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MODERN CHALLENGES OF DANGEROUS AND EXTRAORDINARY GOODS TRANSPORTATIONS

Tadeusz Popkowski, Dmytro Bugayko. "Modern challenges of dangerous and extraordinary goods transportations". *Dangerous goods - goods which, by the nature of their physical characteristics, chemical composition, dimensions, or other specific features and nature (live animals or fish), for some reason endanger human life or health, the environment natural or general order or material goods, including those with features of the principles of humanitarianism. The transport of dangerous and oversize goods is one of the most difficult specialties in the field of goods transport in public transport, in particular in road and rail transport. Such transport is regulated by a number of legal acts that do not apply to companies carrying out tasks related to the transport of loads, the so-called neutral. The United Nations has created a closed TN directory, giving everyone a four-digit "UN number", at the same time dividing them into classes depending on the threat or the predominant threat. The provisions of the ADR agreement relate, inter alia, to the rules (requirements) for TN transport in terms of limiting the possible effects of a potential release of hazardous substances (e.g. as a result of road or rail collisions), as well as, above all, the forms and principles of preventing the possibility of such events. The transport of dangerous goods is a special type of transport and it is subject to specific legal provisions, meeting and observing a number of specific requirements. The safety of this type of transport depends on the proper organization of its transport and the maximum involvement of participants in the entire process. The organization of the transport of hazardous materials requires a comprehensive, comprehensive view of the vehicle, packaging and cargo (means of transport and packaging should be adapted to the transported goods) as well as people involved in the preparation of transport, drivers with appropriate authorizations and training, setting the route, securing this routes in terms of maintaining safety in the event of an emergency. The article offers the author's approaches to the investigation of modern challenges of dangerous and extraordinary goods transportations.*

Keywords*:* transport logistics; dangerous goods; extraordinary goods, International ADR Agreement; cargo label.

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Тадеуш Попковскій, Дмитро Бугайко. "Сучасні проблеми перевезення небезпечних і нестандартних вантажів". *Небезпечні вантажі це товари, які за своїми фізичними характеристиками, хімічним складом, розмірами або іншим специфічним характеристикам і характером (живі тварини або риба) з яких-небудь причин становлять небезпеку для життя або здоров'я людини, навколишнього середовища, громадського порядку або матеріальних цінностей. Перевезення небезпечних і негабаритних вантажів - один з найскладніших напрямків у сфері вантажних перевезень транспорту, зокрема автомобільного та залізничного. Такі перевезення регулюються низкою правових актів, які не поширюються на нейтральні компанії, що виконують завдання, пов'язані з перевезенням даних категорій вантажів. У статті пропонуються авторські підходи до дослідження сучасних проблем перевезення небезпечних і нестандартних вантажів.*

Ключові слова: транспортна логістика; небезпечні вантажі; надзвичайні вантажі; Європейська угода про міжнародне дорожнє перевезення небезпечних вантажів; маркування.

Тадеуш Попковский, Дмитрий Бугайко. "Современные проблемы перевозки опасных и нестандартных грузов". *Опасные грузы - товары, которые по своим физическим характеристикам, химическому составу, размерам или другим специфическим характеристикам и характеру (живые животные или рыба) по каким-либо причинам представляют опасность для жизни или здоровья человека, окружающей среды, общественного порядка или материальных ценностей. Перевозка опасных и негабаритных грузов - одна из самых сложных направлений в сфере грузовых перевозок транспорта, в частности автомобильного и железнодорожного. Такая перевозка регулируется рядом правовых актов, которые не распространяются на нейтральные компании, выполняющие задачи, связанные с перевозкой данных категорий грузов. В статье предлагаются авторские подходы к исследованию современных проблем перевозки опасных и нестандартных грузов.*

Ключевые слова: транспортная логистика; опасные грузы; чрезвычайные грузы; Европейское соглашение о международной дорожной перевозке опасных грузов; маркировка.

Introduction. The transport of dangerous and oversize goods is one of the most difficult specialties in the field of goods transport in public transport, in particular in road and rail transport. Such transport is regulated by a number of legal acts that do not apply to companies carrying out tasks related to the transport of loads, the so-called neutral. The main legal act here is the International ADR Agreement [1], which is binding on all continents, supplemented by acts of local law, which in Poland include, inter alia, the act on the transport of dangerous goods, including the act on weapons and ammunition [2]. Each of these documents introduces appropriate regulations, and additionally with regard to international transport, it is important whether the potentially transit countries, and even more so the destination countries, do not introduce local periodic restrictions applicable to the planned transport route.

Presentation of the main material and research results. Dangerous goods - as it already implies, these are goods which, by the nature of their physical characteristics, chemical composition, dimensions, or other specific features and nature (live animals or fish), for some reason endanger human life or health, the environment natural or general order or material goods, including those with features of the principles of humanitarianism. The United Nations has created a closed TN directory, giving everyone a four-digit "UN number", at the same time dividing them into classes depending on the threat or the predominant threat. The provisions of the ADR agreement relate, inter alia, to the rules (requirements) for TN transport in terms of limiting the possible effects of a potential release of hazardous substances (e.g. as a result of road or rail collisions), as well as, above all, the forms and principles of preventing the possibility of such events. The set of regulations also applies to the rules of

equipping and labeling vehicles, training their crews and others people involved in the implementation of transport, such as forwarders, warehouse workers or equipment service.

The training of drivers, tram drivers, train drivers and operators of equipment used, for example, when loading or moving dangerous goods, including oversized cargo, is one of the basic factors that reduce the likelihood of undesirable events. Lack of awareness and basic knowledge in this area is usually the main cause of the occurrence of events, the effects of which may have the nature of material losses, environmental contamination, and - most importantly - threats to human health or life. The purpose of the regulations governing the transport of dangerous goods is to minimize or significantly reduce the probability of accidents and the extent of possible damage.

The fulfillment of the above requirements is a necessary condition for the transport of cargo from the TN group. However, one should remember about the specificity of the provisions in force for individual modes of transport, as well as the regulations specified in the above-mentioned provisions of national law, not always consistent with the provisions of the ADR agreement.

Generally, the above-mentioned restrictions and conditions apply to road transport. Of course, other modes of transport with a significant share in the global transport of goods, including dangerous and oversized goods, are not to be missed. We are talking about air, sea and inland shipping. The specificity of these transports with regard to the nature, specific conditions and rules with regard to safety, requires a separate discussion, also due to the current set of provisions resulting from the law on both maritime and inland navigation and the use of airspace in relation to cargo transport. This is particularly important in international (intercontinental) transport due to the restrictions on air space and territorial waters.

The transport of dangerous goods is a special type of transport and it is subject to specific legal provisions, meeting and observing a number of specific requirements. The safety of this type of transport depends on the proper organization of its transport and the maximum involvement of participants in the entire process. The organization of the transport of hazardous materials requires a comprehensive, comprehensive view of the vehicle, packaging and cargo (means of transport and packaging should be adapted to the transported goods) as well as people involved in the preparation of transport, drivers with appropriate authorizations and training, setting the route, securing this routes in terms of maintaining safety in the event of an emergency [3]. Incorrect handling of dangerous goods during storage or transport can result in enormous risks imbalance in the functioning of living organisms (including death of humans and animals) or constitute a serious threat to the environment. The development of the existing, as well as the emergence of new, branches of production related to economic development is naturally associated with an increase in transport demand, including the transport of goods belonging to the group of dangerous goods, such as substances that may pose a threat to people, property and the natural environment [4]. Due to the risk that the transport of such loads generates, it was necessary to introduce regulations clearly regulating the principles of organization, protection of resources and protection of people and the environment.

Each type of transport has its own specifics, hence specific, specific rules and methods of planning, organizing and implementing this type of transport also apply to the transport of dangerous goods.

The transport of dangerous goods in accordance with safety regulations and standards guarantees not only the minimization of the risks associated with the transport of hazardous materials, but also its full effectiveness. The selection of the type of packaging and means of transport depending on the threats posed by specific dangerous

goods affects the safety of transport and the external environment.

In road transport, there are three basic ways of transporting dangerous goods: in tankers, in packages and in bulk [5]. Each method has different requirements. In order to present the characteristics of the transport of dangerous goods, these concepts have been presented from the theoretical and practical side.

Basically we distinguish between three ways of transporting hazardous materials in road transport:

– transport of the shipment in pieces - each piece of goods should be marked with a warning label and UN number, and in the case of explosive goods with a label with the name of the material contained in the package. If the goods present several different hazards, separate labels indicate toxicity, corrosivity and flammability. Shipment in pieces can be carried out using crates, containers, on platforms or vehicles with a specially adapted body.

– transport in bulk without packaging - it is carried out using box vehicles or containers (dedicated to solid goods posing a low risk).

– transport in tanks - each tank has a so-called tank code, i.e. requirements that must be met for the transport of a specific load, e.g. type of vehicle, degree of tank filling, appropriate marking.

Pursuant to the regulations in force, the journey with hazardous material should take place, if possible, on roads with good surface and low traffic, with bypassing the roads running in the vicinity of active recreation and sports centers and bypassing built-up areas of cities, in particular streets located in the city center. When organizing the transport of hazardous materials, it should be planned in such a way as to avoid the necessity of parking, especially in cities.

Some hazardous materials cannot be transported on all roads. Some of the materials must be reported to the competent commander of the Provincial Police and the State Fire Service. Certain types of materials also require permission from the local Police Station or the Police Station and the Commander of the State Border Guard for loading and unloading. In the case of domestic transport, this declaration must be made at least 5 days before the start of transport. The obligation to report rests with the carrier (if it is a domestic company) or the sender (if he orders the service to a foreign entity). If, on the other hand, the transport begins abroad, the notification is made by the competent control office of the Border Guard before issuing the permit to enter the territory of Poland. The effect of this notification is not only the approval of transport, but also the determination of the transport route. Packaging and vehicles transporting hazardous materials should contain appropriate stickers indicating individual materials, as well as the corresponding UN numbers (four-digit number identifying the substances). If a given product poses several different hazards, the three most important ones should be indicated by stickers, e.g. toxicity, corrosively, flammability. Labels on collective packaging and packaging with a large capacity greater than 450 l the stickers are placed on both sides of the packaging. The collective packaging should contain all labels and UN numbers of the goods contained inside. Vehicles transporting dangerous goods by road (with the exception of a small amount of cargo in a vehicle carrying packages) must be marked with rectangular orange-colored plates placed at the front and rear of the vehicle or combination, vertically / perpendicular to the vehicle axis. At the top of the plate is the hazard identification number, consisting of two or three digits. e.g. (223, 48, X323). The numbers preceded by the letter X mean that the transported substance reacts dangerously with water and should not be used to extinguish a fire. The most common number 33 on warning boards indicates a very strong and dangerous concentration of the easily or pyrophoric liquid (gases) being transported. The lower figure represents the number under which the substance is classified in the

UN Catalog of Hazardous Materials. A vehicle transporting dangerous goods in bulk, in a container or in a tanker is marked at the front and rear with plates without numbers. At the same time, on the sides it must have plates with numbers appropriate to the transported dangerous goods. As for multi-compartment tanks, such plates should be placed on both sides of each compartment with the number assigned to a given hazardous substance. The essence of such labeling is in a very simple and transparent way to standardize the risk identification process, thus facilitating and streamlining control in each country that has adopted legal regulations the ADR convention.

Contrary to road transport, rail transport does not have the most limitations for oversized transport vehicles. For this reason, many shipping companies choose railroads as a form of carrying out this type of logistics operations. An oversized cargo is one that exceeds the standard weight or dimension. In the case of rolling stock, the key parameters are the loading edge of the wagon and the allowable axle load of the wagon or a running meter of rail. Appropriate load limits have been developed for individual speeds and classes of lines. At the same time, it is necessary to take into account the maximum heights of transported loads due to the height of the railway traction. Nevertheless, a properly planned rail transport does not encounter most of the obstacles typical of large-size transport in road traffic, which is why it is eagerly chosen by business customers.

Despite a number of structural changes in the national and European economy, rail transport is still one of the key branches in the entire freight transport system. It mainly concerns the transport of fuels, raw materials and industrial materials. Due to the speed of delivery, the ease of organizing the forwarding process or the possibility of transporting many thousands of tons of cargo, rail is one of the most-chosen means in modern logistics. Planning of deliveries and their realization are favored by an extensive network of railway connections and the speed of transport performed in this way . Moreover, rail is one of the safest and least accidental forms of modern forwarding, hence the great interest of entities from many sectors in this form of cargo transportation. However, it is subject to certain limitations both in terms of dimensions and weight of the load in relation to the so-called gauge and axle load of the wagon.

Sea transport offers many more possibilities for the transport of special loads. Sea transport is one of the forms of water navigation consisting in the delivery of goods using the waterways of the seas and oceans. It is based on a specially adapted fleet, e.g. general cargo, bulk carriers or container ships. In road transport, oversize cargo is also said when its weight exceeds the permissible axle loads of the vehicle. However, as it follows, not every oversized load in road transport will exceed maritime standards, because in sea transport, oversize loads are only those whose dimensions are several dozen or even several hundred meters, and the weight is from several hundred to several dozen thousand tons and they are specially transported. units constructed for this purpose. The development of world trade meant that many companies moved their production areas to distant regions of the world in order to reduce costs. Moving loads with parameters that exceed traditional capabilities means of transport is gaining more and more economic importance and is a consequence of the dynamic development of various industries. The largest of them are transported by sea, and the only challenge in this respect is the introduction of such cargo on board a ship or barge.

A separate section of shipping is passenger transport. Currently, this type of shipping is focused on the transport of people and goods within the broadly understood tourist traffic. Purely business passenger transport and used as part of communication systems have a much smaller share here. This does not apply to that extent to inland and coastal shipping. For example, in the region of

South-East Asian countries, coastal and inland navigation is still the basic means of passenger transport, but also freight, supported, where possible, by short-range air transport (mainly in countries with territories spread over many islands).

In sea transport, special cargo is referred to when it is to be transported in a sea container, ro-ro ship or special ship. Heavy loads are loads with a large unladen weight. This type of cargo includes: heavy working machines for construction and road construction, tanks and self-propelled guns for the armaments industry and the army, segments of wind towers, industrial machines, boats, ships in parts (ship sections, superstructures, hatch covers, etc.), railway carriages, trams. The mass of this type of cargo, transported by road or rail it ranges from 70 to even 100 tons.

In the case of water transport (by sea), heavy goods are those whose volume is less than 1 m3 by one ton. Special loads are goods with explosive, easily flammable, corrosive properties, goods transported in refrigerated or cisterns, and bulky items.

Poland has favorable natural conditions for river transport, but the statistics show that inland navigation is used minimally in relation to the existing potential. Cargo transportation by river routes accounts for only 0.3 percent of total land transport in Poland. - it follows from the GUS report "Inland navigation in Poland in 2014-2017".

Our country has a relatively high density of the waterway network compared to other European countries. In 2016, there were 11.7 km of navigable routes per 1000 km2. For comparison, the EU average (28 countries) is 9.3 km / 1000 km2. Only 6 countries have a higher density index: the Netherlands (150.7 km), Belgium (49.7 km), Finland (24.0 km), Germany (21.5 km), Hungary (20.0 km) and Luxembourg (14.3 km).

It is also important that although the network of waterways in Poland is 3,654 km long, most of their standard is not adapted to the requirements of modern navigation. The class that allows ships with a tonnage above 1000 tons, which are of international importance, to sail only 6% waterways. That's just over 214 km in total.

It is also not good when it comes to the fleet sailing on Polish rivers. And although in recent years the quantity of the towing fleet (the number of pushers and tugs) of inland navigation has gradually increased, they are practically worn out.

The calculations of the Central Statistical Office show that in 2017, compared to 2014, it increased by 5.8%. number of pushers and tugs. There were also barges without their own propulsion (for towing and pushing) - by 1 percent, and self-propelled - by 12.7 percent. Units used in the pushed system dominate (they account for 85.1% of the total barge fleet, which carried 61.3% of cargo in 2017).

In Poland, in 2017, approx. 5.8 million tonnes of cargo were transported by inland waterway, i.e. 7% less than in the previous year (6.2 million tonnes in 2016). However, last year (2019) more transport performance was performed by 5.4% (i.e. 877.3 million t-km) than in 2016, which means a significant increase in the average distance of 1 ton of cargo in inland waterway transport. In 2017, as in previous years, the freight structure was dominated by the transport of metal ore and other mining and quarrying products (41.7%).

Inland navigation is currently used primarily in servicing sea ports and ensuring their connection with the hinterland. In 2017, approx. 1.5 million tons of cargo were transported as part of servicing Polish seaports, which in total accounts for approx. 26% of all cargo transported in total by inland waterway. Until 2017, mainly the Odra Waterway was used, with a total of approx. 3 million tons of cargo.

In 2017, regular coal transport from Gliwice to the Heat and Power Plant in Wrocław was launched. Transport approx. 120 thousand. tonnes of coal is a significant share in the overall transport balance along the upper canalized section of the Oder. Unfortunately, this positive trend does not apply to the following years, but to 2020. it

will probably result in the lowest rate of transport, mainly as a result of unfavorable hydrotechnical conditions caused by widespread drought, but also significantly deteriorating technical condition of vessels and hydrotechnical devices.

Water transport is one of the safest modes of transport. The percentage of shipping accidents is negligible here. This is mainly due to the almost complete separation of freight from passengers. Unfortunately, the climate changes taking place particularly intensely in recent years have an impact on the navigability of sections of water courses, and more and more often in relation to entire routes that were once used very intensively. Periodic low water level, resulting from commonly noticeable drought, practically periodically completely prevents the navigation of vessels with even a slight draft.

Conclusions. Currently, the logistics departments of production and commercial enterprises, which include units that deal with storage, transport, planning and purchasing, as well as companies providing logistics services outside, are increasingly integrating their actions based on the use of information technology. IT becomes a natural element of supporting the implementation of logistics processes as components of an integrated market structure. It is a natural necessity, allowing the full use of all the possibilities offered by the modern logistics concept. This allows, among other things, to minimize the expenditure on the directional activity of a given economic entity thanks to the systemic, and thus possibly effective, warehouse management and creates the possibility of managing individual processes that occur as a result of cooperation in order to fulfill the order. Functioning in the conditions of global competition, also associated with the naturally forced shortening of the life of the market offer (product, service), it is necessary to launch mechanisms allowing for the parallel implementation of effective changes in the field of technical equipment, as well as economic conditions and organization and management technologies, under the common name broadly defined as logistics, including transport logistics.

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