

LOGISTICS OF A SUPPLY CHAIN – FIRE SAFETY DURING RESCUE AND FIREFIGHTING OPERATIONS IN SEAPORTS

Marian KOPCZEWSKI, Marek TOBOLSKI

Abstract: Logistic – of a supply chain – fire safety during rescue and firefighting operations in seaports – in this paper it was presented as a form of logistic operations carried out for the benefit of the victims of situations of potential source of fire.

The aim of logistic support during fires in seaports is to save property, life and health of the wounded and injured and to provide all people in need conditions necessary to survive in this kind of situation. The fundamental aim of logistic support during fires in seaports that in the majority of cases is performed by quartermaster and technical services of company fire service units and company forces of fire service – is limited to provide fundamental supply facilities and logistic services as well as reaching to all injured as soon as possible.

Key words: logistic support for operations, seaport, security, company emergency services, rescue and firefighting operation.

1. Introduction

A seaport is a point of contact of sea routes with roads. This specifies its function as a place in which goods are transshipped from ships to rolling stock or watercraft or vice versa. Therefore it is above all a sea routes and roads hub. Moreover, the seaport serves also as the centre of the industry that is located in it because of factors that favour this localization and are related to the neighbourhood of navigable waters and transport of raw materials among others. Centers of maritime, foreign trade, industrial and shipowner administration etc. are located there. The demand for various kinds of services, storage of goods and processing as well as dispatching is growing. Besides the nearby town, its needs and base are developing as well. Essentially, this is a complex economic organism which is characterized by different factors than other urban and industrial centers [1].

The business activity of the seaport takes place in an area that is especially developed by means of hydraulic constructions that separate the water surface of harbour (the so-called aquatory) from the land surface (the so-called port area). In technical terms the seaport is a place on water shielded from the activity of waves and wind which enables safe berth. This is ensured by breakwaters which separate the port from the sea and deep port basins with moorings that make it possible for a ship to reach shore, berth and transship. Depending on the kind of cargo and region, ship handling equipment are installed at the wharf and its base [2].

Major fire hazard in the seaport results from the concentration of national wealth of great value which consists of the infrastructure of the seaport, materials, goods, ships, warehouses, equipment, installations, arteries etc. on a restricted area. Similar concentration of so many valuable investments and material goods is found nowhere else in the whole country, even in the largest industrial centers.

A great variety of cargo and materials that are located in the port area, constant changes in payload, operations such as transshipment, storage, processing and dispatch, the presence

in the port of many industrial plants of various fields - not only shipyards, but also fish, food, timber, plant processing plants and petrochemical and chemical plants etc. also play an important role here. Depending on the material, technological processes, storage methods, transport etc. there is varied fire hazard, sometimes very high, requiring special preventive measures and spatial separation which, however, sometimes turn out to be insufficient as a result of the cramped conditions of the area which was developed without separation [3].

Essentially this depicts fire hazard in seaports which generally speaking has to be considered as high. That is why logistics support for rescue and firefighting operations plays an important role in this regard and is a factor which enables emergency services to carry out successful rescue and firefighting operations.

2. Characteristics of fire hazard in seaports

As business premises situated in the place where sea meets land, seaports are prepared in technical and organizational terms to handle foreign trade by sea along with the means of maritime and land transport [4]. That is why providing an acceptable level of fire safety in seaports has to include all kinds of risks related to the characteristics of each of them. Even though some groups of fire hazards are common to all types of seaports, a distinction needs to be made between the scale and results of their influence depending whether they concern commercial ports, passenger ports or naval bases. Taking civil ports into consideration, one has to have in mind that ports, especially those situated in Gdańsk-Gdynia or Szczecin-Świnoujście agglomerations, are key elements for the economy of our country. These are also seaports in which there is the greatest number and variety of risks. With respect to fire hazards, a separate category of seaports are fuels ports, such as Northern Port in Gdańsk where dedicated systems of early-risk detection and elimination of such hazards are used on account of the fact that the port handles media of defined fire characteristics (fire hazardous materials).

A great amount of market pulp that is transshipped, manipulated and stored in ports, as well as related to them technological groups of buildings and equipment together with people that handle them, pose a huge challenge in terms of organization of port fire safety. It is therefore appropriate to make a distinction between factors that cause fire hazards in seaports. These above all are floating objects and stationary objects and their infrastructure. A similar division exists in the International Ship and Port Facility Security Code where a distinction between port objects and ships [5] was made in the evaluation of protection of objects in order to indicate differences and interdependencies on the safety plane of these two areas that influence each other.

As far as stationary objects and fire security regulations are concerned, legislative acts that regulate proper design and workmanship, and then also utilization of developed buildings are applicable [6]. In addition, in case of seaport buildings intended for passenger movement of a great number of people, there are requirements for equipping such buildings in fire detection systems including alerting and signaling devices that automatically detect and transmit information about fire as well for using acousting warning signals and voice communications for the security of people who stay in these buildings which are automatically transmitted once they receive a signal from the fire detection system [7]. Attention must also be drawn to fire hazards which result from using land transport, both rail transport and road transport, the intensity of which is increasing significantly. Its amount and susceptibility to damage or collisions they may be involved in are likely to

disrupt the operation of the seaport, especially in case of organizational and logistic failures. In case accidents or collisions happen, they may result in serious obstacles on traffic routes impeding e.g. emergency services access to objects and as a result leads to spread of fire hazards from the wharf to floating objects or vice versa.

Changing lessees of areas and service establishment, as well as increased movement of equipment and people related to the use of port resources require port administrators to develop optimal safety procedures and constant supervision over the course of these complex processes.

Industrial buildings and technologies which are used in them, where a lot of business entities operate on a small area, have their effect on the level of fire safety in the seaport. On account of the type and amount of processed hazardous materials some of them are classified as Higher or High Risk of Major Industrial Accidents Facilities for which the following programmes are developed and implemented: Prevention of Major Industrial Accidents Programme, Safety Reports and Emergency Plans in case of an extraordinary hazard. Each of the abovementioned documents, which themselves constitute emergency procedures, need to be approved by the Fire State Service [8].

Floating object constitute a second group of objects characteristic of seaports on account of fire hazard. Having statistical data in mind, the greatest fire hazard is created when ships are mooring in the port or when they are being repaired in shipyards which usually neighbour port areas. The data presented in figures below show that fires in ports have occurred for a long time and are on the increase.

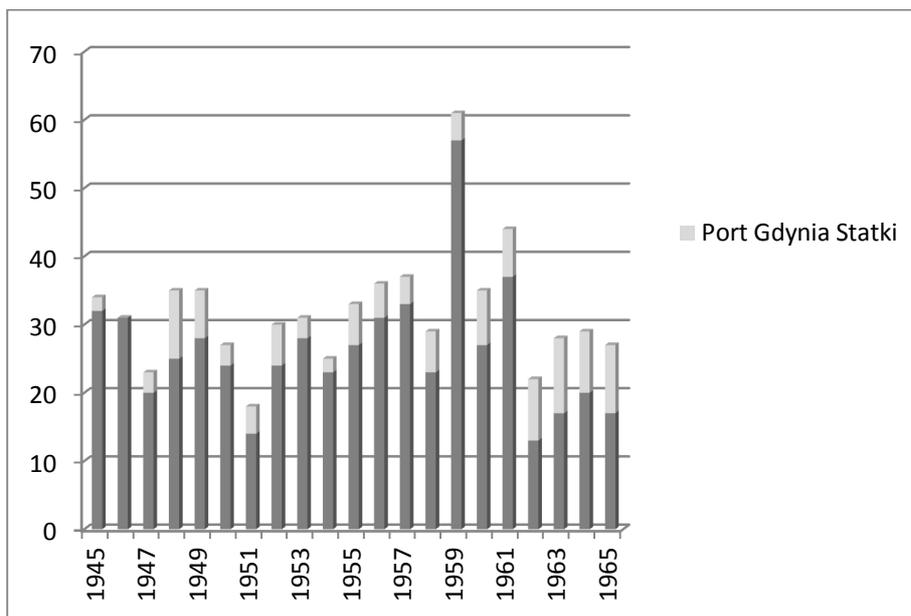


Figure 1: Fires in Polish ports in the period of 1845-1964 [2]

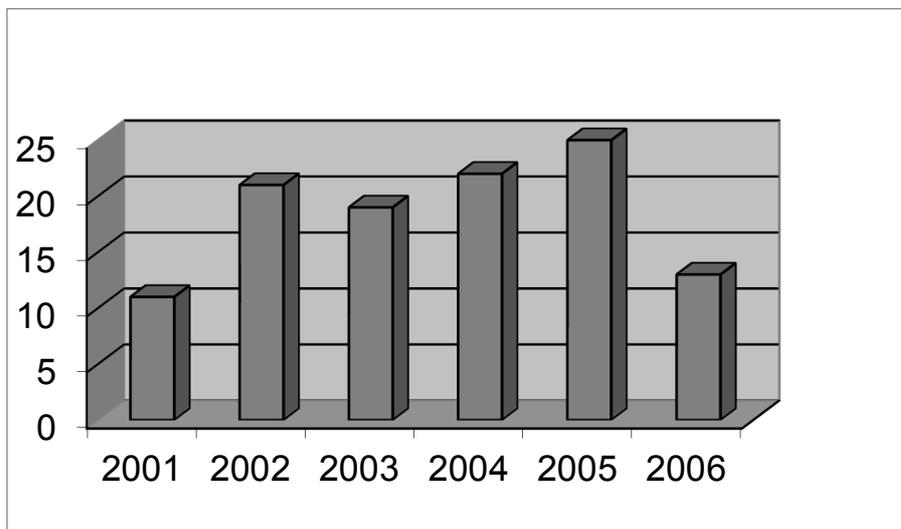


Figure 2. Ship mooring in ports fires in the period of 2001-2006 – the need for help of fire service

Source: Own work based on the data of the Marine Institute in the period of 2001-2005, page 32, and 2006, page 16.



Figure 3. The number of Polish ship fires in the period of 1980-95 depending on the place.

Source: Own work based on the data of the Marine Institute.

It turns out that fire outbreaks rarely when a ship is at sea and when all members of the crew, who as a general rule are well trained, fulfill their duties in accordance with their

responsibilities. This is supported mainly by Polish data as well as data of other European countries [9].

The data show that such factors as incomplete crew, lack of proper supervision e.g. turning off the fire detection system when the ship is mooring in ports and shipyards create situations in which the majority of fire incidents and explosions occur. Significant density of objects at wharf – mooring of various kind of floating objects such as barges, tugboats or ferries and related to them commodity turnover in the place where sea meets land, requires special safety procedures. While ensuring good storage conditions in warehouses and meeting technical and building requirements at the same time does not pose a problem, the movement of transported market pulp, which is characterized by inertia, in a changeable environment on ships requires individual approach and imagination. Two factors may cause problems here: transported great market pulp and meeting safety standards by the users of ports. That is why the most frequent causes of the outbreak of fire and explosions in the port area remain the same:

- not exercising caution when carrying out works of fire risk (welding, painting);
- electrical failures;
- equipment failures (overloads, leakage of flammable liquids);
- inappropriate storage of hazardous materials [10].

Avoiding the abovementioned hazards is nothing else but meeting basic fire safety rules and health and safety at work regulations.

Seafarer's Offices play an important role in meeting suitable standards in this regard. Through harbour boards and harbour master's offices they are to supervise the following:

- the overall operation of vessels transporting hazardous materials,
- procedures of conducting works of fire risk,
- fire safety in the area of port and harbour.

The abovementioned issues are governed by the Act of 21 March 1991 on the maritime areas of the Republic of Poland and Maritime Administration which in art. 42, section 2, item 9 establishes that "Fire supervision in Polish maritime areas and seaports and wharfs is particularly the responsibility of maritime administration body" [11].

Detailed and internal arrangements in this respect are the responsibility of administrators of individual ports.

Transport of dangerous goods carries special risk. Taking into consideration physico-chemical properties of only selected substances and materials: ammonia, ethanol, trinitrotoluene, dynamite, zinc oxides etc. which are transported in the amount of thousand tons each year and are transshipped in Polish ports, it seems obvious that one should spare no means to secure them in an optimal way. One should not forget about the earlier mentioned fact that the main Polish ports are located within urban agglomerations. What is more, organizing large-scale mass events which on account of the attractiveness of the localization in the summer period take place close to wharfs is more and more common is another reason for taking care of the safety of participants of such events.

3. The role of port fire service in fire protection of ports

Port Fire Services have long tradition in Poland. Port firefighters can be proud of their long experience and high level of professionalism in performing operations in the port area and beyond it in the form of mutual support for rescue and firefighting units of the State Fire Service. Tactics and methods of rescue and firefighting operations on floating objects require special skills because of specific conditions of ship fires. Knowledge of ship

structure and reaction of construction elements to overloads related to the influence of fire and great amount of extinguishing agents which can have disadvantageous effect on the stability of extinguished facilities is essential.

On account of the fact that they operate both on land and at sea, apart from standard fire engines, Port Fire Services have also fireboats at their disposal. They are indispensable to ensure the proper safety level of a port, their routine use consists in protecting the transported hazardous materials in the port and its neighbourhood. This concerns both the risk of fire and explosion, but also the pollution of water in port by derivatives of petroleum. The possibility of being able to access the areas and object at risk, e.g. during mass events taking place by wharfs or warehouses affected by fires which can be accessed only from port canals, is also important. Parameters of fireboats seem impressive, they enable to enter the fire zone protected and perform effective rescue and firefighting operations. However, considering the technical development and the increasing scale hazards in Polish ports, it seems that the time has come to supply or replace these fireboats, which are more than thirty years old, with vessels of the new generation.

The example of Fire Fighter, McKean and John J. Harvey fireboats shows the essence of having such fire resources at one's disposal. After the attack on the World Trade Center in New York, when as a result of destruction or serious damage none of the local water supplies was working, these fireboats saved the day by supplying water from the Hudson River to fire engines and helped to evacuate the trapped people [12].

As the initial analysis presented above shows, fire hazards turn out to be a part of hazards occurring in a specific object which is the port. Even though individual Polish ports differ from each other, their optimal fire protection requires a holistic approach supported by knowledge and experience. One also needs to have in mind that fire hazards in port can occur secondarily as a result of sabotage, they can be deliberate arsons or acts of terror. However the most important thing is the awareness of risks that can occur in the port area. This knowledge is certainly useful for vessels of the Polish Navy (the Armed Forces of the Republic of Poland) that perform operations in the neighbourhood of civil ports.

4. Logistic support for rescue and firefighting operations in ports

In the event of fire logistics deals not only with the issue of supply and providing specialist and well-being services, but also logistic support for entities (crews, units, institutions) that perform rescue and firefighting operations.

Logistics of rescue and firefighting operations provides mainly theoretical solutions that favour the development, control and supervision of supply processes and service processes which are a part of logistics chains organized for the benefit of fire victims. It is oriented to all victims, to save the live and health of the wounded and the sick, to satisfy basic logistics needs of the victims, the needs of units performing rescue and firefighting operations, to ensure the protection of supplies and logistics and medical services for all people in need and to minimize the execution time of logistics tasks [13].

It is commonly accepted that supply and provided logistic and medical services are effective when they reach all recipients: at the right time and place, in the right form or condition and in the right (essential) number.

Logistic support for rescue and firefighting operations during seaport fire includes the supply of basic supply facilities and logistic and medical services organized by logistic bodies that are an element of the port infrastructure or company emergency services.

Supply facilities that are delivered to the victims in the event of fire are mainly: drinking water, food, commonly used articles (clothing, personal-hygiene products, bedding, household appliances, cleansing agents, substitute light sources), energy products (fuel, liquid fuels, gas, electrical energy etc.)

Logistic support for victims of fires in ports is usually organized and carried out under pressure. These includes expectations of the victims formulated as demands for survival conditions in a fire situation and danger and risk of the loss of life, health or work resulting from it.

Efficient and effective performance of logistic and medical tasks for the benefit of the victims requires efficient organization of logistic management and includes: devising the strategy of operations, planning, initiating, managing and controlling the process of performing logistic (and medical) tasks in the whole supply chain (supply and services) organized for the benefit of the victims and to ensure effective rescue and firefighting operations.

Organization of and ensuring an efficient operation of the logistic system rests on Logistic Support Manager's shoulders. This system should be above all well-prepared so that the actions taken for the benefit of the victims and property proceed in a manner that is not only ordered and accurate, but also possible to carry out. The system should also consider the likelihood of the event that may occur and predict alternative concepts of operation. Once the fire risk has occurred, its results need to be removed and that is why accurate resources and means (people and equipment) to deal with these results should be collected in the system.

Qualified personnel who posses essential skills, e.g. the ability to make quick decisions, communicate with other entities or select problems well, is of vital importance here.

5. Conclusions

Seaports, as interchanges in a global supply chain, require special attention to fire safety. Ensuring safety of seaports is getting more and more difficult, it requires more and more financial contributions and in the event of fire or other local hazard to organization of a proper logistic support of conducted rescue operations.

The main aim of logistic support for rescue and firefighting operations should be ensuring organizational conditions for efficient and effective ordering of financial, material and human resources in conducted operations.

The most difficult issues in terms of logistic support are definitely ensuring appropriate communication between the people who take part in an action and their food supply. Creating radio communication network that enables to effectively lead and manage a rescue and firefighting operation is the basic task of logistic support. In order to perform this task in a suitable way, it is essential to use all available means of communication that are suitable in a given situation. One of the most difficult elements of logistic support is to providing food supply to its participants, especially during long-lasting rescue operations. Hot drinks and meals should be provided to all people taking part in an action, which in case of operations taking place in large areas can be greatly impeded.

Literature

1. Ficoń K.: Technical logistics. Logistic infrastructure, BEL Studio, Warszawa 2009.
2. Grzywaczewski Z: Fighting fires in ports. Maritime Publishing House, Gdańsk.
3. Misztal S., Szwankowski S.: Organization and use of seaports, Gdańsk 2001.

4. Gołemska E.: Compedium of logistic knowledge. WN PWN Warsaw – Poznań 2002.
5. Kwiatkowski M.: „Safety of civil population in an organizational and technical aspect of rescue and firefighting units of the State Fire Service” – “Logistics in emergency events” Science Conference materials, AON, Warsaw 2009.
6. Kwiatkowski M.: „The concept of logistic support for coordinated rescue operations within the area of Mazovian Voivodeship”. SGSP research works 2007 – Own Research, Warsaw, SGSP 2008.
7. Kubicki J.: Logistic problems in modeling transport system, WKiŁ, Warsaw 2000.
8. Mindur L.: Transport in logistic system [in] Transporting Technologies of the XXI century, ITeE-PIB, Warsaw-Radom 2008.
9. Nowak W., Nowak E.: Principles of logistics in emergency situations with elements of logistic management, Łódź-Warsaw 2009, p. 93.
10. Pełka D.: Fire hazards in Polish ports, „Przegląd Morski”, no. 3/2010, p. 25-29.
11. The Regulation of the Minister of Interior and Administration of 21 April 2006 on the fire safety in buildings, other civil structures and areas (Journal of Regulations of 2006 No. 80, heading 564).
12. The Regulation of 27 April 2001 on the Environmental Protection Law (Journal of Regulations of 2008 No. 25 heading 150 with further amendments).
13. The Act of 21 March 1991 on the maritime areas of the Republic of Poland and Maritime Administration (Journal of Regulations of 2003 No. 153, heading 1502 with further amendments).

Prof. conjunction. dr hab. Eng. Marian Kopczewski
 Higher Safety Glass in Poznan
 ul. Eliza Orzeszkowa 1
 60-778 Poznań
 tel. / fax.: (61) 8510518
 E-mail: marian.kopczewski @interia.pl

Junior Brigadier. dr Eng. Marek Tobolski
 Military Delegation of Fire Protection in Gdynia
 ul. John of Koln 8A, 81-301 Gdynia
 tel. / fax.: (58) 6266178
 E-mail: marektobolski@tlen.pl