Scientific and Technical Journal

Safety & Defense 5(1) (2019) 13–19

Aerial Weapon Safety under the Provisions of Law

Krzysztof OGONOWSKI*

Polish Air Force University, Dęblin, Poland; k.ogonowski@law.mil.pl, ORCID: 0000-0002-6075-4571

Dariusz BOGUSZ

Polish Air Force University, Dęblin, Poland; d.bogusz@law.mil.pl, ORCID: 0000-0001-7755-0949

Abstract

The article presents several of many safety aspects regarding aerial weapons. An attempt was made to present problems related to environmental safety, technical services, the transport of hazardous materials in the light of the applicable provisions of Polish and international laws.

Keywords: security, weapons, services of the weapons, environmental safety, transport of weapons.

1. Introduction

The process of the technical modernization of the Polish Armed Forces has accelerated significantly over the past few years. We are currently witnessing the introduction of new, complex weapon systems and military equipment into the Armed Forces. These are the key and well-known modernization programs aimed at increasing the combat potential of the Polish army. Simultaneously, a significant range of weapons and military equipment is constantly ordered and purchased, ranging from radiolocation stations to uniforms.

On the other hand, Poland's membership in the EU has forced the adaptation of the legislation to EU requirements. This process also applies to legal acts regulating the purchase, transportation and weapons convoy, as well as ensuring safety during the performance of all the listed operations.

The diversity of these law provisions consists of many factors. The main ones are: an extensive list of dangerous goods, different physicochemical properties of individual goods, their various types and the extent of the threats they pose. They also include conditions for packaging and marking transported weapons, detailed technical conditions of motor vehicles, tanks and containers thanks to which hazardous materials are transported, and their equipment and markings for rail and air transport, extended documentation of weapons service, and finally provisions related to ecology.

2. The importance of aerial weapons and aviation safety

When analyzing legal acts regarding the defense and security of the state, it can be noticed that the main reference point in the understanding of the term "weapon" is the Act of November 29, 2000 on the foreign trade in goods, technologies and services of strategic importance for the security of the state, as well as for the maintenance of international peace and security, and on the amendment of certain laws (i.e., Journal of Laws of 2004, No. 229, item 2315). According to art. 3 (2) of the Act [quoted]:

* Corresponding author

weapon is ammunition, explosives, products, their parts, technologies, specified in the list referred to in art. 6 (5);

The term aerial weapons is understood as air weapons, aircraft equipment enabling targeting and weapon guidance, as well as ground equipment for operating weapons and corresponding on-board systems. Thus, aerial weapons consist of: weapons, weapon sights or targeting systems, weapon positions, weapon control systems and ground equipment.

Aerial weapons are munitions with their drives, devices for controlling or stabilizing the flight path and detonators.

The composition and characteristics of aerial weapons may change over time. The reasons for these changes are: scientific and technical progress, changes in the characteristics of tactical and technical objectives, the emergence of new weapons, war experience and changes in the concept of using the air force in the event of armed conflict.

All systems and types of weapons can be operated, stored or renovated. All types of weapons and devices should be safe when handling them, that is during servicing, repair, transport, use and storage. They should be characterized by high service life and, at the same time, high reliability. Operation of the weapons should be easy and not labor-intensive.

Each type of weapons is characterized by certain operation specifications. For example, guided missiles require specially equipped technical positions to check and integrate missiles and deliver them to an aircraft. Barrel weapons require regular cleaning after shooting and appropriate equipment for ammunition taping. The bombardier service is very labor-intensive and requires special mechanical means to suspend the bombs. Therefore, aerial weapons are serviced by aerial weapon specialists belonging to the engineering and air service (maintenance). These specialists are also entrusted with handling: on-board passive interference devices, transport and amphibious equipment, blasting mechanisms and pyrotechnics, rocket accelerators, including on-board installation, air targets, as well as aerodrome and on-board crew training devices with regard to weapons use.

The scope, technologies and aviation equipment maintenance organizations, including weapons, are regulated by provisions of law, consisting of: uniform sets of technical maintenance, technical descriptions and operations manuals, operating methodologies and technology cards, flight service instruction as well as orders issued depending on current needs.

Depending on the point of view, the concept of aviation safety may have different associations, such as:

- no accidents or serious incidents – a view commonly represented by travelers;
- no threats, i.e. factors that cause or may cause damage;
- attitude of employees of aviation organizations in relation to dangerous activities and conditions;
- avoiding mistakes;
- compliance with regulations.

Regardless of the connotation, all the aspects presented have one common denominator: the possibility of total control. No accidents, no hazards, etc. indicate the idea that this is possible (through the right project or the right actions) to master and control all factors that can have adverse effects in operational reality. However, while the elimination of accidents and / or serious incidents and the achievement of absolute control is certainly desirable, it is an unattainable goal in an open and dynamically changing operational reality. Threats are an integral part of operating activities. Errors and mistakes will occur in aviation, despite efforts to prevent them. No human activity or a human system can guarantee complete exclusion of threats or behavioral errors.

Safety is therefore a more relative than absolute concept in which the safety risks resulting from the effects of threats in the operational reality must be allowed in a system that is safe in nature. The key issue is still control (supervision), but more in relative than absolute terms. As long as the safety risk and the possibility of operating errors in operational activities are maintained at a reasonable level of control, the systems so open to change and dynamically subject to them as civil commercial aviation are considered safe. In other words, safety risks and operational errors in operational activities that are controlled at a reasonable level are acceptable in a system that is safe in nature.

Safety is increasingly perceived as the result of managing some of the organizational processes that are aimed at maintaining the safety risk resulting from the effects of threats in the operational reality as part of an organized control. Therefore, the concept of safety has the following meaning:

Safety is a condition in which the possibility of damage to people or property is minimized and is maintained as part of a continuous process of risk identification and safety risk management at an acceptable level or below this acceptable level.

Therefore, in order to ensure the safety of the aerial weapons, it is necessary to ensure:

- proper servicing of aerial weapons both on the ground and in the air;
- adequate transport of weapons and hazardous materials;
- proper storage and disposal of these materials, without harm to the environment.

3. Safety during aerial weapons service

The service of aerial weapons should be efficient, i.e. fast, technologically correct and safe. Efficiency of service depends on the quantity and quality of ground equipment, the number of specialists, their skills and experience, and the organization of service. During the preparation of aerial weapon specialists, and when planning and organizing the weapons service, the specifics of the aerial weapons as an object of operation should be taken into account, namely:

- high level of safety risk, including bystanders;
- rigorous compliance with safety rules when working on weapons;
- high labor-consuming preparation for combat use of certain types of weapons, especially bombardier weapons;
- significant differences in weapons service during peacetime and in times of war, when the intensity of the use

of different types of weapons, and thus the intensity of armament services, increases significantly.

Due to the aforementioned characteristics, aerial weapon specialists should be prepared in a moral, psychological and substantive way to boldly handle weapons during their use while strictly adhering to the applicable regulations.

Flight and Maintenance personnel employed in the service of weapons must be familiar with and strictly comply with all the safety provisions contained in the aircraft operations manuals and the instructions of the combat assets.

Personnel who have undergone proper training, know safety rules, and have passed the examinations in this field should be allowed to operate aerial weapons. All work and training performed on aircrafts should be agreed with an aircraft or helicopter technician.

Safety during weapon service is ensured by:

- knowledge of the construction of weapons and service technology;
- systematic monitoring of compliance with safety rules by superiors;
- regular training in the use of weapons in all its variants;
- analysis of the malfunction of weapons and combat assets.

Each weapon specialist should know the technological order of individual maintenance operations with various weapon options.

In order to ensure **safety on the ground**, it is necessary to know the rules of moving around the plane of aircraft or helicopter preparation (*PPS*) and therefore it is forbidden, among others:

- to walk, drive or taxi in front of the aircraft marked with the red flag or warning light;
- to pass or drive behind the aircraft between the tail and the red flag or warning light.

Before starting the review or training on the aircraft, the condition of the equipment should be checked and precautions taken to protect oneself against unintentional firing, firing or dropping of suspensions, and the ejection seat firing.

The inspection should be carried out in accordance with the inspection route and inspection rules specified for a given type of aircraft, for a given type of combat asset and for a given weapon type.

During the inspection, attention should be paid to:

a) Barreled weapons:
   - check the correctness of closing the hatches and fairings;
   - check the correctness of a cannon or rifle fixings;

   if possible, check:
   - the correctness of the position of a cannon or rifle;
   - the correctness of loading a cannon or rifle.

b) Missile weapons:
   - check the correctness of the launcher's suspension (correct placing and rigidity);
   - check the proper connection of the electrical connector;
   - check if the rear and / or front fairings are correctly installed and closed;
   - check the correctness of loading rocket missiles.

c) Bombardier weapons:
   - check the correctness of the bomb suspension (correct placing and rigidity);

   when using a fan fuze, check:
   - correctness of the fuze installation and the MDW[1] mechanism;
   - correctness of connecting the UWP-J[2] rod to the W-N mechanism;
   - correctness of connecting and tightening the UWP-J carabiner to MDW;
   - when using an electric igniter, check the correctness of its assembly and connection of the MPI[3] ball.

Before taking a seat in the cabin of the aircraft, make sure that the pocket is fastened and that it is correct

- that the ejection seat is secured;
- that the position of Circuit Breakers (CBs) and switches is correct.

On the ground (in addition to training), do not turn on any controls for dropping or firing combat assets. After completing the combat missions allow the aircraft to be inspected by the weapons control group and follow their recommendations. Taxi an aeroplane or helicopter into a safe zone and shut down engines.

To ensure **safety in the air**, only the instructor – pilot on the training ground has the right to permit and prohibit shooting or bombing on the training ground. The aircraft weapon system should only be switched on the combat path.

When firing on the training ground:

- prepare the weapons for use only on the command of the commanding officer in the places provided for that;
- fire only in the direction of the firing axis.

Performing a combat task on the training ground should be stopped during:

- a target incident over rail roads, streets where traffic was not stopped during the shooting period;
- dive recovery;
- loss of radio communication with the flight instructor on the training ground;
  – loss of communication between the aircraft in the air;
- violation of the combat formation, approach course deviation and change in altitude;
- presence of people, transport and floating means on the training ground;
- occurrence of white banners (at night – a white lighthouse) in the shooting range of the training ground;
  – dramatic deterioration of meteorological conditions;

[1] The MDW distance-releasing mechanism – the release mechanism of the airborne means of destruction – fulfills the role of a retarder activated at the time of release and operating for the time necessary to move the means of destruction at a distance excluding the carrier palsy.

[2] UWP-J safety bar – auxiliary bomb weapon component connecting the explosion mechanism lock (Exploded/Unexploded ordnance) with the trigger device of the detonator or the distance mechanism of release.

[3] MPI pulse delivery mechanism – a mechanism that gives a current impulse to the electro-technical firing device of an air bomb in the case of the blast bomb.

– rapid deterioration of the pilot's health conditions.

In the case of any irregularities in the functioning of the weapon system, make sure that the switches and Circuit Brakers are set correctly.

If after confirming the correctness of the above-mentioned settings, the weapon system still does not work, you should:

- in the case of: barreled weapon – follow the manual of a given type of weapon;
- in the case of: unguided missiles – set the missile variant to "all" and fire the missiles with a salvo;
- in the case of guided missiles – launch another missile;
- in the case of bombardier weapons – carry out an emergency drop.

After completing the shooting (bombing), disable the given weapon system. If there is a need to land with combat assets, follow the pilot's instructions for the particular aircraft.

Below is an example diagram of the fragmentation density and velocity at the bomb explosion and the table of the fragmentation range and the fragmentation time using different types of aerial weapons. As seen below, these are parameters that have a significant impact on the safety of both the flight crew and all service members of the training ground, as well as the bystanders who might be anywhere near the weapons zone.

In order to systematically remind the crew of the rules of using weapon control systems, apart from regular technical training of flight personnel, special instruction is provided with training in the aircraft cabin before each combat flight. The subject of instruction and training may be imposed by the commander, according to the planned task in the air. It can also be planned by the weapon engineer according to the needs resulting from the analysis of occurrences of air events or due to the crew's inaccurate activity.

As part of the instruction and training with the crew on a given volatile day, the following issues should be discussed:

- tactical and technical characteristics of the combat assets planned for use and the way of their assembly of detonators;
- the range of acceptable speeds and flight altitude during approach and attack;
- flight parameters when escaping from an attack;

Illustration 1. Characteristics of Frag density and velocity in the event of a bomb explosion.

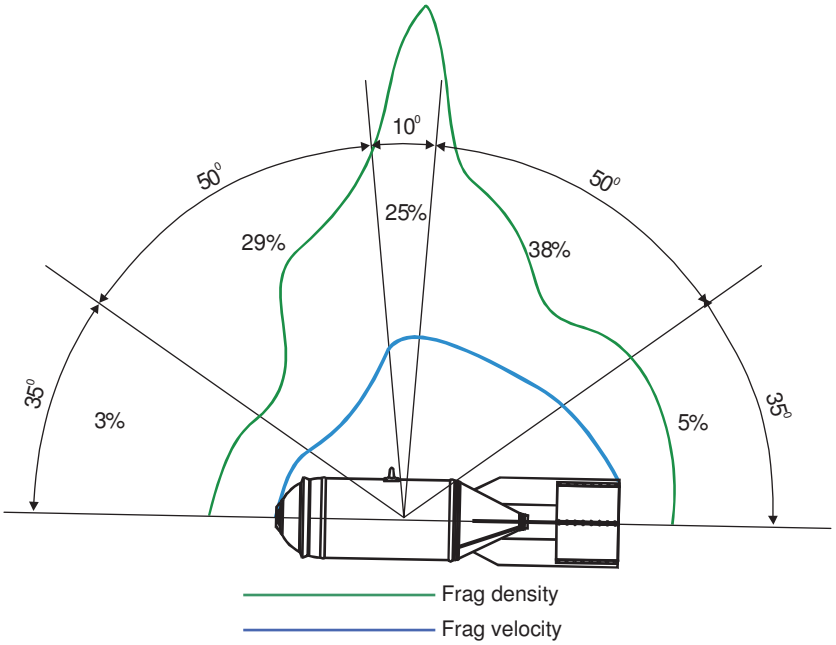

Table 1. Frag range and Frag time in the air.

Types of combat assets	Ammunition [mm]			Unguided Rockets			Bombs		
Caliber	***12,7***	***23***	***30***	***S-5***	***S-8***	***S-24***	***100***	***250***	***500***
Maximum Frag range $\mathbf{R_o}$ [m]	150	200	231	224	280	634	800	900	950
Frag time R_o $\mathbf{t_o}$ [s]	3	4	4	4	5	8	8	11	13
Frag time in the air $\mathbf{t_p}$[s]	10	13	15	14	17	23	24	30	34

- activities in special cases, such as: no descent of combat assets, premature explosion on the flight path, bomb hanging, cannon stoppage, not firing missiles, etc.;
- assurance of weapon safety condition after attack;
- cooperation with the armament control group at the post-landing checkpoint and other activities resulting from the construction peculiarities of aircraft and their weapons.

4. Safety during the transport of weapons

In order to ensure the safety of people and material goods, a number of provisions have been developed and issued. They relate to the conditions and control of the carriage of these goods, their storage, utilization, ensuring environmental safety and, finally, security of operation and use of weapons. These regulations are so diverse that they become unclear. Military hazardous goods, including combat assets, can be transported by rail, car, air or water.

The main type of transport is rail transport, and in the field of district supply – road transport.

All items or substances with the characteristics of hazardous materials must be identified, classified and designated by unique standard names used in the *ADR*[4] regulations on the transport of dangerous goods. Full names and classifications can be found in the relevant chapters and table in the *ADR* regulations.

Hazardous materials are classified in one of 13 classes. Each material has its own item marked with a four-letter UN number and is assigned to one of three packing groups (PG). These four pieces of information (UN, name according to *ADR*, class and PG) are sufficient to identify any dangerous material.

Road Transport

For the transport of dangerous goods, only the following vehicles may be used:

- lorries without a trailer or with one trailer;
- road tractors with a trailer;
- articulated vehicles (tractors with semi-trailer);
- cars without or with a trailer:
- agricultural tractors with a trailer (only some dangerous materials).

Vehicles qualified for a specific transport unit may be used for the carriage of Class 1 explosives. In accordance with applicable regulations, transport units are divided into units of category EX / II or EX / III. Detailed requirements for vehicles for transporting hazardous materials can be found in Part 9 of the *ADR* agreement.

A further step in increasing the safety of the transport of dangerous goods is the effective marking of vehicles with these goods. As the type and severity of the hazard of most goods vary, the marking of vehicles is also varied.

Vehicles with a box body carrying dangerous goods in appropriate packaging (other than explosives and radioactive materials) are marked only with reflective warning boards without identification numbers, aimed, on the one hand, to warn road users against such a vehicle and, on the other hand, to distinguish them from vehicles on the road. On the other hand, box vehicles carrying explosives or radioactive materials shall be marked simultaneously with reflective warning boards without identification numbers and appropriate warning stickers. This marking is intended both to warn traffic participants against a more specific type of threat, and to inform about the manner of behavior against such a vehicle, e.g.: do not smoke in the close vicinity of a vehicle.

In the light of *ADR* regulations, explosives may be accepted for carriage if they are sent in suitable packaging.

'An item of package' means the final product of a packaging operation, consisting of a package, a large package or a large container for packaging in bulk with its contents, ready for shipment. The term does not include unpackaged goods transported in bulk in containers or vehicles and goods carried in tanks.

The sender issuing dangerous goods in packages for transport is obliged to pack them in accordance with the provisions of Annex A of the *ADR* agreement.

Rail Transport

The legal situation of rail transport of hazardous materials similar to that which occurs in the case of road transport also occurs in international rail transport.

In this regard, Poland belongs to two large convention systems. The first of them is the international COTIF rail transport system. It includes an annex regarding the carriage of goods, and its sub-section is the Regulations for the international carriage of dangerous goods (*RID*)[5].

The second is the collection of Warsaw conventions called *SMGS*, which also cover the transport of goods. In Poland, however, the main legal act regulating the transport of hazardous materials by rail is the Act on railway transport, which in art. 26 par. 2 instructs delegations to apply the *RID* Regulations.

As regards military regulations, the transport of dangerous goods is regulated in the DD 4.4.1.Instruction on the Transport of Military Vehicles by Rail.

Transports of military dangerous cargo are planned by military communication authorities that assign a number to each transport. The sender may only send a dangerous load to transport after having previously planned it and after obtaining a transport number from the competent military communication authorities (in our case, the basis for ordering transport by *PKP* – Polish State Railways is a letter from superior authorities with the given composition, date and transport number). Each transport of military dangerous

[4] The ADR Agreement is a European Agreement concerning the International Carriage of Dangerous Goods (ADR) drawn up in Geneva on September 30, 1957. It was developed and issued by the European Committee of Internal Transport. The ADR Agreement was ratified by Poland in 1975. ADR regulations ADR regulations are amended in a two-year cycle (always at the beginning of the odd year).

[5] RID – Regulations for the international carriage of dangerous goods by rail. Persons involved in the carriage of dangerous goods should take appropriate security measures, in accordance with the nature and extent of the foreseeable hazards, in order to prevent damage and injury, and, if necessary, to minimize their effects. However, they should comply with the current RID regulations in each case.

cargoes from the moment of commencement of their transport to the railway area (siding) for loading, throughout the entire transport, until complete removal from the railway area after unloading, should be under the supervision and protection of the convoy. Rail transport can be carried out with whole trains, groups of wagons or single wagons. Dangerous goods should be transported only in covered wagons, in functional and typical packaging. The sender bears responsibility for the quality of the packaging of hazardous materials, the correctness of determining their type and providing their actual total weight. Wagons should be marked in accordance with *PKP* regulations.

A convoy consisting of escorts and a convoy commander in the number specified by the "General Regulations of the Polish Armed Forces" is designated to protect the transported cargo.

Maritime Transport

With regard to the transport of dangerous goods by sea, the International Maritime Organization (IMO) regulations in the form of International Regulations on maritime transport of hazardous materials are of fundamental importance (The International Maritime Dangerous Goods Code of the International Maritime Organization – IMDG), and a package of legal acts known as Erika I and II.

Dangerous goods may be transported by inland waterway vessels in a way that does not jeopardize the safety of maritime traffic and excludes pollution or environmental contamination, in accordance with the requirements of the European Agreement on the international transport of dangerous goods by inland waterways (ADN). A ship transporting hazardous materials is obliged to have the certificate of admittance for carriage of hazardous materials, stating that the requirements for construction and equipment are met. The certificate in question is issued after an inspection made by the director of the inland waterway office for a period not longer than five years. The transport of combat assets by sea must take place in appropriate containers adapted for maritime transport. The container transported by vessels should be kept in a condition ensuring safety in accordance with the provisions of the International Convention on Safe Containers drawn up in Geneva on December 2nd, 1972. The proof that the container is safe is a plate fitted on it that indicates the safety class.

Air Transport

International laws that regulate the rules for the transport of dangerous goods in air transport are relatively new. The International Air Transport Association (IATA) developed them in 1953, whereas the first regulations on a global scale were formulated under the auspices of the United Nations only in 1983 (known as The Technical Instructions for the Safe Transport of Dangerous Goods by Air of the International Civil Aviation Organization – ICAO). The document regulating the issue of air transport in the army is DD 4.4.2. Instruction on transporting the military personnel, armament and military equipment by air transport.

Air services usually take place between properly adapted transport points, which are referred to as international airports, airports and aerodromes.

While in other branches of transport in extreme emergency situations it is possible to accept and operate a means of transport outside designated and properly prepared transport points (ports, stations and stops), in air transport, due to its technical characteristics, it is sometimes very difficult.

In the case of air transport, containers, boxes and other packaging can be used depending on the size of transported combat assets. Combat assets intended for transport should be properly prepared (packaged), spaced and fixed (lashings, wedging). Each transport of weapons should take place under the protection of a convoy. The rules that apply when loading warfare means on planes are the same as for road, rail and maritime transport.

5. Environmental safety

In the course of the daily activities of the Armed Forces, many ecological problems arise, the analysis of which indicates that they are mostly related to the use of weapons and military technology – one of the most important technical components of the Armed Forces, whose purpose is the destruction of living force, military technique and the surrounding environment.

It should be noted that the destruction of the environment during armed conflict is an extreme example of the destructive capabilities of weapons. Most often, damage to the environment is caused in peacetime during the production, testing, operation and utilization of military technology. These processes (although not as intense as in the war) have a negative impact on all the components of the biosphere.

From the point of view of the mechanism of the impact on the environment, three types of pollution are distinguished: physical, chemical and biological. Armament and military technology generate the most dangerous (specific only in terms of weapons and military technology) types of these pollutants (ecologically hazardous agents).

In everyday operations of troops, most often we encounter the negative effects of electromagnetic radiation, noise, which are the source of classic armament and military technology. The electromagnetic radiation occurring during the operation of radar systems of air defense forces often exceeds the permissible level of 30–35 times. Crews of combat vehicles and tanks are exposed to noise levels of 50 decibels and more, and the level of vibration exceeds acceptable norms dozens of times.

A particular threat occurs during the operation of the rocket technology. Most of the pollutants are released into the atmosphere during the take-offs of space complexes. During the starting engines procedure, in every second of engine operation, approximately 3100 kg of toxic combustion products are released into the atmosphere, at a speed of 2800 – 3000 m / s and at a temperature of 3000ºC. These parameters illustrate the huge dynamics of the physical and chemical processes taking place. In a number of cases, after the

start of the rockets, there may be weather changes in the regional range. Human activity in space also leads to the contamination of the space around the Earth. At present, around 7.5 thousand objects are moving around the Earth in various orbits, of which only 5% are technically active and operated space devices, the remaining objects form "cosmic garbage" with a mass of approx. 3.2 thousand tone.

Armaments and military technology can function "ecologically safe" only during peacetime, although their use in war leads to the destruction of the living force and the environment or the zone of human activity, including the environment. In the issue discussed, environmental degradation will not cause activities in which weapons will be used – (latest generation) non-lethal weapons or an information war will be carried out.

In the near future, it will probably not be possible to create a completely "ecologically safe" weapon (in relation to the time of peace). There will always be a correlation in which the tactical and technical requirements set for armaments will determine and adversely affect the requirements in the field of ecology. It can be concluded that there is no optimal balance between technical and ecological requirements for a given pattern of military technology.

Undertaking the issue of ecological safety must be systemic and cover all stages of the "life" of weapons. The systemic nature of the issue of ecological safety is the coherence of coexisting and successive processes characterizing a given weapon pattern from the design process to the moment of destruction (utilization).

The life cycle of military technology includes five main stages:

1. research and determination of tactical and technical requirements (carried out during experimental and construction works);
2. preparation of technical documentation (carried out during experimental and construction works);
3. production (including research and modernization);
4. operation (including technical services and repairs);
5. disposal (including destruction).

The ecological safety of weapons and military technology are general properties of various types and designs of weapons enabling the elimination or minimization of their negative impact on man and the environment (natural environment) at all stages of their "life cycle", with the exception of their military use.

A very important issue is the creation of organizational and legal rules implying undertakings aimed at reducing the negative effects and harmful factors emitted to the environment. One should strive to modernize the operated models of weapons and military technology already existing. The aim of modernization, apart from improving combat properties, should be to increase the level of ecological safety during storage, operation, technical service, and the utilization of a given pattern of military technology.

The final issue is the creation of a whole package of legal acts regulating the issues of environmental protection and work safety in the environment, of which an integral part is a variety of weaponry and military technology that creates specific danger and threats.

Bibliography

[1] ADAMSKI M., „Rozwiązania konstrukcyjne uzbrojenia lotniczego", WSOSP, Dęblin 2008r.
[2] ADAMSKI M., GRZESIK N.: „Uzbrojenie lotnicze. Lotnicze środki bojowe. Cz. I Samoloty", WSOSP, Dęblin 2013r.
[3] ANDREV. V. G.: „Ekologićeskaja bezopasnost' vooruženija i voennoj techniki". Voennaja Mysl 1999 nr 5 s. 44–47.
[4] DD 4.4 Transport i ruch wojsk.
[5] DD 4.4.1 (A) Instrukcja o przewozach wojsk transportem kolejowym.
[6] DD 4.4.2 Instrukcja o przewozach wojsk transportem lotniczym.
[7] DD 4.4.3 Instrukcja o przewozach transportem morskim.
[8] DD 4.4.8 Instrukcja o zasadach wykorzystania palet i kontenerów w Siłach Zbrojnych Rzeczypospolitej Polskiej.
[9] DD 4.22.1 Przepisy o gospodarowaniu mieniem służby uzbrojenia i elektroniki.
[10] GRZESIK N., KUŹMA K.: „Logistyczne zabezpieczenie środków lotniczych" WSOSP, Dęblin 2014r.
[11] OGONOWSKI K.: „Systemy uzbrojenia śmigłowca Mi-24. Cz.II Obsługi techniczne uzbrojenia". WSOSP, Dęblin 2015r.
[12] Prawo ochrony środowiska (Dz.U 62 poz. 627 z 2001 r. z późniejszymi zmianami).
[13] Przepisy o gospodarce mienia SUiE w wojsku – uzbr. 2000/79.
[14] SZCZECIŃSKI S. (red.): „Ilustowany Leksykon Lotniczy – Uzbrojenie". Wydawnictwa Komunikacji i Łączności. Warszawa 1991r.