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Safety Management of Dangerous Goods Logistics Warehouses

A veszélyes áru logisztikai raktárbázisok biztonságszervezése

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Introduction

Major accidents or events related to hazardous substances that may occur in the chemical warehouses can seriously endanger the environment and the people living in the environment after the release of the dangerous substances stored there. The present article after the analyses of main safety features of chemical logistics warehouses provides a short outlook on safety management aspects of national legal regulations published in the field of management of environmental risks arising in dangerous substance logistic warehouses.

Bevezetés

A veszélyes anyagok tárolására szolgáló logisztikai létesítményekben esetlegesen bekövetkező veszélyes anyagokkal kapcsolatos súlyos balesetek vagy események az ott tárolt veszélyes anyagok kiszabadulását követően súlyosan veszélyeztethetik a környezetet és a környezetben élőket. Jelen cikk a veszélyes áruval foglalkozó logisztikai raktárak főbb biztonsági jellemzőinek elemzése után rövid kitekintést ad a veszélyes áru logisztikai raktárakban felmerülő környezeti kockázatok kezelése terén megjelent nemzeti jogszabályok biztonságszervezési aspektusaira.

Kulcsszavak: ipari balesetek, környezeti károk, veszélyes üzemek, biztonságszervezés, veszélyes anyag logisztikai raktár

Keywords: industrial accidents, environmental impact, dangerous establishment, safety management, chemical warehouse

Incidents

There have been a number of major industrial accidents involving dangerous substances around the world, often with fatal consequences, which have spread beyond the site and have had a catastrophic effect on both surface and groundwater. Dangers caused by dangerous substances and dangerous goods storage units appear in Hungary (just like abroad) in facilities that store

dangerous substances, and base materials, semi-finished and finished products with sub-limit qualification. Such units include plants producing and processing and storing – mainly for commercial purposes – dangerous substances (dangerous goods logistic warehouse bases). We may experience damage to the environment as a consequence of emission of dangerous substances and irregular leakage of fire water into the environment [1].

The present article provides a short outlook on international trends in legal regulations published in the field of management of environmental risks arising in dangerous substance logistic warehouses.

Safety Features of Chemical Warehouses

The most typical locations for dangerous goods are the plants that produce, store and process dangerous substances and transportation operations with dangerous goods. Among the plant facilities used for the transport of dangerous goods by road, we have in mind the dangerous goods storage bases in which dangerous goods with special packaging are stored. Railway transport operating facilities are mainly railway marshalling yards. Inland waterway transport facilities include the loading, unloading and storage facilities of dangerous substances plants, as well as ports handling dangerous goods. In the case of air transport preparation facilities, the dangerous goods warehouses located in the airport area can be identified primarily [2].

Facilities working with dangerous substances under the regulation on the protection against major accidents with dangerous substances and facilities working below the limit values are categorised as dangerous facilities. Facilities working with dangerous substance are called "Seveso plants" that work with dangerous substances between the lower and upper limit values.

As the rule of thumb, logistic facilities working with dangerous goods do not belong to the scope of the Seveso III Directive. Already in 2012, lawmakers have covered the scope of the regulation on the facilities that transport dangerous substances through pipelines. However, railway shunting yards and ports are most unfortunately still not considered facilities working with dangerous substance presenting major accident risks.

In the present study, we are addressing industrial, agricultural and commercial facilities where dangerous substances and dangerous goods are stored. These may include the following:

- logistic warehouse bases engaged in independent dangerous substance storage;
- or base material, semi-finished product or finished product warehouses of plants where dangerous substances are processes, stored or produced.

In the classical concept, logistic warehouses storing dangerous substances are depots where such substances are stored in packaging in compliance with the ADR (The European Agreement Concerning the International Carriage of Dangerous Goods by Road), and no operation is performed that would require a specific packaging process of the opening of the internal packaging.

Logistic warehouse bases implemented in Hungary during the past 10–15 years were built in compliance with technical safety, environmental protection and disaster management requirements prescribed for modern dangerous goods warehouses. Some of the dangerous substance warehouses operating in the area of the chemical sector and agriculture (for instance pesticide warehouses) are, however, in residential areas and have outdated configuration and equipment pool, moreover as a consequence of their transformation, they are often used for purposes other than their original destination [3].

Logistic bases implemented with traditional plans are, in my opinion, only partly acceptable for the storage and treatment of dangerous goods from fire protection and industrial safety aspects.

It can be concluded that logistic warehouse bases implemented in Hungary with state contribution – as they, at the same time, form a combined transport nod – are also able to play production and distribution functions.

The following are the typical characteristics of the activities of logistic warehouse bases of dangerous goods:

- The purpose of logistic warehouse bases storing dangerous goods is to perform the logistic warehousing operations in these facilities in leasing structure and in a passive form.
- In these depots, only finished products are stored, commissioned and distributed.
- The arriving ADR packaged products are forwarded without further procession and in most cases in their original package.
- The goods received in these warehouses are stored in a pallet system, on scaffolding or shelves, and forklifts etc. are used for moving the goods.
- In case of logistic warehouse bases, we cannot speak about a "classical" equipment of chemical technology.
- In these logistic warehouse bases storing dangerous goods, the "technology" basically covers the movement and storage of materials and substances in qualified packaging solutions.

Analysis of major industrial accident scenarios during storage of dangerous substances

A common feature of logistics organisations engaged in the storage of dangerous goods is that the quantity and type of dangerous goods in their territory are controlled by the legislation on the prevention of major industrial accidents; this legislation may change at any time. Therefore, the safety documentation (safety analysis and report) prepared for the industrial safety authorisation of dangerous activities should provide a high degree of flexibility in the quantity and quality of dangerous substances and allow for adaptation to continuous change. In addition to the qualitative analysis of dangerous goods stored in dangerous goods logistics warehouses, their quantitative data must also be determined. The amount of dangerous substances stored depends primarily on the manner, shape, and vulnerability of storage and packaging. Storage tanks containing liquid dangerous substances may release dangerous substances into the environment in quantities appropriate to the size of the tanks and the conditions of discharge. In case of damage to the collection package (pallet) consisting of unit packages, the amount of escaping material depends on the design and nature of the package and may exceed the maximum weight of the collection package. The major accidents involving dangerous substances usually occur at process equipment, storing equipment, pipelines, loading and unloading installations, or during transportation of dangerous substances within the establishment. Modelling the consequences of a major accident requires input data such as physical and chemical properties of dangerous substances (inflammability, toxicity etc.), emission potential (heat radiation, overpressure) releasing properties (quantity, state of aggregation etc.) and weather conditions. The results of this model calculation is specified in terms of seriousness of the (potential) effect. Potential effect is usually expressed in terms of risk to health in the safety reports, although relative damages to property or environment can also be specified [4].

The risk analysis of the dangerous establishment must cover the following important elements: a detailed description of the internal and external prerequisites (causes) and probability of occurrence of possible major accident scenarios; evaluation of the seriousness and possible consequences of the identified major accident hazards; description of the technical prerequisites and the applied equipment that are necessary for safe operation of the dangerous establishments;

the emergency responses for mitigation of consequences of major accidents.

In the case of fires in warehouses of dangerous goods, the most significant event endangering the environment is the release of toxic substances and combustion products. This can pose a serious environmental risk.

In the event of storage fires, various adverse effects on human health and the environment are to be expected. These dangerous substances, based on their flammable and / or toxic properties, may include: the toxic effect of the release of the toxic dangerous substance; the formation of a fire following the release of flammable substances and the effect of toxic combustion products in a fire which causes a serious accident. The latter can have both air and water pollution effects.

In case of fire, mainly due to the effect of heat radiation, plastic containers may be damaged, as a result of which toxic material may be released into the open air. Furthermore, toxic substances released under high temperature conditions evaporate faster, so their consequences for human health can have a more severe toxic effect than the release of dangerous substances under normal storage conditions.

In the event of an extensive storage fire, arsenic, sulfur, nitrogen, chlorine, fluorine, as well as toxic combustion products from bromine atoms will release such as arsenic oxide, sulfur dioxide, nitrogen dioxide, hydrochloric acid gas, hydrogen fluoride, or hydrogen bromide. Emissions of toxic combustion products generated by storage fires are expected to cause severe air and water pollution, and pose a direct threat to the facility's environment, including surface and groundwater. Examining this is one of the most important professional tasks for operators.

The appropriate solution of the later problem is the domestic application of the recommendations of the methodological guide Safety Guidelines and Good Practice for the Management and Retention of Firefighting Water developed by the United Nations Economic Commission for Europe [5].

Analysis of safety regulation on the safety management of chemical logistics warehouses

The disaster management regulations concerning accidental water pollution in dangerous establishments are mostly based on the legal regulations dealing with the prevention of major accidents involving dangerous substances and the fire prevention regulations as well. The content requirements for the safety reporting documentation set out in the Seveso III Directive have generally been incorporated into Hungarian law. The implementation regulations of the Seveso III Directive in Hungary are:

- Act CXXVIII of 2011 on disaster management and the amendment of certain related laws
- Government Decree 219/2011 (X. 20.) on the prevention of major-accident hazards involving dangerous substances.

The content requirements of the safety documentation must be adapted to the acceptance of technical requirements of an environmental impact. In this case the analysis of the consequences of environmental effects, the introduction of remediation, decontamination and disposal measures as well as the personal and technical conditions of the application of response measures must be taken into consideration.

The Ministry of the Interior Decree 54/2014 (XII. 5.) on National Fire Protection Regulations (hereinafter: NFPR) contains the most important requirements for the design of storage facilities, which are typical for logistics warehouses dealing with dangerous goods.

The most important specifications of the regulation are:

- the fire protection requirements of the materials and structures belonging to the relevant risk class that can be installed during construction;
- the fire distance;
- the floor area of the storage fire sections;
- the obligation to install fire alarm and fire extinguishing equipment;
- the required amount of extinguishing water;
- the obligation to install a wall fire hydrant and the required water;
- the requirements for heat and smoke extraction;
- the requirements for installing a fission opening surface;
- the requirements for electrical equipment and lightning protection;
- the regulation on safety lighting and safety signals;
- rules of use related to storage and the requirements for firefighting routes;
- the rules applied for the use of flammable liquids and gases.

In line with Government Decree 314/2005 (XII. 25.) on the environmental impact assessment and the unified environmental use permit procedure, the environmental protection authority issues an environmental use permit for the activities covered by this decree. The procedure is based on the obligation to carry out an environmental impact assessment procedure. Among the content requirements concerning the preparation of the environmental impact study, we can find an obligation to present and evaluate possible major accident scenarios that may cause environmental impact, the possibilities of failures, and the resulting factors.

The procedure for the prevention and remediation of environmental damage in water quality is regulated by Government Decree 90/2007 (IV. 26.) on procedures for the prevention and remedying of environmental damage (hereinafter: Environment Remediation Decree) with regard to groundwater and surface water as environmental elements, taking into account the environmental and nature protection requirements.

One of the important means of preventing fires that may occur in chemical warehouses is the establishment and operation of fire alarm systems, which fulfill their purpose together with fire extinguishing systems. Property protection systems are also part of the site physical protection system [6]. As a result of technological development, camera systems installed for the purpose of property and occupational safety tasks have also come to the fore [7]. Further research can be conducted on the dual application of the latter systems.

In the scientific examination of the present question, additional industrial safety literature sources [8-9] can be studied, which discuss in detail the legal and technical foundations of the scientific problem. The regulation on the resilience of critical entities addresses the regulation on the safety of critical infrastructure system elements, which also include in its scope dangerous establishments [10]. Similarly, we can learn important practical lessons for the development of fire protection authority activity when dealing with the policing issues of event order security [11-12].

Conclusions

In the present study, the author made the following findings based on an examination of the safety management of chemical logistics warehouses:

1. It can be stated that the majority of accidents involving a release of a dangerous substance and requiring intervention in the field of disaster management are in most cases fire events, which could have a dangerous impact not only on the air but also on the surface and groundwater.

2. In the form of quality requirements in the major-accidents regulation, there are only qualitative requirements for the acceptability of the risk of major accidents involving environmental damages.

3. One of the decisive bases for the installation and usage of dangerous goods storage facilities is the fire prevention concept. The amount of firewater and extinguishing agent is determined by the efficiency of the fire alarm system, the type of fire extinguishing equipment installed, and the amount of firewater used. The National Fire Protection Regulations does not yet have an industrial and logistics chapter dealing with the handling and storing of dangerous substances or goods.

4. In the field of prevention and remediation of environmental impacts on water quality, the preparation and application of operators remediation plans based on the Environment Remediation Decree have a decisive role.

5. It is necessary to provide training in the field of industrial pollution prevention in Hungarian industrial safety higher education, as well as in the traditional fields of activity of industrial safety.

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