These proceedings are conducted by the prosecutor but, to a certain degree, also the Police. The rights of the Police can in some cases be the province of Boarder Guard, Office of State Protection (Polish: ABW), financial audits and other institutions as well. The proceedings can be conducted in two ways: by means of an inquiry or investigation.

The rule of *true fact situation,* stipulated in Art. 2§2 of the Polish Code of Criminal Procedure (CoCP), states that *the basis for any kind of determination shall be the established true fact situation.* This forces the organs conducting the procedure, including the Police, to decide on the necessity of an expert opinion in every case, the solving of which requires special knowledge (special data).

In accordance with Article 193 §1 (CoCP) If the determination of material facts having an essential bearing upon the resolution of the case requires some special knowledge, the court shall consult an expert or experts [2].

The concept of special knowledge is understood quite broadly, not only as the knowledge of individual scientific disciplines which exceeds the knowledge of an averagely educated person, but also the practical knowledge gained as the result of practicing a special trade or as the result of personal interests.

Considering the dynamic development of military technology, the tests or studies should be conducted by the dully prepared scientific institutions, specialised institutions or persons – the experts, when solving particularly intricate or complex problems. An expert can be called from the list of permanent court experts or it can be obligated to act as an expert, due to have sufficient, special knowledge in a particular field.

The initiative to conduct expertise belongs solely to the agency conducting the procedure. In the criminal procedure, the initiative lies on the side of the prosecutor, the Police, Boarder Guard, Office of State Protection (Art. 312 item 1 CoCP) or organs foreseen in specific provision (Art. 307 item 2 CoCP). Expert opinion can be issued by an individual or, pursuant to 193 § 2 CoCP, a scientific or specialized institutions. The duty of the authority conducting the proceedings is to collect expert opinion concerning all the circumstances which are to be the fundaments of the decision (judgment, order) in a case.

It should be noted that the evidence from expert opinion is, in practice, often an extremely vital “strong” proof, and more than once it strongly influences the substance of the decision relating to the proceedings. An opinion on its own, however, cannot be treated as the most important evidence (deciding about the fate of the procedure) since it is appraised at the discretion of the court or other agency conducting the trial.

Obtaining an expert opinion does not exempt the agency conducting the trial from making their own findings based on the entirety of the material evidence that the agency is in disposition of. Expert opinion is but an element of the material evidence. Unfortunately, there happen the cases of experts’ being wrong or of obtaining contradictory opinions.

As far as munitions are concerned, the legal regulation pertaining to the matter and which are relevant by a prosecuting agency and the persons conducting expertise within the preparatory proceedings are the following:

- The Firearms and Ammunition Act of May 21st, 1999 with subsequent amendments: Art. 4, item 2; Art. 5, item 1, 3; Art. 10, item 6;

- The provisions of the Law of June 22nd, 2001, on the implementation of business activity in the scope of production and trade of explosives, weapon, ammunition, products and technologies used by Armed Forces and Police, with subsequent amendments;
- Criminal Code (Journal of Laws of 1997, No. 88, item. 553 with subsequent amendments): Art. 171 §1; Art. 263 § (1-4).

It often happens that the questions posed by the agency to the expert are formulated rather vaguely. This is due to lack of specialist knowledge on the part of the person filing a motion for an expert opinion. Lack of knowledge about the material object submitted for expertise (about its structure, method of operation etc.) results in the use of terms often unrelated to the given material object in the questionnaire.

The scope of specialist terms and definitions relative to ammunition is very broad and that is why only two, crucial definitions are included below. They describe munitions (ammunition) and explosives.

Ammunition is understood as device used in combat to neutralize or incapacitate enemy forces, firing points, equipment; demolition or destruction of fortifications, deterrents and other objects; producing smoke-screens, is used for lighting, contamination of the terrain, imitation of gun fire, explosions and targets, as well as for weapon munition component tests; for educational-, training-, control- and measurement purposes. Ammunition includes firearm cartridges and their components, missile, grenades, bombs, mines, torpedoes, simulators, propellants, explosive charges, fuzes, priming compositions, means of illuminating and generating smoke. Munition can be subdivided with respect to its purpose into: service ammunition, practice ammunition, drill ammunition, test ammunition and control ammunition. Other division includes the kind of weapon it is used for: small-arms ammunition, artillery ammunition, rockets, ammunition for hunting, spots, engineer munitions, naval munitions, air launched munitions, hand grenades and rifle grenades [2].

Explosives are the substances which undergo explosive transformation when subjected to external stimuli. Explosives are divided according to the function they perform and these are: primary explosives, secondary explosives, propellants and pyrotechnic mixtures [3].

The Firearms and Ammunition Act specifies ammunition as cartridges used to fire firearms [8]. The vital components include rounds filled with explosives, incapacitating agents, incendiary substances or other substances which may pose threat to human life or health; ignition primers igniting the propellants and propellant in the form of gunpowder [9].

2. EKSPER OPINIONS

2.1. Division of expert opinions

Munitions expertise is no more than testing of the ammunition and its components in order to provide answers to some basic questions. These tests have to be conducted according to the standards in force or with other methods which provide reliable and

credible results. It is important that the personnel conducting the tests was properly qualified and had the necessary knowledge in the area. The machines and requirement used in the process should have calibration certificates or be properly verified.

Expert opinions on ammunition (Figure 2) can be divided into:

- Expert opinion on ammunition collected from the crime scene. This mostly concerns ammunition already fired. One deals here mostly with those elements which remain after the shot had been fired, such as a cartridge case or a deformed bullet after it had encountered an obstacle.
- Expert opinion on confiscated ammunition. This concerns when the ammunition was seized during operational activities, e.g. a search. This ammunition (or its elements) is in good condition and is mostly military in origin.

Fig. 2. Division of expert opinions on ammunition

Source: Own work

2.2. Expert opinion on ammunition collected from the crime scene

Expert opinion on ammunition collected from the crime scene is descried in detail in criminology literature. It follows along a set scheme of individual steps and recording of the findings. It is mostly conducted by the specialist from the police forensic laboratories. In case of this kind of expert opinion, the goal is to identify the firearm basing of the elements of ammunition left behind after the shot had been fired.

There are two kinds of characteristics – class characteristics and individual characteristics. In this sense, following the toolmark identification (macroscopic tests) of the bullet and the cartridge case class characteristics will constitute testifying that the shot had been fired from a Walther PP pistol, whereas individual characteristics results in the statement that the shot had been fired from a 7.65 mm Walther PP pistol with a specific serial number (it there is comparative data).

Class characteristics of a firearm based on cartridge cases is conducted via the analysis of its shape, size, weight and producer identification. The producer, type of firearm and the calibre of the firearm from which the shot had been fired is specified. Assigning an element of the cartridge to individual type of firearm is possible mostly as the result of detailed external examination of the ammunition. Just based on the placement of firing pin markings/firing pin impressions, angular placement of extractor marks, as well as their location relative to the ejector marks, class characteristics is made possible. This firearm class can even be narrowed down, and the system, mark

and model of the firearm from which a cartridge case may have been fired is given. Class characteristics of the firearm based on the bullets (material evidence) depends on the securing of the highest possible number of bullet elements which is often fragmented or deformed having hit a target or obstacle. The examination of the bullet, its calibre, model and the material from which the jacket had been manufactured is possible. If the recovered bullet is in good condition, what is also possible is determination of the number of lands and groves, the angle of the groves and direction of their twist. Having these data allows for the type of firearm which fired the bullet to be identified. However, it should be underlined that some firearm models are characterised by the same parameters i.e. the number of lands, the angle and direction of twist and the calibre of the barrel. This precludes the investigators from establishing the precise firearm model. It is only after the undamaged bullet (material evidence) is submitted for the tests that a precise identification of its weight, length, diameter is determined, and basing on this information, narrow characteristics of the firearm which had been used is made possible.

Fig. 1. Characteristic marks left by the ejector, extractor and firing pin on a cartridge case fired from GLOCK pistol. Ammunition producer stamp and calibre are visible

Source: [4]

a) **b)**

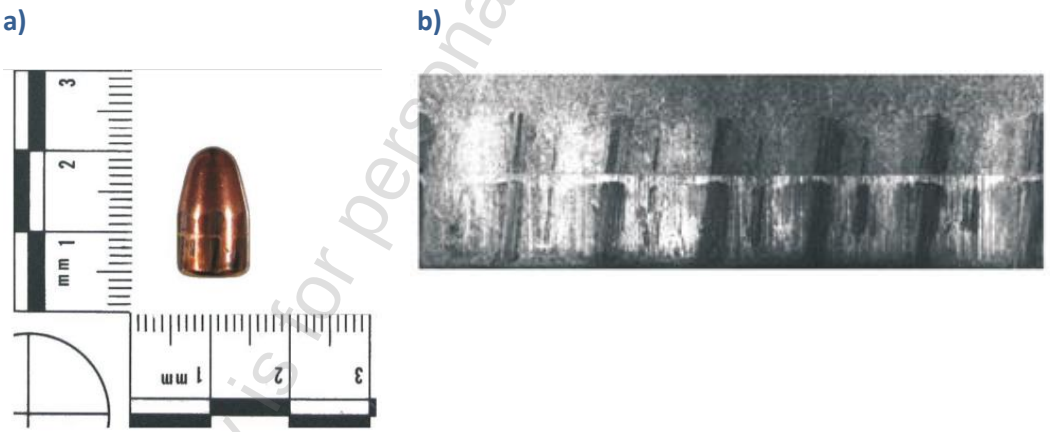


Fig. 2. Characteristic markings on the projectile fired from GLOCK model 17 pistol: - projectile (after it left the barrel) with visible deformations on the jacket,
b – x-y plane view of the fired projectile

Source: [5]

2.3. Expert opinions on military munitions

Due to a specific structure, operation and special application of military munitions, their tests are different from those listed in Chapter 2.2. Police forensic criminals issue expert opinions on civil ammunition mostly, and they are reluctant to analyse military munitions. This is the effect of lack of knowledge and experience in such tests on the one hand, and the necessity of following a set of complex operations (often dangerous ones) for the tests to be completed on the other. Furthermore, civil ammunition (used in hunting and in sports) differs from the military one, where there are armour-piercing-, incendiary-, tracer-, explosive, armour-piercing incendiary munitions etc. contain explosives (primary or secondary explosives, propellants, pyrotechnic compositions).

Figure3. presents some basic questions collected throught several cases that an expert was to answer.

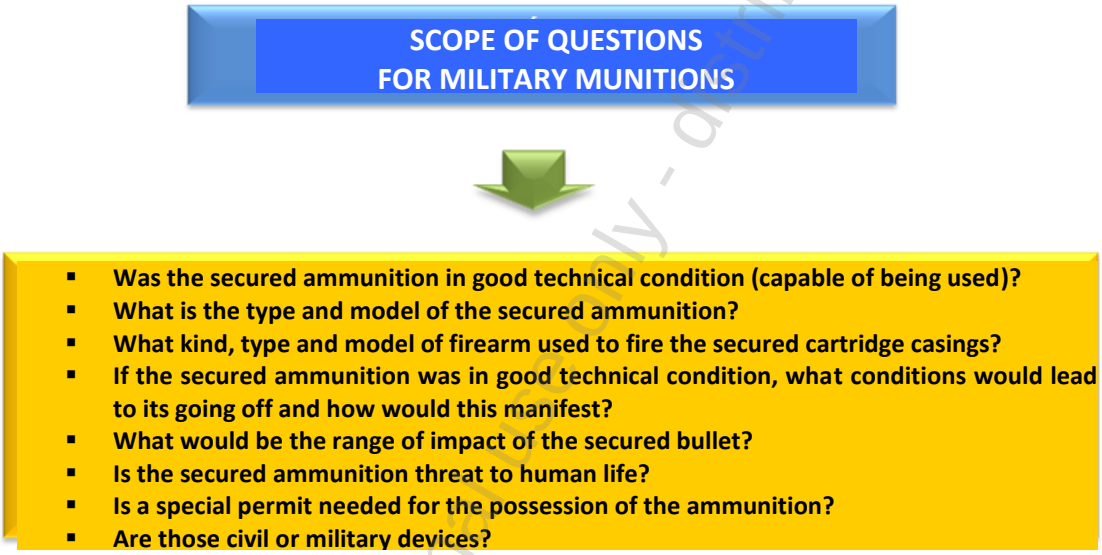


Fig.3. Exemplary questions relating to military munitions (small arms)

Source: Own work

Figure 4. presents the diagram of how the individual steps lead to issuing expert opinion in case of military munitions. The detailed procedure leads to reliable results and answers to the inquiries by the agencies commissioning the expertise.

It should be noted that ammunition testing is a dangerous process because often technical condition of munitions is unknown. That is why only the fully qualified persons following very strict procedures and with access to proper technical equipment are allowed to conduct such analyses.

According to the diagram, the testing process begins with identification of munitions. Figure 3 presents an example, of how a projectile (shell) is identified. Based on individual characteristics of a given kind of ammunition, such as markings on its walls (paint, imprints etc.), the shape, characteristic features and dimensions, ammunition type and kind can be identified. Knowing the type and kind of munitions, and using the available

database, the kind and the amount of explosive which can be found within is identified, and so is the structure of the projectile (Figure 5b). Lastly, it can be stated, whether the ammunition was fired or not, which is quite important for the curse of subsequent proceedings.

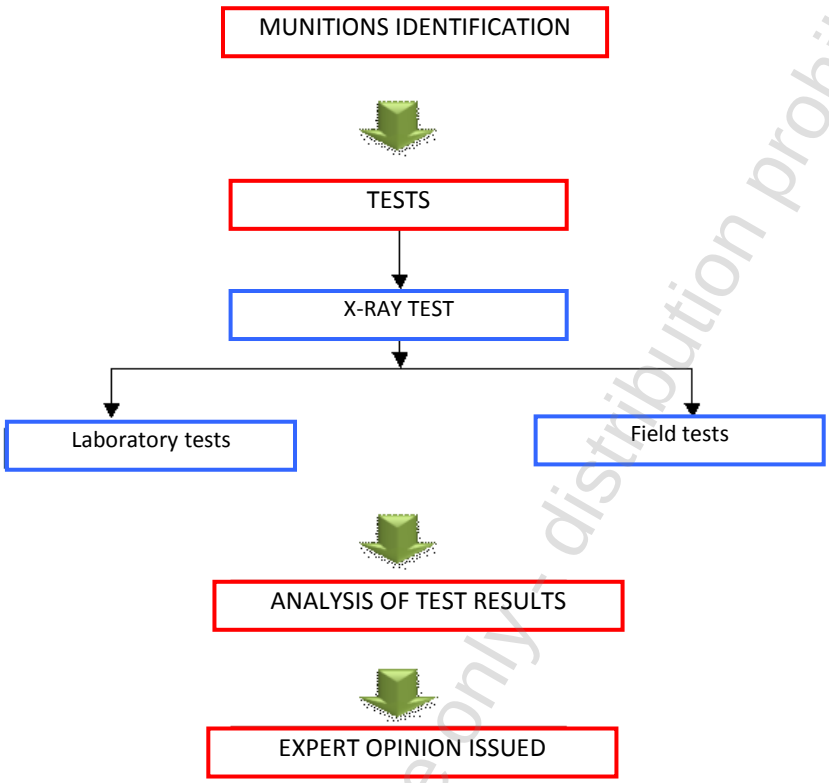


Fig. 4. Testing procedure (leading to issuing expert opinion) for military munitions

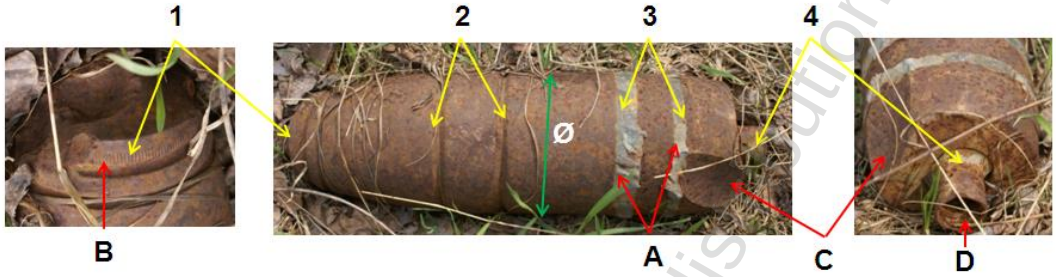
Source: Own work

X-ray is a useful device which enables the expert to scan the ammunition in order to verify the presence of explosives within, and to asses the hazard connected with further test, such as ammunition disassembly. More often than not, ammunition delivered to the expert is corroded and does not have any identifying markings, Thanks to the non-invasive x-ray method, the presence or absence of elements containing explosives within the tested object.

Figure 3 *a* and 3*b* presents examples of 14.5 mm cartridges submitted for forensic testing. Figure 3a presents external view of these cartridges: corrosion on the jacket is visible and no markings (paint) which would specify the type of the cartridge. 14.5 mm cal. cartridges are manufactured in many types, such as: armour-piercing incendiary, explosive, armour-piercing incendiary with tracer. The x-ray scan (Figure 3b) revealed information on the kind of cartridge; what can be observed is the pressed compositions: tracer mixture (in their the bottom part) and incendiary (in their upper part).

The munitions fully identified, the central stage of the expertise can be initiated, namely conducting the necessary tests which can be divided into laboratory tests and

field tests. The selection of the type of tests takes place after the technical condition of the ammunition had been verified, and the danger level of testing assessed, since the safety of the persons involved in the process is of utmost importance in forensic ballistic analyses of ammunition. One approach concerns unfired ammunition (with no corrosion or mechanical damage), while completely other pertains to ammunition which had been fired but had not worked, the so-called unexploded ordnance (UXO). This sort of ammunition is often corroded or mechanically damaged. Furthermore, in the case of UXO there is the danger that some of their explosive train mechanisms could be in the armed position. Any manipulation of this sort of munition is extremely dangerous and is burdened with the risk of explosion.



MARKING SYSTEM	SHAPE AND CHARACTERISTIC FEATURES	DIMENSIONS [MM]	TYPE	EXPLOSIVE CONTENT [kg]	MINIMAL HAZARDOUS ZONE [m]
absent	1 – mounting area for ballistic cap 2- notches 3 – rotating bands 4 – plug with base fuse UXO A – firing marks on rotating band B – ballistic cap detached C – hitting marks on the body D – tracer burned down	Ø – Projectile diameter – 101 L – length without the ballistic cap Ø — plug diameter – 26	Armour-piercing	About 0.06	700* ** Based on the publication „Oczyszczanie terenu z przedmiotów wybuchowych i niebezpiecznych, MON, Inż. 387/75, p. 37. Table 1*

Fig. 3. Example of munitions being identified

Source: Own work

Field tests require fewer necessary operations to conduct the test in comparison to the laboratory tests. There are three stages of laboratory analysis:

- disassembly of munitions;
- sampling of explosives for analysis; preparation of ammunition components for analysis;
- physical and chemical tests of explosives and tests of technical condition of elements of ammunition, such as e.g. primers.

a) b)

Figure 4. 14.5 mm cartridges submitted for forensic tests: a – external view, b – x-rayed cartridges

Source: Own work

Figure 5 present an exemplary field test of a projectile [1]. The goal of the test was to answer the question, whether this object is of military origin and thus a threat to human life, and, in particular, does it contain explosives. Because of the advanced stage of corrosion, its disassembly would be dangerous. After the kind of projectile was identified and the probability of it containing explosives has been attested to, a test was conducted (Figure 6), the aim of which was corroboration of the presence of explosives.

a) b)

Fig. 5. Projectile:a – projectile as submitted for analysis,
b – data on the projectile as collected following the identification

Source: [1]

The projectile has been heated using a gas burner on the side of fuze and after one minute time the projectile detonated. The presence of explosives in the tested projectile is indicated by the number and the kind of fragments from the body of the projectile (Figure 6).

Figure 8 presents 14.5 mm cartridges submitted for forensic analysis. They underwent laboratory tests, the first of which included identification of the kind of rifle cartridge

using the X-ray scan (Figure 4). The cartridges were devoid of propelling charge but they had an unfired primer. Should there be a propellant inside the cartridge case, and the condition of the projectile would allow for the shot to be fired, this would be the quickest test assessing the technical condition of the cartridge and its elements i.e. through measurement of bullet muzzle velocity, study of the bullet path or verification of the bullet action when hitting the target. In this case, what was necessary was disassembly of the following cartridge elements: the primer and the bullet, in order to sample explosives for the physical and chemical tests. These tests allow for the determination of the kind of explosive, and whether its physical and chemical properties allow the expert to draw a conclusion relating to its "good technical condition/working order". It often happens that an explosive, when in contact with environmental factors (such as humidity or temperature) loses its chemical and physical properties, becoming even more sensitive to external factors. The physical and chemical analysis identifies the kind of explosive used and its stability, which entails the verification of its technical performance.

Fig. 6. Field test of the projectile for the presence of explosives

Source: [1]

Fig. 7. Fragments generated as the result of projectile detonation

Source: [1]

Figure 8 presents a disassembled primer from which explosive has been sampled for physical and chemical analysis.

An example of physical and chemical analysis of a sampled primary explosive as sampled from the primer and initiating its decay is illustrated in Figure 9. The sample decay

testifies to the parameters of the tested mixture being maintained and this, in turn, corroborates its unchanged technical performance.

Fig. 8. Disassembled primer

Source: Own work

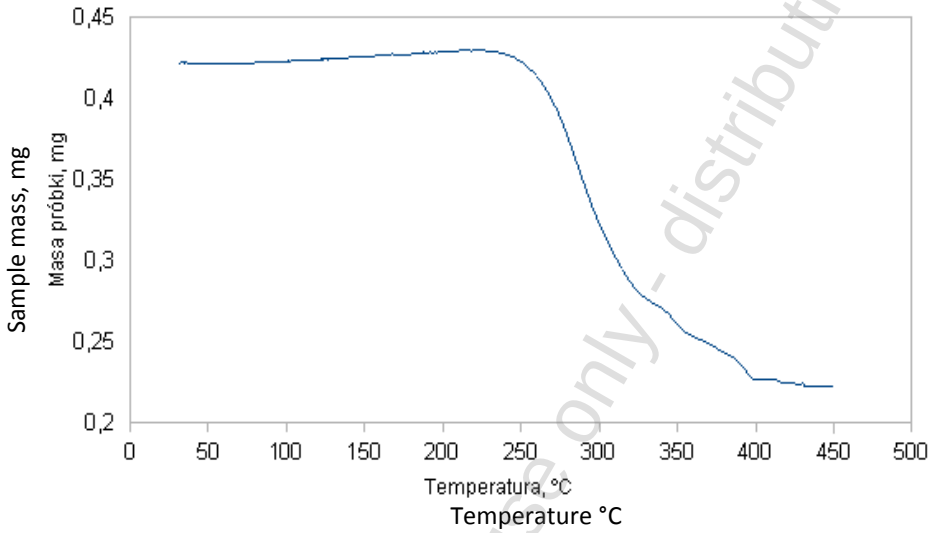


Fig. 9. Exemplary diagram of physical and chemical analysis of the sampled explosive

Source: Own work

The collection of all the test results from all the steps and then their analysis allows the person carrying out the expertise to answer the questions posed to them precisely. Frequently, such analysis requires involvement of a number of persons, with varying educational backgrounds. Their knowledge allows for the specialist tests of a given object to be carried out, and then for correct assessment of the test results.

CONCLUSIONS

Basing on examples from the tests of military munitions, the complexity of the process leading up to issuing an expert opinion has been illustrated in the paper. It is these results that are most often used as arguments, both by the defence and the prosecution in order to impact the court's decision. That is why reliable and professional expertise is the key element deciding on the guilt or innocence of the person accused.

What is worth noting, however, is that the substantial value, the contents of such expert opinion is rather low. This may result from a number of factors, from insufficient knowledge of the given field by an expert; carelessness and lack of precision in carrying out the expertise to lack of proper technical facilities required for the test results to be

reliable. The authors often responded to inquiries by the prosecuting agencies about the possibility of issuing an opinion on an expert opinion already issued by someone else, or of issuing the opinion once again. This was due to the fact that previous expertise was unreliable, and either the defence or the prosecution challenged its validity. In such cases, the court may rule that another expert opinion is to be issued concerning the same issue. However, it often happens that the material evidence has already been destroyed during the course of the first expertise and another reliable expertise is impossible to carry out. This results in a demand (by the agency commissioning the expertise) to produce an expertise solely basing on the case files (photographic record of material evidence). The authors do not comply with such requests, since there are no substantive grounds to carry out such expertise.

Another separate issue worth discussing are the questions formed by the agency commissioning the expertise of material evidence (ammunition). Often the person posing a question has no specialist knowledge on ammunition components and on principles of its operation. For an expert, this sort of questions is unclear and disconnected from the subject matter of the given expertise.

The authors think that it would be productive and justified to organize meetings, seminars and conferences, in which the persons from the forensics area representing relevant institutions should participate. During such meetings, the results of studies could be presented, the experiences shared and various training or practical exercises conducted.

The two types of expert opinions described in this paper, one conducted by Police laboratories and one in MIAT's Research and Testing Department of Explosive Ordnance have different character, resulting mostly from different areas of activities of the two institutions. To sum up, in order for the process leading up to issuing expert opinion to be legitimate, what is vital, is professional training of the experts, access to properly equipped technical facilities, allowing for and reliable results and, finally, correct interpretation of the test results.

REFERENCES

1. Bik P., Jakusz P., *Opinia z zakresu przedmiotów wybuchowych pochodzenia wojskowego oraz oczyszczania terenów poligonowych*, Syg. akt 1 Ds. 1241/13, Gdańsk 2013.
2. Ciepliński A., Wozniak R., *Encyklopedia współczesnej broni palnej*, Wydawnictwo WIS, Warszawa1994., p. 8.
3. Ciepliński A., Wozniak R., *Encyklopedia współczesnej broni palnej*, Wydawnictwo WIS, Warszawa1994., p. 134.
4. Gacek J., Maciejczyk R., Przyjemski W., *Badania mechanicznych skutków strzału z broni palnej*, [in:] "Biuletyn WAT", Vol. LVII, No. 3, 2008, p. 52.
5. Gacek J., Maciejczyk R., Przyjemski W., *Badania mechanicznych skutków strzału z broni palnej*, [in:] "Biuletyn WAT", Vol. LVII, No. 3, 2008, p. 54.

6. K.p.k. (CoCP) Dz.U. No. 89, poz. 555 z późn. zm., Art. 193. §1.
7. Sprawozdanie z działalności Centralnego Biura Śledczego KGP za 2012 rok, rozdział 1.2. "Wyniki działań w zakresie rozpoznania i zwalczania terroru kryminalnego oraz terroryzmu", p. 7.
8. Ustawa z dnia 21 maja 1999r o broni i amunicji (Dz. U. z 2004. No. 52, poz 525 ze zm.), Art. 4, item. 3.

BIOGRAPHICAL NOTES

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