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Dangerous Goods Transport Problems in the European Union and Poland

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ABSTRACT: The paper refers to threat assessment of dangerous goods (DG) in transportation of the European Union and the Republic of Poland. Dangerous goods in the European Union are carried by inland waterways, rail and road. In Poland 87.5% of DG have been carried by road and 12.5% by rail in 2014. DG can cause an accident and lead to fires, explosions and chemical poisoning or burning with considerable harm to people and the environment. There is not monitoring system in Poland to control in real time road transportation of dangerous goods. Proposition of National System of Monitoring Dangerous Goods in Poland was presented. Realization of mentioned kind of system may significantly contribute to improving safety of people and environment.

1 INTRODUCTION

Dangerous goods (DG) have known in more commonly as hazardous materials, (abbreviated as HazMat). Dangerous goods include materials there are flammable, explosive, radioactive, corrosive, oxidizing, asphyxiating, toxic, pathogenic, or allergic.

Dangerous goods in European Union are carried by transport in three manners: by road, rail and inland waterway.

Dangerous goods can cause accidents and lead to fires, explosions and chemical poisoning or burning with considerable harm to people and the environment.

Accidents involving DG often require the intervention of different emergency services and procedures for the mutual exchange of information and coordination should be put in place.

The European Union has passed numerous directives and regulations to avoid the dissemination and restrict the usage of hazardous substances, important ones being the restriction of Hazardous Substances Directive. There are also long-standing European treaties [12, 18, 19], that regulate the transportation of hazardous materials by road, rail, river and inland waterways.

Directive 2008/68/EC [3] shall apply to the transport of dangerous goods by road, by rail or by inland waterway within or between Member States, including the activities of loading and unloading, the transfer to or from another mode of transport and the stops necessitated by the circumstances of the transport. It shall not apply to the transport of dangerous goods:

It shall not apply to the transport of dangerous goods:

– by vehicles, wagons or vessels belonging to or under the responsibility of the armed forces,by seagoing vessels on maritime waterways forming part of inland waterways, by ferries only crossing an inland waterway or harbour, wholly

performed within the perimeter of an enclosed area.

The transport of dangerous goods by road, rail or inland waterway presents a considerable risk of accidents. Measures should therefore be taken to ensure that such transport is carried out under the best possible conditions of safety.

Dangerous goods in Poland are transported mainly by road and a little amount by rail.

Poland ratified the Regulations concerning the International Carriage of Dangerous Goods by Rail - RID and the European Agreement concerning the International Carriage of Dangerous Goods by Road - ADR in 1975.

Even, if the RID and ADR agreement is ratified, unfortunately there are still problems in the transport sector, especially problems regarding the transport of dangerous goods, that offers extensive deficiency at streets. The most numerous group of dangerous goods include items of class 3 (liquid, flammable materials), especially liquid fuels.

There is not monitoring system to control in real time dangerous goods vehicle in Poland. The aim to develop a cooperative system for dangerous goods vehicles (DGV) through route monitoring, re-routing (in case of need) enforcement and driver support, based upon dynamic, real time data, in order to minimize threats related to movements of DGV.

2 CHARACTERIZATION OF DANGEROUS GOODS

2.1 *General characterization*

Hazardous material is a material or object which, is not be accepted for carriage by road, or is approved for such carriage under the conditions laid down in those provisions [12, 18, 19]. There are nine classes of dangerous goods as follows:

- Class 1. Explosive substances and articles;
- Class 2. Gases, including compressed, liquefied and dissolved under pressure gases and vapours (Flammable gases e.g. butane, propane acetylene. Non-flammable and non-toxic, likely to cause asphyxiation e.g. nitrogen, CO_2 or oxidizers e.g. oxygen. Toxic e.g. Chlorine, Phosgene);
- Class 3. Flammable liquids:
- Class 4.1. Flammable solids, self-reactive substances and solid desensitized explosives;
- Class 4.2. Substances liable to spontaneous combustion;
- Class 4.3. Substances which, in contact with water, emit flammable gases;
- Class 5.1. Oxidizing substances;
- Class 5.2. Organic peroxides;
- Class 6.1. Toxic substances;
- Class 6.2. Infectious substances;
- Class 7. Radioactive material;
- Class 8. Corrosive substances;
- Class 9. Miscellaneous dangerous substances and articles.

2.2 *Percentage share of dangerous goods delivery*

The transport of dangerous goods in the EU-28 slightly increased [10] from 79 billion tonne-kilometres in 2010 to almost 81 billion tonne-kilometres in 2012, but felt to 74 billion tonne-kilometres in 2013 before increasing again in 2014 to reach 75 billion tonne-kilometres (+1.5 % compared to 2013) – table 1.

Table 1. Transport of dangerous goods by reporting country, 2010-2014 (million tonne-kilometres) [10]

	2010	2011	2012	2013	2014	Change 2013-2014
EU-28	79 106	81 023	80 805	73 946	75 027	1.5%
BE	1 853	1 973	1 985	2 124	1 694	-20.2%
BG	347	665	928	958	684	-28.6%
CZ	1 669	1 787	1 393	1 281	1 567	22.3%
DK	772	730	767	760	690	-9.2%
DE	12 853	13 028	12 773	12 958	12 912	-0.4%
EE	171	189	133	163	172	5.5%
IE	379	419	443	476	355	-25.4%
EL	2 708	1 989	2 268	1 169	1 010	-13.6%
ES	11 643	11 908	11 833	10 626	11 718	10.3%
FR	7 325	7 785	8 900	8 158	7 976	-2.2%
HR	481	533	511	483	501	3.7%
IT	11 342	9 556	8 313	8 037	7 358	-8.4%
CY	184	194	167	181	147	-18.8%
LV	114	234	219	213	227	6.6%
LT	283	324	392	386	534	38.3%
LU	413	482	581	700	839	19.9%
HU	1 049	1 032	883	997	1 023	2.6%
NL	3 432	2 749	2 232	1 342	957	-28.7%
AT	1 083	1 144	928	946	933	-1.4%
PL	5 880	6 848	6 801	7 024	8 778	25.0%
PT	938	1 143	715	973	946	-2.8%
RO	1 369	1 182	1 453	1 704	1 664	-2.3%
SI	607	842	637	552	724	31.2%
SK	498	361	289	228	329	44.3%
FI	2 169	1 535	1 357	1 426	1 423	-0.2%
SE	1 387	1 304	1 251	1 064	1 283	20.6%
UK	8 157	11 087	12 653	9 017	8 583	-4.8%
NO	1 321	778	1 319	1 141	1 029	-9.8%
CH	794	506	833	749	812	8.4%

Between 2010 and 2014, most Member States have observed a decrease in the transport of dangerous goods [10]. The highest falls were recorded in the Netherlands and Bulgaria (-29 %), followed by Ireland (-25 %) and Belgium (-20 %). On the other side, very high increases of transport of dangerous goods were registered in countries like Slovakia (+44 %), Lithuania (+38 %) and Slovenia (+31 %) - table 1.

Table 2 shows the share of the transport of dangerous goods between national and international transport in 2014 [10]. For most of the countries, more than half of the transport of dangerous goods is performed on national territory. Luxembourg has a special pattern: as most of its transport is international transport, more than 90 % of the transport of dangerous goods is performed in international transport. For most countries, the share of dangerous goods carried in international transport is linked to the share of international transport (total of all goods). Exceptions are Bulgaria, Croatia, Estonia, Hungary, the Netherlands, Austria, Poland, Portugal and Romania: international transport represents more than half of these countries'

transport, but most of these countries' transport of dangerous goods is performed on national territory.

Table 2. The share of the transport of dangerous goods between national and international transport in 2014 [10]

Figure 1 shows the types of dangerous goods in road transport in 2014 [10].

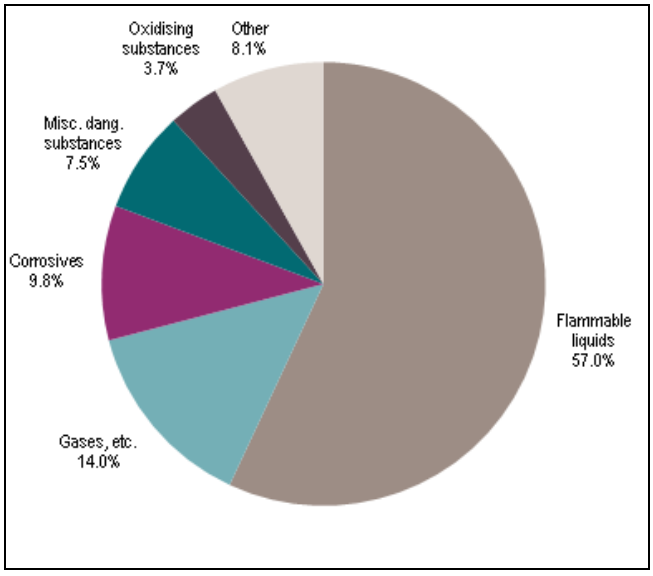

Figure 1. EU - 28 transport of dangerous goods by type, 2014 (% in tonne-kilometres) [10]

The largest specific product group was flammable liquids, taking over more than half of the total. Two other groups, gases (compressed, liquefied or dissolved under pressure) and corrosives, accounted for 14 % and 10 % respectively. This represents very little change compared with previous years showing a very similar distribution between product groups.

The methodology being used in the collection of the data implies considerable uncertainties about the figures, both in absolute values and in terms of allocation by country and type of dangerous goods [10].

According to statistics [1], dangerous goods in European Union in 2004 were carried by transport in three manners as follows (see figure 2):
- by Inland Waterways – 17%,
- by Rail – 25%,
- by Road – 58%.

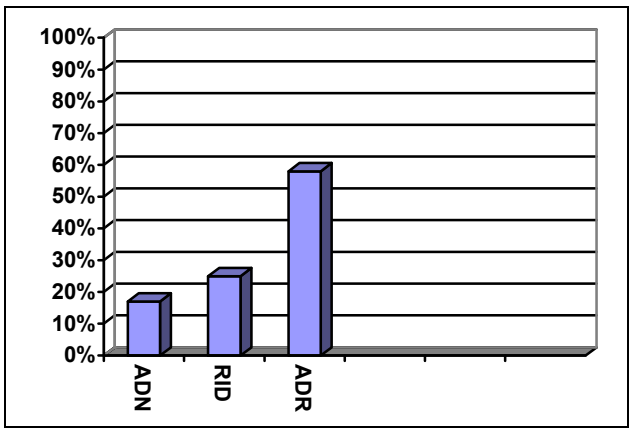

Figure 2. Transport of Dangerous Goods in European Union [1]

In 2011 there were some changes of DG statistics in European Union as follows (see figure 3):
- by Inland Waterways – 6.8%,
- by Rail – 27.4%,
- by Road – 65.8 %.

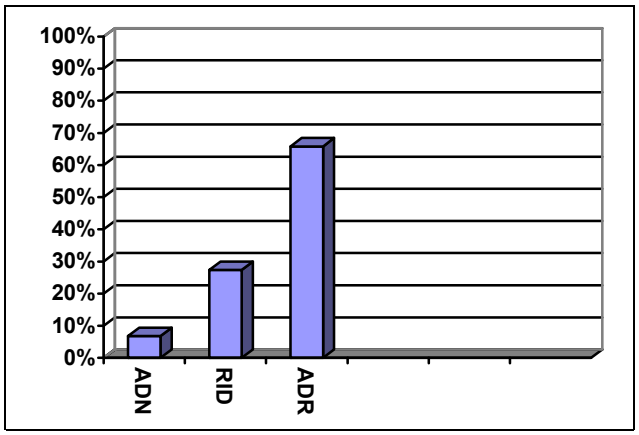

Figure 3. Transport of Dangerous Goods in European Union [10]

According to Commission Recommendation [2] Member States should follow the guidelines set out in the Annex when completing the annual report on checks concerning the transport of dangerous goods by road as follows:
- Number of transport units checked on the basis of the contents of the load (and ADR),
- Number of transport units not conforming to ADR Number of transport units immobilised,
- Number of infringements noted, according to risk category (Risk category I, II, III);

– Number of penalties imposed, according to penalty type (Caution, Fine, Other).

In Poland, according to statistics [20], 87.5% of dangerous goods are carried by road transport and only 12,5% by rail in 2014.

According to data provided by M. Różycki and P. Grzegorczyk the largest amounts transported concern liquid materials (table 3, 4).

Table 3. Percentage share of the dangerous goods transported [4, 5, 6, 7, 11]

Class	Share	Percentage
Class 1	Explosive substances and articles	0.95%
Class 2	Gases, including compressed, liquefied and vapours	25.17%
Class 3	Flammable liquids	66.19%
Class 4.1	Flammable solids, self-reactive substances	1.50%
Class 8	Corrosive substances	1.62%
Class 9	Miscellaneous dangerous substances and articles	2.93%
Rest	Class 4.2, 4.3, 5.1, 5.2, 6.1, 6.2, 7	1,64%

Table 4. Percentage share arranged according to the form of transport [4, 5, 6, 7, 11]

Transport means	Percentage
Tankers	79%
Containers	20%
Goods in bulks	1%

To make a right choice of packaging for the transport of dangerous goods, some materials classified as hazardous classes ADR, may be included in the so-called packing groups according to the degree of danger they present. In most cases, the degree of risk is assessed on a three-stage scale:
– Packing group I: Substances presenting high danger,
– Packing group II: Substances presenting medium danger,
– Packing group III: Substances presenting low danger.

3 ORGANIZATION OF CARRIAGE OF DANGEROUS GOODS

3.1 *SEE Mariner project*

The South Eastern Europe (SEE) area is a sea and river transit space of vessels carrying hazardous freight which constitutes many potential environmental risks for coasts and inland waterways.

Economic development and a strong growth of transport and increased traffic in the SEE area aggravate the already increased threats of pollution and thus require a good management and high performance of observation, communication and monitoring response systems (figure 4).

Therefore the SEE MARINER (South Eastern Europe Marine and River Integrated System for Monitoring and Transportation of Dangerous Goods) project was developed [13] from February 2011 to December 2013 (overall project budget: 2.188.000,00 €).

Figure 4. South East Europe marine and river information systems, http://www.seemariner.eu

It was focusing on mitigating environmental risks arising from the transportation of dangerous goods in marine areas and rivers by applying an integrated system for the joint prevention and response procedures, enhanced monitoring of maritime and river traffic and increased coordination capacity for the mobilization of the relevant authorities and stakeholder groups.

SEE Mariner project results:
– Improved coordination, harmonization and availability of data on the transportation of dangerous cargoes;
– Enhanced managerial skills and equipment for handling dangerous cargoes;
– Developed and tested common management structures and tools for the monitoring of dangerous goods transportation;
– Streamlined procedures and protocols for emergency situations or disasters caused by the transportation of dangerous goods.

3.2 *Responsibility of dangerous goods in Poland*

Road transport of dangerous goods, means any movement of dangerous goods by the vehicle on public road or other generally accessible roads, including stops required during the transportation and activities related to this haulage [14].

Road transport of dangerous goods is a complex process, which is why many sectors are responsible for its implementation [14, 15, 16, 17]:
– the minister responsible for transport, supervises the transport of dangerous goods and the entity executing tasks associated with this transport with the exception of the armed forces vehicles,
– Minister of National Defence, supervises the transport of dangerous goods by the transport means belonging to the armed forces,
– Minister responsible for the economy, deals with the matters of technical conditions and testing of packaging of dangerous goods,

- Minister responsible for health, deals with the matters of the conditions of carriage of infectious substances,
- Provincial Inspector of Road Transport - in the matters of the road transport safety inspections of hazardous materials,
- President of the National Atomic Energy Agency, on in the matters concerning conditions of carriage of radioactive material.

3.3 *Control services of dangerous goods in Poland*

The participant of carriage of dangerous goods is required to send a copy of the annual report on its activities in the carriage of dangerous goods and related activities, hereinafter referred to as "annual report" before the February 28 of each year following the year covered by the report, to the voivodship road transport inspector appropriate for the seat or place of residence for the participant of dangerous goods carriage.

If, a serious accident or breakdown occurred in connection with the carriage of dangerous goods, within the meaning of ADR, the transport participant, within 14 days from the day of the event, is to submit the report:
- to the appropriate, for the place of the event, Regional Road Transport Inspector - in the case of road transport of dangerous goods,
- Head of the Armed Forces Support Inspectorate - in the case of transport of dangerous goods by the transport means belonging to the armed forces or means of transport, for which the armed forces are responsible.

Information about a serious incident or accident in the carriage of dangerous goods is transferred to the Minister responsible for transport by these authorities, immediately upon receipt by them of the accident report [14, 15, 16, 17].

The inspection of the transport of dangerous goods is conducted by:
- Road Transport Inspectorate officer – on the roads, parking lots and at the place of business of the participant in the carriage of dangerous goods,
- Police officers - on the roads and parking lots,
- Border Guard officers - on the roads and parking lots,
- Customs officers - on Polish territory,
- Military Police Soldiers – with respect to the carriage of dangerous goods performed by the armed forces.

In carrying out inspection, the officers work together, to the extent necessary, with the authorized representatives of:
- Nuclear regulatory bodies - on the conditions of carriage of radioactive material,
- Transport Technical Supervision - on the conditions of carriage of dangerous goods,
- Inspectorate for Armed Forces Support and the Military Technical Inspection – on the carriage of dangerous goods performed by the armed forces,
- Inspection of Environmental Protection – on the matters relating to compliance with environmental regulations.

Road Transport Chief Inspector reports serious or repeated infringements, jeopardizing the safety of the transport of dangerous goods, carried out by the vehicle or company from another Member State of the European Union, to the competent authorities of the Member State of the European Union, in which the vehicle or the company is registered.

According to the competence possessed, the Road Transport Chief Inspector, provides the Minister responsible for transport matters the information, before March 31 of each calendar year, on penalties imposed for violations relating to the carriage of dangerous goods and the number of checks on the transport of dangerous goods, observed breaches of regulations, relating to the carriage of dangerous goods.

Road Transport Chief Inspector conveys to the European Commission each calendar year, and not later than 12 months from the end of this year, a report on the inspection of road transport of dangerous goods which contains the following information:
- If possible, the actual or estimated volume of dangerous goods by transported by road (in the tons transported or in ton-kilometres),
- The number of checks carried out,
- The number of vehicles checked at registration location (vehicles registered in this country, in other EU Member States or other countries),
- The number and types of infringements.

3.4 *Problems of dangerous goods monitoring*

Road transport of goods within the EU, including Poland is growing constantly, as is evidenced by the data presented in table 5.

According to the of Central Statistical Office (CSO), about 10 percent of cargo transported by trucks on the Polish roads are dangerous goods.

Table 5. Road transport - transport of goods [20]

Year	DG road transport weight (million ton)	DG rail transport weight (million ton)
2005	107.98	26.96
2010	149.13	23.46
2013	155.31	23.26
2014	154.79	22.79

In 2013, it was 155.31 million tons of dangerous goods transported by road and only 23.26 million tons by rail, often representing lethal threat. 155.3 million tons per year, is 425 thousand tons a day - to carry the load on standard semi-trailers with a capacity of 18 tons, it takes 23.6 thousand trucks per day. There was a little decrease in 2014, 154.79 million tons of dangerous goods transported by road and only 22.79 million tons by rail, often representing lethal threat.

According to the Road Transport Inspection data, in 2011, inspectors checked more than 16 thousand vehicles carrying hazardous materials. The most common violations consisted of by passing restrictions on drivers' driving times and mandatory rest periods, lack of fire-fighting equipment in

vehicles, poor labelling of goods and lack of required transport certificates and documents.

Similar data can be found in the report of the Supreme Audit Office (SAO). Irregularities lead to a situation in which entrepreneurs, advisors for the safety matters and drivers are not adequately prepared to organize and carry out transport of dangerous goods. Hazardous materials are transported in Poland often during peak traffic hours, near public buildings and green areas. There are more and more frequent accidents and crashes involving their transport. Provincial governors and marshals are not aware of the potential risks, and the persons directly responsible for the transport of these materials are poorly prepared for that.

Every day on the Polish roads, one can meet thousands of trucks carrying explosives, corrosive, or radioactive materials. They drive virtually unattended.

Improper handling of them can result in death, the huge material losses and environmental contamination.

According to statistics [9], threats of DG delivery in Poland were gained serious number from 2005 to 2007 (see table 6).

Under the ADR agreement, in the case of vehicles carrying dangerous goods at high risk, there should be monitoring devices used for dangerous goods (telemetry systems, tracking devices for movement of goods), effectively prevent the theft of vehicles and cargo.

In addition, following the tragic events of September 11, 2001 in New York, and March 11, 2004 in Madrid, the EU directive was adopted, which drew attention to the possibility of terrorist attacks, including the use of dangerous goods, which are subject to the obligation of monitoring (tracking).

Therefore, to ensure the monitoring of dangerous goods in Poland, it is necessary to design and implement national monitoring system of DG.

Table 6. Local threats No of DG delivery in Poland from 2005 to 2007 [9]

Category	Chemical threats	Ecological threats	Total (No)
Man deliberate activity	3	3	6
Defects and improper usage	6	1	7
Improper storage of DG	6	2	8
Man unintentional activity	4	7	11
Defects of mechanical devices	6	15	21
Improper operation of transport means	5	20	25
Unidentified	25	66	91
Defects of transport means	37	78	115
Lack of condition monitoring of DG	67	87	154
Unlawful of Road Transport Safety	104	446	550
Total	263	725	988

4 PROPOSITION OF NATIONAL SYSTEM OF MONITORING DANGEROUS GOODS VEHICLES - NSMDGV

4.1 *Structure of system*

To decrease the risk during transportation, there is a complex information system which will monitor the oversized and dangerous goods in real time, and which will be interconnected on-line with an integrated emergency system. To determine this kind of system there should be taken into consideration the following architecture qualities: modularity, flexibility, possibility to be used in heterogeneous, environment, interoperability, use of open standards, performance, language independency, system reliability, information security and safety, user interface usability, service intelligence [8].

It intends to carry out the following tasks:

- Analysis of legislative, international, EU and national documents on the transport of dangerous goods,
- Analysis of operating and implemented ITS solutions in the EU countries and Poland, associated with the process of monitoring dangerous goods,
- Analysis of the functional, communication and physical (transport layer) structure of the systems monitoring vehicles carrying dangerous goods,
- Identifying the needs for interoperability, reliability, security, and mobility of the ITS solutions at different user levels,
- Identification of monitoring systems for vehicles carrying dangerous goods in the world and the EU,
- Developing a model of the national monitoring system for vehicles carrying dangerous goods - NSMDGV (see figure 5),
- Developing technical specifications for the demonstrator of the national monitoring system for vehicles carrying dangerous goods – NSMDGV,
- Producing the national monitoring system demonstrator for vehicles carrying dangerous goods - NSMDGV.

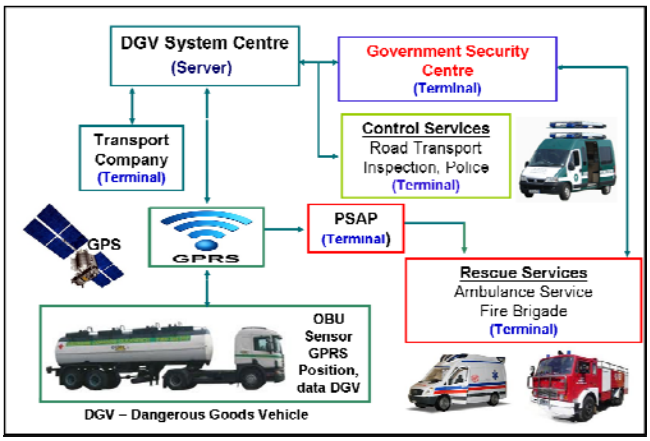

Figure 5. Scheme of NSMDGV (own study)

The final effect of project will be model and demonstrator of the National Monitoring System of Dangerous Goods Vehicles consists of following elements:

- demonstrator of system centre,

- five demonstrators of on-board unit (OBU) for DGV,
- five demonstrators of terminals for Crises Management Centre, Control Services, PSAP (Public Safety Answering Point), Rescue Services and Transport Company,
- demonstrator of innovation sensor for detecting chemical and gases threats.

Demonstrator of System Centre will be perform as a form of communications server with interface, that provides:
- communications with objects,
- random configuration of objects,
- monitoring of objects on map,
- configuration of alarm state of objects,
- creating of standard rotes.

Demonstrator of OBU for DGV can provide some functions as follows:
- localization of DGV,
- communications to System Centre,
- identification and configuration of OBU,
- data collection from sensors, meters and logical inputs.

Demonstrator of terminal will be perform as a form of client applications connected to communications server. The applications provide as follows:
- monitoring of actual positions of objects on map,
- configuration of alarm state of objects,
- creating of standard rotes.

4.2 *Technical characteristics of system*

The use of GPS and GSM technology, supported by a specialized software package enables the location of vehicles on the Polish territory as well as the entire Europe. This solution not only enables the precise location of the vehicle, but allows:

- monitoring the cargo, its physical and chemical state, which substantially affect the safety of those involved in transport as well as members of the public
- localising the vehicle transporting dangerous goods and other vehicles on the road,
- more efficient management of the fleet of transport companies, which has a direct impact on reducing the cost of transport,
- remote immobilisation of the vehicle, in case of e.g. theft,
- acquisition of a vehicle operating data,
- acquisition of the prevailing meteorological data from the vehicle,
- maintaining constant communication, vehicle – base, and sending messages,
- in the event of a breakdown or disaster automatic notification of the appropriate crisis management centre and emergency services,
- selection of the optimal and economical routes (defining route and maximum deviation from it for safety reasons such as traffic, weather conditions and surface condition).

The accidents of transport dangerous goods are caused mainly by changes in the tankers and containers environment during transportation (such as temperature, humidity, pressure, etc.) or a mixture of goods caused by a chemical reaction and lead to combustion, explosion, toxic gas leaks and so on. Therefore, it has great significance of improving the safety of road tankers and container in the real-time state can be monitored during whole the transportation of dangerous goods. Early and accurate detection, characterization and warning of a chemical and gas event are critical to an effective response. To achieve these objectives, an integrated system of sensors is needed and a supporting information technology network.

Demonstrator of NSMDGV (National System of Monitoring Dangerous Goods Vehicles) should be in line with all specifications (environmental, physical and electromagnetic compatibility) determined by EU directives and standards defined by CEN, ISO and ETSI. The main of tem are following:
- Council Directive 73/23/EEC of 19 Februarv 1973 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits,
- Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility,
- Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity,
- PN-ETS 300 135:1997/A1:1999. Radio Equipment and Systems. Angle-modulated Citizens' Band radio equipment. Technical characteristics and methods of measurement,
- PN-ETS 300 673;2005. Radio Equipment and Systems RES. Electromagnetic Compatibility (EMS),
- PN-ETSI EN 300 433-2 V1.1.1:2003. PN-ETSI EN 301 489-1 V1.6.1:2006. PN-ETSI EN 301 489-13 V1.2.1:2003. Electromagnetic compatibility (EMC) and Radio Spectrum Matters,
- PN-EN 60950-1:2007/A1:2011. Information technology equipment – Safety.

5 CONCLUSIONS

DGV can cause an accident and lead to fires, explosions and chemical poisoning or burning with considerable harm to people and the environment.

There is not monitoring system in Poland to control in real time road transportation of dangerous goods.

Developing the model and the implementation of the national monitoring system demonstrator for the vehicles carrying dangerous goods - NSMDGV can significantly contribute to:
- improving the safety of people and the environment,
- developing methods to minimize the damages and costs,
- improving the exchange of information between the centres of production, transport, collection and rescue,
- developing methods of cooperation at the breakdown site.

REFERENCES

[1] Bojar P, Assessment of threats connected with transport of hazardous materials by train. Logistics No 6/2011.

[2] Commission Recommendation of 21.2.2011 on reporting of checks concerning the transport of dangerous goods by road. Brussels, C(2011) 909.

[3] Directive 2008/68/EC of the European Parliament and of the Council of 24 September 2008 on the inland transport of dangerous goods. Official Journal of the European Union, L 260/13, 30.9.2008,

[4] Grzegorczyk, K., Hancyk, B., Buchcar R., Dangerous Goods in Road Transport. ADR 2007-2009. BUCH-CAR. Błonie 2007.

[5] Grzegorczyk, K., Buchar, R, Dangerous Goods. Transport in practise. ADR 2011-2013. BUCHCH-CAR. 1 Issue 2011.

[6] Grzegorczyk, K., Changes in Dangerous Goods Transport. Dangerous Goods (Towary Niebezpieczne), No 1/ 2011.

[7] Grzegorczyk, K., Transport of Dangerous Goods. Dangerous Goods (Towary Niebezpieczne), No 3/ 2011.

[8] Kršák, E., Herkt, P., Technical Infrastructure for Monitoring the Transportation of Oversized and Dangerous Goods. Proceedings of the Federated Conference on Computer Science and Information Systems. 2012.

[9] Michalik, J., Gajek, A., Grzegorczyk K. & others. Threats reasons of DG in road transport. Bezpieczeństwo Pracy. Nauka i Praktyka nr 10/2009. CIOP, Warsaw 2009.

[10] Road freight transport by type of goods. EC, Eurostat statistics explained, http://ec.europa.eu/eurostat/statistics-explained/index.php/Road_freight_transport_by_type_of_goods, 10 February 2016.

[11] Różycki, M., Safety Transport of Dangerous Goods. PPHU Moritz Marek Różycki, 2009.

[12] Regulations concerning the International Carriage of Dangerous Goods by Rail (RID), http://www.cit-rail.org/en/rail-transport-law/cotif. 01.01.2013.

[13] Squillante, P., South Eastern Europe Marine and River integrated Monitoring System for the Transportation of Dangerous Goods, Italy, 31/1/13, http://www.southeast-europe.net/en/projects/approved_projects/?id=147.

[14] The act from 15 November 2011. OJ. 2011, No 227, pos. 1367.

[15] The act from 15 November 1984. Transport Law. OJ. 2000, No 50, pos. 601.

[16] The act from 29 November 2007. Atomic Law. OJ. 2007, No 42, pos. 276.

[17] The act from 21 December 2000 refers Technical Inspection. OJ. 2000, No 122, pos. 1321.

[1] The European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR), 1 January 2013, www.unece.org/trans/danger/publi/adr/adr_e.html.

[18] The European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN). ADN 2013: Annexed regulations, 1 January 2013, http://www.unece.org/trans/danger/publi/adn/adn2011/13files_e.html, 1 January 2013.

[19] The statistics of Central Statistical Office from June 2015. Concise Statistical Yearbook of Poland. Warsaw 2015.