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Dangerous materials in intermodal transport

Abstract: The article presents issues related to the transport of hazardous materials in intermodal transport. Attention has been paid to intermodal units used for mass transport of liquid goods with various modes of transport, which are mostly considered as hazardous materials. Next, the state of intermodal terminals in Poland was discussed, and then the legal status and applicable regulations were referred to. Current trends and perspectives in the development of the transport of hazardous materials in intermodal transport were indicated.

Keywords: Tank-containers; Development of intermodal transport; Dangerous materials; Storage yards security systems

Appearance of a container as a new transport medium has transformed the entire transport system. In order to limit in maritime transport large number of little loads and expensive packages requiring time consuming package handling, new concept of loading units have been developed allowing easier and faster loading process in the docks. In the initial period this way of transshipment was dedicated to retail shipments only. Gradually however the generic range of supported cargo. The construction of the container has also changed in terms of adapting it to the segment of transported cargo. The system used in maritime transport forced other branches of transport to change and join this consideration in the transport of the detail cargo. In this way containerization also covered land transport: road, rail and air, which use a different type of loading unit. In latest years in Poland, intermodal transport was developing very actively. Their development dynamics is counted in over a dozen percentage reaching 15,9% in years 2011 through 2018 in transport workload increasing tonne-kilometer numbers from 2,45 billion in 2011 to 6,62 billion in 2018. The development dynamics in the transported cargo mass is even greater and in the same period reached 16,4%. In 2011, 5,9 billion tonnes were transported whereas in 2018 the numbers reached 17 billion tonnes of transported cargo. Having in mind part of intermodal transport in polish market of rail cargo transport the numbers are 6,8% in terms of mass and 10,3% in terms of workload. In comparison to the average European Union's measures in this area on level of 17% - 19%, market for transportation in this cargo segments in Poland will still develop. Keeping the current tempo of intermodal transports after 2020 will not be possible without adjusting linear and nodal infrastructure as well as railroad cars and tractions. Actions promoting this type of transport in terms of financial support and legal regulations are also necessary. Together with the development of economy and new technologies, need for various composite materials, chemical and petrochemical products increases. Developing economies also means increase in the consumption. Year by year, transports of food products, including liquids, increase. For their transportation more and more often are used specialistic containers, tank containers in particular. This type of intermodal units are used for the bulk transports of liquid products by various modes of transport. Majority of those goods are currently considered as dangerous goods. This kind of goods are, among others, chemical and petrochemical goods like acids, alkali, fuels or liquefied gases. This type of intermodal units are still small part of general transports not exceeding 10%, however their participation increases every year. Analysis of the period between year 2013 and 2016 proves that globally increase of over 40% occurred in transports of this type of loads. Number of specialized containers from that period increased roughly 2.5 times and currently reached in

worldwide exchange number of 600 thousands. Every year available intermodal units of this type increase by around 50 thousands units. China dominates the production of these containers as well as the production of classical intermodal units. Second country in terms of number of produced specialized units is Republic of South Africa. On the transport market of tank containers, as well as other intermodal units, dominate the biggest players = global operator who possess around 50% of whole market thus also the one of tank containers. As the biggest of them we can consider Neport/Sinochem, Blukhaul, Hoyer, Stolt-Nielsen. Great number of specialized containers are the possession of the companies that produce materials requiring those specialized units, including tank containers. Increasing number of companies dealing in leasing of tank-containers, noticing the growing situation, increases their fleet resources. The largest leasing companies include Exsif, Triton International, Seaco Global, Euro-tainer, Raffles Lease, Trifleet Leasing. Having in mind current increasing trends in this type of transports, in Poland transports in tank containers and other specialized intermodal units will also increase proportionally.

In Poland there are currently 36 intermodal terminals, however their scale and technical background varies greatly. Sadly, majority of those terminals do not meet the requirements for safe storage of containers with dangerous goods. Only few of those terminals have storage yards allowing full catching of potential leaks. Terminal operators either don't have any safety measures or have safety measures in form of movable tanks on which leaking containers are placed. This type of safety measure do not guarantee protection of environment. Those tanks resemble in shape short open containers on which faulty intermodal unit is placed. However it's capacity is greatly limited, which is important during high leaks of tank containers, in particular during heavy rainfall. The most advanced solution in Poland, meeting all ecological standards, is given into the use in 2009 storage yard of hazardous materials in Małszewicze. It was built with help of funds from European Union in the financial perspective 2007-2013. In this case, the functions of the wagon storage area were combined with dangerous materials storage in the transport of conventional and intermodal shipments. The terminal ground together with the drainage was made in technology that ensures full capture of hazardous substances in two large tanks. Costs of building such dedicated yards however, are very high, which is the reason why it would be advisable to predict ability to fund this kind of investments in the future financial plan at the level of 70% to 80%.

Essential law for dangerous materials transportation is Act of 19 August 2011 on the transport of dangerous goods (i.e., Dz.U of 2018, item 169). Rules of packaging, holding (partially) and transport as well as loading and unloading of hazardous materials are included in the executive rules of ADR agreement for road transport, regulations RID for rail transport, regulations IATA for air transport, regulations IMDG for maritime transport and ADN for inland waterway transport. According to decisions stated in aforementioned international conventions, hazardous materials can be transported only in certified packages, which are authorized to have UN sign on them. These requirements apply to domestic and international transports. Information circulation and monitoring process is a very important issue when transporting hazardous materials. In principle, intermodal units are not conveyed during transport unless the sender of those dangerous shipments is interested in it or the goods have very high level of danger e.g. nuclear fuel. An important preparatory action for container carrying dangerous materials is securing it properly. The ability to track shipments and prevent unauthorized access to the transported goods is provided by new technical solutions. In intermodal transports responsibility to seal intermodal units in loading state, in general, falls to the sender (cargo handler) who after finished container loading process places their own seal on the unit. It is essential that the placed seal, by its construction, material, level of guaranteed safety and correct markings, meets specific conditions needed to secure the cargo in terms of stating the packaging violation. All containers used for transportation of hazardous materials in empty state, unless

decontaminated, should be treated as loaded and should be sealed. After decontamination, there is no need to seal the containers. Having in mind optimization of container securing process, apart from security seals (metal, bottle), additional security measures are used, usually referring to containers in loaded state in order to eliminate loosening (damaging) the cargo. More and more common in transportation in this type of cargo are intelligent containers supplied with sensors that report every opening information back to the base. Increasing customer requirements and technological progress also cause the security technologies to successively transform. Among the newest solutions we can include: intelligent containers, intelligent electronic seals, systems of electronic fence type, LRAD (Long Range Acoustic Device) or ADS (Active Denial System). By looking at the shipment map of dangerous materials in Poland, we can see real need of modern infrastructure which would meet the requirements of transshipment and storing of hazardous materials. The greatest number of those cargos are sent around the area of Tricity, Greater Poland, Upper and Lower Silesia. Based on the analysis of hazardous materials flow, transported in intermodal units (mostly tank containers), we can say that significant part of containers is unloaded on sidetracks of chemical plants, directly from the train car without taking the container off from it. Sadly, numerous industrial areas and technological parks, in which chemical industry's plants have been placed, were built without access to railroad tracks. During construction of those industrial areas, it was usually not foreseen to provide rail transport service in the future by leaving a separate strip of land on which track could be led. For such plant clusters rail transport handling could be assured by dedicated multimodal terminal. Having in mind need of environment protection and reduction of hazards towards human's health it would be advisable that significant part of hazardous materials shipments was realized through railroad transport. However due to decreasing number of sidetracks, intermodal transports seem to be the solution. There are many fields of technology for innovative solutions in reducing transport costs in tank containers and increasing safety of transported cargo, such as using them in production of light composite materials which reduce the weight of container itself allowing to increase the weight of the transported substances. Such containers are not exposed to corrosion and allow better adaptation to the technical standards of road and railroad transport. Another important aspect, which was already mentioned is using intelligent intermodal units. Here, should be used so called 'smart logistics', which means that the container, and thus the cargo itself, would be under constant surveillance. Those containers are equipped with few sensors, usually of around 5 types, controlling for example pressure, temperature, location or unauthorized access to the tank's valves. Data from those sensors based on telematics technology are sent to the shipment operator or suitable authorities. Having in mind changing trends in energy resources we should expect greater need for gas fuels. In tank containers there would be transported not only LPG gases but also LNG. In China, technologies of transporting liquified gases in container have been tested. It should be kept in mind that the development of containerization in hazardous materials transport will proceed and that is why we should customize terminals for this type of transports. Intermodal transports using rail and roads at the last mile are included in transport systems having relatively low negative effect on the environment. In order for this transport technology to ensure full safety, it is necessary to increase shipment's and terminal's operators awareness of the need to use appropriate technical and organizational solutions.

Source materials

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