

THE ANALYSIS OF THE LAW MAKING PROCESS IN THE TRANSPORT OF DANGEROUS MATERIALS

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***Abstract** The risks associated with the transport of dangerous goods by air have constituted a tremendous problem since the beginning of the activity connected with the transport of chemicals, radioactive substances and biological agents. In a situation of an increased mass of transported dangerous materials, it was necessary to develop international regulations in order to simplify the shipment of dangerous cargo between countries. International organizations responsible for air transport, as far as the middle of the previous century, introduced and updated provisions, whose aim was to organize safe carriage of dangerous substances and goods. The authors of this article attempt to make an analysis of the law-making process in the transport of dangerous goods and on its basis make an assessment of the undertaken actions.*

***Key words:** Air transport, dangerous materials, ICAO, IATA, IAEA, CFR.*

1. INTRODUCTION

The transport of dangerous materials constitutes a specific segment of the undertakings related to the carriage of the whole range of cargo. This is due to an enormous risk for human health and life as well as the natural environment, which may arise as a result of an unfortunate incident during the transportation of chemicals, radioactive substances or biological infectious agents. The risks associated with the carriage of materials, posing such a huge threat, is the subject of ongoing analyses, research and legislative work aimed at the development of standards and recommended procedures for dealing with hazard substances and goods. The issue of threats posed by the transport of dangerous goods is dealt with by a large number of specialized national and international institutions. As a result of decades of work over the creation of possibly optimal arrangements with regard to the handling of dangerous substances and goods, new instructions, codes and regulations have successively been introduced. Very often revising the existing legislation was caused by tragic events that occurred during the carriage of dangerous materials.

Therefore, despite the fact that a number of procedures, published articles and books are legally binding, the process of making regulations for the transportation of hazard materials is not and will not be completed. Therefore, it is becoming extremely crucial to investigate the actions undertaken to improve transport safety of the materials endangering human life. The authors of this publication have attempted to demonstrate, on the basis of an analysis of implementing the legal regulations by international institutions engaged in the air transport of dangerous materials, its effectiveness and timeliness of the introduced solutions. The concept of timeliness shall be understood that the regulations have not been implemented too late in relation to the existing risks and measures adopted in other means of transport.

In the course of the analysis of the available literature and legal materials, particular emphasis has been on the issues of cooperation among particular institutions and results achieved in this way in the form of developed transportation regulations. An important asset of the conducted literature examinations is also a reference to the issue of the definition of dangerous materials. In the interpretation, on the one hand of varied approaches to the concept of "dangerous materials", and on the other hand of rendering the essence of the analyzed issue, has allowed a better understanding of the issues presented in this article.

2. THE ESSENCE OF DANGEROUS MATERIALS

The developed scientific publications and the binding legal norms contain a large number of phrases specifying the risks which arise from the air transport of dangerous goods. According to the authors, the created definitions were to facilitate a better understanding of the discussed problems, although quite often their contents tackles the expressions in a different way. In order to demonstrate the existing differences, the authors presented the definitions of dangerous materials, which particularly highlight the existing diversity in this matter.

The most common definition is the one that is included in the Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO) that defines dangerous goods as: "*Articles or materials capable of posing significant risk to people, health, property, or environment, and which are listed in the dangerous goods in these Instructions or that have been classified in accordance with these instructions*" [13].

While characterizing the issue of clarifying the concept of dangerous materials, special attention should be drawn to the way it is interpreted by the US Department of Transportation (United States Department of Transportation - DOT) [15]. It is important to take this institution into consideration in the transport of dangerous materials for two reasons: Firstly, the market for the transport of dangerous materials in the USA is currently - in terms of size - the largest and thus the most developed one in the world. The second reason is associated with source materials, i.e. which regulations introduced by the DOT underlined the provisions created by the International Air Transport Association (IATA) and the International Civil Aviation Organisation (ICAO). In the definition developed by the US Department of Transportation and included in 49 Code of Federal Regulations (49 CFR), hazardous materials are: "*Substances or materials that may pose undue risk to health, safety or property during transport in commerce*" [15].

In the subject literature it is possible to find also other definitions of hazardous materials that are worth quoting, due to their slightly different approach to the issue at stake. For instance, W.G. Watters, in his publication „*Transportation of Hazard Goods and Materials, Handbook of Transport and the Environment*”, presents dangerous materials in a very general way, specifying the core of the mentioned substances and goods. He claims that: “Hazardous materials are various types of materials and substances which may be marked as dangerous for several reasons” [10]. A more precise definition of hazardous materials, representing both the practical approach to the risks inherent in transport, was concluded in *Podręcznik Spedytora*.

Hazardous materials mentioned in this publication are referred to as [9]: *"Substances and goods which, because of their physical, chemical or biological properties, in case of improper handling during transport or cargo handling operations, may cause damage to the human body, health disorder, death, damage or destruction of tangible property, as well as contamination of the natural environment. From a legal point of view, dangerous goods are those materials and objects, whose carriage, in accordance with the binding regulations, is either prohibited or authorised only under the conditions specified in these regulations"* [16].

Despite the indication of existing differences in defining dangerous materials, there are also noticeable important similarities, which derive from the general characteristics of these substances. They mostly concern harmful effects on living organisms and the need for special conditions of their carriage. For this reason, the introduced legislation must cover all means of transport (land, water and air), which deal with the transport of cargo, and which constitute a threat to people and the natural environment. The safety of transport of dangerous materials must be based on the regulations that will become the basis of the activity of domestic and international carriers. In order to adapt the transport provisions to the needs of environmental transport (water, air, land) and at the same time, unify the existing regulations as much as possible, the international transport organisations have developed and implemented a number of provisions which take into account also the intermodal transport. The existing documents, depending on the modes of transport – include [2]:

a) Road Transport (ADR) - European agreement concerning the international carriage of dangerous goods by road.

b) Rail Transport (RID) - terms and conditions for the international carriage of dangerous goods by rail.

c) Maritime Transport (IMDG-Code) - international code for the carriage of dangerous goods in a packaged form.

d) Air Transport (IATA-DGR) - agreement specified by the International Association of Air Transport - the rules relating to hazardous goods.

Among the above-mentioned regulations, containing the norms and procedures for the safe transport of dangerous goods, the main principle is to attempt to develop common procedures for the carriage of dangerous goods for all modes of transport. The unification of norms and recommended practices, with regard to the existing capabilities, improves safety of carriage and allows the development of intermodal transport of hazardous materials carried by air, land, inland waterways and sea.

Among the mentioned means of transport, air services currently constitute one of the fastest growing capabilities of carrying people and goods. The constantly falling drop in the cost of air carriage, causes a rapid growth in weight and the range of goods carried by air. Air transport is constantly progressing although it is realized in conditions which are incomparably more difficult than those existing in land and water transport. Currently the largest existing restrictions on air transport are conditions connected with oversized loads and the ones which exceed the aircraft payload.

The primary factors hindering safe air transport are also pressure differences related to changes in altitude, big temperature differences between the inside of the aircraft and its surroundings, occurring mainly at high cruising altitudes. By analyzing the emerging hazards, one should also take into account weather conditions, which pose a significant threat, particularly during take-off and landing of aircraft [7].

The above-mentioned risks, related to the execution of flights in airspace, grow even further in the transport of hazardous materials. In case of the substances where physical, chemical or biological properties pose a threat to human life and health as well as the natural environment, it is possible to create favorable conditions for uncontrolled leaking into the environment. During the carriage of dangerous materials, there are circumstances posing a threat of unsealing of packaging used for the transport of chemical, biological or radioactive substances. Transportation errors (human factor), air incidents or terrorist activities may lead to unsealing transported single units or cargo containers.

Dangerous materials can be safely transported by air provided there are implemented and then enforced very strict transport procedures. The primary objective of creating procedures is to facilitate the transport of hazardous materials, while ensuring the level of security at which the risk of events, entailing a threat to the aircraft or its passengers, is reduced. However, in the event of unforeseen incidents involving dangerous materials, the existing procedures must prevent or minimize the size of possible disasters [13].

Therefore, dangerous materials or goods and substances that may pose risk to humans, animals, means of transport and any other components involved in the process of transport, that is, from the moment of their forwarding by the sender for delivery to the recipient, should have such conditions designed so as to safeguard their safe transport. The International Civil Aviation Convention, established in Chicago, December 5, 1944 [8], and in force as amended to date, does not contain any detailed formulations concerning the transportation of hazardous materials. However, it advises actions aimed at improving air safety [14]. On its basis, a number of documents that govern the carriage of substances dangerous for people and their environment were drawn, the most important one being Annex 18 to the Convention and the linked technical instructions for the Safe Transport of Dangerous Goods by Air. It should be noted that the carriage of dangerous goods is regulated by IATA Dangerous Goods Regulations, which are the interpretation of the provisions drawn up by the Committee of Experts of the ICAO (International Civil Aviation Organization) [3].

3. THE PROCESS OF CREATING THE REGULATORY FRAMEWORK IN THE TRANSPORT OF CHEMICAL AND BIOLOGICAL MATERIALS

Due to the constantly increasing air transport, resulting from the introduced international trade facilitations, after World War Two, there also increased air transport of hazardous materials. The growing number of chemical and biological substances, carried by air, with a simultaneous lack of regulations or the existence of inaccurate, complicated regulations, for instance in terms of the strength of the packaging, forced international organizations to take action to change the current status. The International Air Transport Association (IATA) [19], as early as in the 1950s took action aimed at establishing an international regulation with regard to the principles of transporting hazardous materials.

The research which was then conducted proved that only a few countries in the world had regulations regarding the carriage of dangerous substances, which could be used to develop international regulations. In considering the solutions that were possible to adapt, it was found that the United States had the most detailed provisions that had previously been developed for the carriage of dangerous goods by rail, and which later became adapted for the sake of American civil aviation [1].

The first regulations, resolving the issue of air transport of hazardous materials (Restricted Articles Regulations), were published in the year 1956. The solutions largely based on the transport regulations already in force in the USA, made by the United States Department of Transportation (DOT). It should be noted that the adopted provisions were restricted in numerous cases.

It involved the introduction of double or even triple packagings for chemical and biological materials in order to protect them from pressure changes and vibrations, occurring in air transport. Further changes to the existing legislation concerning the packaging of dangerous substances being transported, were already introduced in the 1960's. The International Air Transport Association also took steps to adopt the developed legislation (Restricted Articles Regulation) by the legislation of the IATA member states. The aim of internationalizing the developed provisions was to introduce them to the applicable national legislation, which in turn would create conditions for issuing permits for the carriage of dangerous substances by domestic and foreign carriers to or through the territory of particular countries [1].

A later increase in the mass of chemical and biological materials transported by air, involved the incorporation of the UN institution i.e. the International Civil Aviation Organization (ICAO) into the standardization of regulations [6]. The 1970s faced expectations as for the introduction of the regulations concerning the carriage of dangerous goods by air, which would cover all ICAO member states. The event which accelerated the inclusion of the International Civil Aviation Organization in the development of international arrangements, was the disaster of the Boeing 707-321C airline of the Pan American World Airways. It became apparent that there is a general lack of compliance procedures, normalizing the transport of hazardous materials. The occurred disaster resulted from the complexity of the existing legislation, on the other hand, however, it was caused by the general lack of knowledge of the applicable regulations and imperfections of supervision in their practical applications.

In order to enhance the provisions, in 1976 ICAO established a group of experts, which included the representatives of the International Air Transport Association (IATA) and the representatives of the IATA member states. The result of the five-year work of the Dangerous Goods Panel (DGP), was another 18 Annex to the Chicago Convention on the International Civil Aviation, bearing the name "*Safe transport of dangerous goods by air*". The enclosed document to Annex 18 of the Convention, was "*Technical instructions for the safe transport of dangerous goods by air (Doc 9284)*". The Technical Instructions were developed as a legislation extending the basic provisions of Annex 18, and contained detailed solutions necessary to organize safe transport of dangerous goods by air [13].

The provisions included in Annex 18, in order to facilitate the achievement of the compatibility with the rules governing the transport of dangerous goods by other modes of transport (1), were based on the recommendations of the subcommittee - United Nations Committee of Experts on the Transport of Dangerous Goods as well as the provisions of the International Atomic Energy Agency (IAEA) relating to the Safe Transport of Radioactive Material [1].

The requirements governing the legal transportation of hazardous materials, of all ICAO member states, see Annex 18, and the linked Technical Instructions, were formally adopted by the Council of ICAO, at the beginning of the 1980s. The provisions of the ICAO Technical Instructions came into force in 1 January 1983, but their use was not mandatory. The first official release of the Technical Instructions for the safe transport of dangerous goods by air appeared in 1984 and since then it has been binding as legal regulations in the airline industry. The International Air Transport Association (IATA) consistently adjusted the binding regulations to the ones created by ICAO. In 1983 it changed the insofar used term - restricted articles - for dangerous goods. In the same year, IATA made significant changes in the regulations of its members, adapting them to the requirements of ICAO [1].

Adjusting the regulations of the International Air Transport Association (IATA) to the provisions in force in ICAO Technical Instructions does not mean the total abandonment of the provisions created by IATA. The binding IATA Dangerous Goods Regulations (DGR), which refer to air carriers, are called the "field manual" of the ICAO Technical Instructions. Despite the common regulatory basis, there are small differences between the rules applied by the International Air Transport Association and the International Civil Aviation Organization. It is written and revised by experts dealing with air transport of dangerous goods. It contains the requirements necessary for the shipment of dangerous goods by air in a way which is friendly to the user and easy to interpret. DGR also contains additional information that can help carriers in the preparation of consignments, in accordance with the requirements accepted by airlines. IATA-associated carriers have slightly more rigorous procedures set by the ICAO Technical Instructions [20].

The implementation of the ICAO Technical Instructions ICAO in use did not complete the process of procedural changes in the transport of dangerous materials. The increasing size of transport of chemical and biological substances, as well as the changing technological conditions, of both aircraft and goods, which serve to ensure safety during transport, enforce continuous updating of the existing legislation. The International Organization of Civil Aviation Transport has developed two-year periods of implementing changes in Annex 18 to the Civil Aviation Convention.

4. THE IMPLEMENTATION OF THE REGULATIONS ON THE SAFETY OF TRANSPORT OF RADIOACTIVE MATERIAL

Radioactive materials, similarly to the earlier discussed chemical substances and biological agents, are subject to the carriage by various modes of transport, around the world. Among the radioactive material carried by air, the majority of substances serve medical purposes. The use of aviation for a substantial part of the transport of radioactive medical materials is confirmed by Alicja Pieńkowska, an employee of the Office of Cargo and Mail in the Polish Airlines LOT S.A.

In the article entitled *Przewozy lotnicze materiałów radioaktywnych (Air transport of radioactive material)*, she claims that: "The majority of airlifted radioactive material serve medical purposes. (...) Due to medical reasons, useful isotopes have quite a short life, which creates the need to arrange an efficient and fast transport over distances exceeding one thousand kilometers. Without air transport it is difficult to imagine the ability to carry, in a matter of several hours, an isotope from Warsaw to any Europe's capital." [4].

The rise of the significance of radioactive material, used not only in medicine but also in industry, agriculture and science in the 1950s of the 20th century, resulted in the need to develop international procedures for the transport of these substances. The first provisions introduced by the International Air Transport Association, as in the case of transport rules for chemical and biological materials, were adapted from the regulations already in force in the United States Department of Transportation (DOT), which were used in rail transport, and then in the Civil Aviation of the United States [1].

The international regulations on the transport of radioactive material have been effective since June 1, 1958. They enabled transport of more radioactive sources with higher radioactivity in relation to the rules applicable in the United States. They also introduce new solutions for the packaging of radioactive shipments, whose structural strength to the risk of damage during a crash or a fire had to be certified. It is the certification of packages, particularly with regard to the transport of materials with heightened activity or radioactive concentration which allowed their automatic acceptance by individual members of the International Organization of Civil Aviation Transport.

At the beginning of the sixties, IATA jointly with the International Atomic Energy Agency (IAEA) conducted research aimed at the unification of norms and procedures for the safe transport of radioactive material in all modes of transport. This involved with the ever-increasing demand for radioactive material, and thus the growing transport. The rapid growth in the transport of these materials caused a large number of technical and organizational problems. The outcome of the research was the preparation and issuing, in 1961, for the first time, the Rules of Safe Transport of Radioactive Material [12].

Parallel to the development of the Rules on the Safe Transport of Radioactive Material, IATA, IAEA and the representatives of the main countries that manufacture or use radioactive material conducted research aimed at specifying uniform transport requirements in air transport. The final effect of the work over the IATA Regulations on Radioactive Material was the publication of the IATA Restricted Articles Regulations in October 1, 1967. The rules implemented by the International Air Transport Association (IATA), took into account the transportation regulations of the International Atomic Energy Agency (IAEA). The introduced provisions were periodically updated in order to implement the latest solutions in the area of safety, technology of applied packages and the rules for the transport of radioactive material [11].

Another achievement of the IAEA for improving the safety of transport of radioactive material was Regulations of the International Atomic Energy Agency on the safe transport of radioactive material (TS-R-1). The Regulations published in 1996 replaced the previously binding provisions Safety Series No. 6 (SS6) in 1985. However, the introduction of new regulations did not occur without obstacles. The greatest problems arose in the large changes introduced by TS-R-1. They concerned e.g. the definition of radioactive material, annual limits of absorbed doses, requirements concerning fissile materials, changes in UN shipment numbers and the rules for the transport of nuclear material by air [1].

The initially adopted date of 1 January 2001 for the introduction by member states of the International Atomic Energy Agency Regulations on the Safe Transport of radioactive material (TS-R-1) very quickly proved to be unrealistic. As a result of the emerging concerns, a new date of the implementation of the Regulations was set for 1 July 2001. Only the regulations for the International Civil Aviation Organisation (safety regulations for air transport) were introduced, despite an extended deadline. However, in road transport (ADR), rail transport (RID) and maritime transport (IMDG), a transitional period was fixed during which the TS-R-1 and Safety Series No.6 (SS6) remained in effect [2].

The success linked with an introduction of changes in air transport of radioactive material involved facilitations contained in the Regulations of the International Atomic Energy Agency on the Safe Transport of Radioactive Material (TS-R-1). In the autumn of 2000, IATA published a special edition of the *Technical Instructions for the Safe Transport of Dangerous Goods by Air 2001 (42nd DGR)*, which contained both the existing rules SS6, remaining in force until 30 June 2001, and the new TS-R-1, which came in force on 1 July 2001. The double version of the Regulations informed of the extent of the new changes, such as: constructors of packages, the senders and recipients of radioactive cargo. It also simplified training, particularly of emergency services [1]. It should be noted that the current international regulations, relating to the safe transport of radioactive material TS-R-1, are implemented directly into national legislation (e.g. the Code of Federal Regulations - CFR in the United States). They also form the foundation for the created international rules (ICAO Technical Instructions, ADR, RID, ADN, IMDG Code), which relate to the transport of dangerous goods of class 7 [18].

The provisions concerning the transport of radioactive material by air, similar to the rules on the transport of chemical and biological substances - are periodically updated by a group of ICAO experts. They are made by periodical meetings within the works of the ICAO Dangerous Goods Panel. The result of the work carried out are the issues, made in two-year periods, of new versions of Technical Instructions. In the framework of the meetings, experts review the comments and proposals submitted by the ICAO member states as well as international organizations involved in the transport of dangerous materials. The updates of carriage rules do not concern - as proved earlier - only the carriage of radioactive material, but include transport of all hazardous materials. In addition, they assume the possibility of the best unification of the introduced regulations in all modes of transport. For this reason, the changes approved by the ICAO Dangerous Goods are recommended not only to the International Atomic Energy Agency (IAEA), but also to the United Nations Committee of Experts on the Transport of Dangerous Goods.

5. CONCLUSION

The conditionings, presented in this article, concerning the process of implementing the rules on dangerous goods transport, have been discussed according to the division into chemical and biological materials as well as radioactive substances. It is related to the specific properties of these materials and essential cooperation with the International Atomic Energy Agency (IAEA) in the creation of provisions for the transport of radioactive substances. It should be noted that despite the varied processes of developing and implementing the regulations for the transport of chemical and biological materials as well as radioactive substances, they have been included jointly in the Technical Instructions of the ICAO and are referred to under one common name of dangerous materials, in the publication.

Another issue that needs to be emphasized is the duration for the introduction of arrangements in the air transport of dangerous materials. The implementation of the current regulations, in particular types of means of transport, was made over a large time span. For example:

1. European Agreement concerning the International Carriage of Dangerous Goods by Road
2. European Agreement concerning the International Carriage of Dangerous Goods by Rail - implemented in 1980.
3. Technical Instruction of the International Civil Aviation Organization (ICAO) - implemented in 1984.
4. European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways - implemented in 2000.

It should be noted that the implementation of the regulations in the first half of the eighties should not be considered too late, at least in relation to other modes of transport. Although the European Agreement concerning the international carriage of dangerous goods by road (ADR) was introduced already in the year 1957, the first settlements in the transport of dangerous materials (e.g. Restricted Articles Regulations) appeared in a similar time. Another issue is the efficiency, timeliness and revision of the applied procedural solutions. The process of making constant changes in the binding procedures, points to the variable environment linked with the transport of dangerous goods, and not low efficiency of the existing regulations.

The examples presented in this article demonstrate that significant changes have frequently been made because of the occurring accidents. This does not prove, however, the late response of institutions involved in making law for the requests of carriers, and above all, intricacies of the existing regulations, as well as the low level of their enforcement.

An important conclusion therefore made based on the conducted analysis of the process of creating a regulatory framework in the transport of dangerous materials is the existing cooperation between users and institutions implementing their regulations. The development of e.g. common rules for the transport of dangerous materials, for all means of transport, resulted in a significant improvement in safety. Special attention needs to be drawn to the works over the creation of regulations in the transport of intermodal dangerous materials, i.e. those that combine carriage by air, land or sea. However, the development of uniform rules is not possible. In some cases, especially in air transport, it was necessary to introduce additional requirements and restrictions, directly related to the specific conditions prevailing in air transport.

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