

## Major Accident Hazard Posed by Non-Seveso Establishments in Poland and Management in the Area of Their Control

Agnieszka Gajek\*, Jerzy S. Michalik

Central Institute for Labour Protection – National Research Institute, Czerniakowska 16, Warsaw, Poland  
 aggaj@ciop.pl

According to Polish regulations establishments other than upper- or lower-tier, can be potentially responsible for the major accidents. This establishments will be called non-Seveso establishments. In the publication, non-Seveso establishments were defined, types of this establishments and substances present in them were described. Computer simulation was used to made a series of forecasts of possible consequences of release of substances, present in non-Seveso establishments, in major accident cases. In these establishments, take place the considerable number of the accidents, and accident index is approximately 2.5 times higher for non-Seveso establishments than for Seveso ones. The National Labour Inspectorate inspections, in that kind of establishments, showed insufficient management in the area of major accident hazard.

### 1. Major accident definition

According to the definition by Seveso III Directive (EU, 2012) a **major accident** means an occurrence such as a major emission, fire, or explosion resulting from uncontrolled developments in the course of the operation of any establishment covered by this Directive, and leading to serious danger to human health or the environment, immediate or delayed, inside or outside the establishment, and involving one or more dangerous substances. In Poland, the term a **major accident** includes not only accidents in upper-tier and lower-tier establishments (establishments covered by Seveso III Directive), but also events in other establishments during storage or transport of any substance, which can be dangerous to life, health or the environment because of its properties or amounts, leading to at least one of the effects listed in the regulation of the minister of the environment (Polish Parliament, 2008). This means that, according to Polish law, substances that cause accidents or are involved in them do not have to be Seveso substances, that is substances covered by qualification criteria of Seveso II Directive. The Polish definition of a major accident comprises a much wider spectrum of events than the provisions of Seveso II Directive.

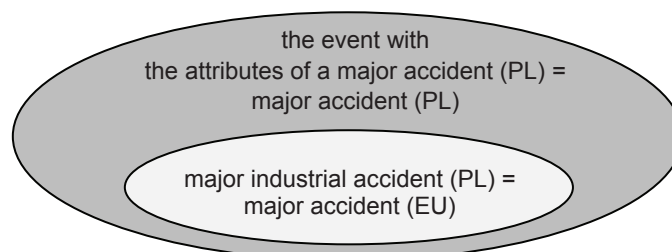


Figure 1. Correlation between definition of major accident in Polish and UE regulations

Many misunderstandings could be avoided with creating a term **the event with the attributes of a major accident** or **major accident (PL)**, which comply with the Polish definition of a major accident and a term

**industrial major accident or major accident (EU)** corresponding with events determined by Seveso III Directive (Gajek and Michalik, 2008; Gajek et al., 2010).

## 2. Major accident (PL) hazard in Poland (Seveso and non-Seveso establishments)

Considering wider definition of a major accident in Polish regulations, potentially responsible for a major accident (PL) may not only be upper or lower tier establishments. Potentially responsible may also be:

- Establishments not classified as lower-tier due to the relatively lower amounts of substances than in the qualifying criteria set out by Seveso II Directives (“sub-threshold” quantities). Consequences of failure at such establishments can also be very serious, however.
- Establishments with large quantities of substances classified as corrosive (Skin Corr.), including acids and alkalis, irritant (Skin Irrit., Eye Irrit.) and others, not included in the criteria of Seveso II Directive. According to Polish law, release into the environment – as a result of an accident – of large masses of these substances will also be classified as a major accident (PL).

Both categories of establishments defined here will be called **non-Seveso establishments**.

Magnitude of the events with attributes of a major accident hazards in Poland is quite considerable. Figure 2 shows the number of establishments (upper-tier, lower-tier and non-Seveso establishments) that pose a serious hazard of major accident (PL) in each province.

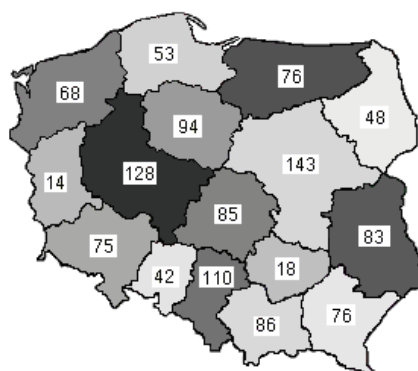


Figure 2. Seveso establishments in each province as of December 31, 2010; based on data from the Chief Inspectorate of Environmental Protection (GIOS, 2011)

At the end of 2010, there were **358 Seveso establishments in Poland** (171 upper- and 187 lower-tier ones). However, in 2010 according to the Chief Inspectorate of Environmental Protection (GIOS) there were **846 non-Seveso establishments** posing the risk of a major accident (PL) and **1196 according to the National Headquarters of the State Fire Service (KG PSP)**. That discrepancy results from the different rules the two institutions use for qualifying establishments into the non-Seveso category. Figure 3 shows the ratio of the Seveso to non-Seveso establishments based on the data from GIOS (2011).

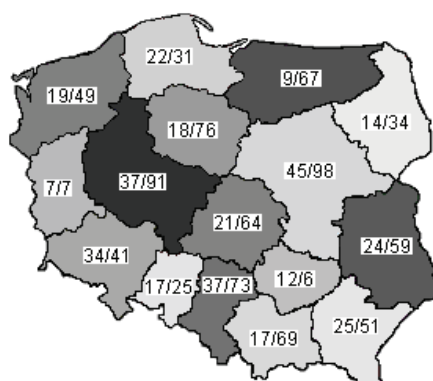


Figure 3. Establishments posing a major accident (PL) hazard in each province as of December 31, 2010  
Notes. Seveso establishments/non-Seveso establishments; based on the data from GIOS (2011)

### 3. The events with the attributes of the major accident

Non-Seveso establishments are not obligated to comply with specific requirements and implementation of procedures of major industrial accidents prevention. Therefore, they do not have to undertake and perform any measures to prevent major accidents and to limit their consequences. These issues do not have to be included in the company safety management systems, workers' health protection and the environment protection. The question is how big influence (if any) such number of non-Seveso establishments posing the threat of major accident has on the total number of the events with the attributes of the major accident in Poland? For this purpose, accident index was created, which shows the relation between the number of establishments and the number of events with attributes of a major accidents and shows susceptibility of the establishments to the occurrence of the events with the attributes of a major accident. The adjusted index takes into account the actual number of upper-tier installations, not just the number of upper-tier establishments. In Poland one of the largest upper-tier establishments has dozens of upper-tier installations. An analysis of the KG PSP database showed that the so-called failure rate is approximately 2.5 times (!) higher for non-Seveso establishments than for Seveso ones. This means that those establishments pose a relatively greater major accident (PL) hazard than Seveso ones (Gajek and Michalik, 2008).

Table 1. Adjusted accident index (including all upper-tier installations) (Gajek and Michalik, 2008)

Establishments	Estimated average number of installations (2002-2007)	Number of events with the attributes of a major accident in 2003-2007	Adjusted accident index (%)
Lower-tier	193	19	≈ 10
Upper-tier	330	57	≈ 17
Non-Seveso	740	258	≈ 35
Total	1263	334	≈ 26

### 4. Types of non-Seveso establishments

Identification of types of non-Seveso establishments, with the regard of branches of industry, will permit to qualify kinds of hazards. Most of the non-Seveso establishments were industrial establishments, followed by storage and municipal establishments as it shows in table 2. Food industry topped the list of industrial establishments with 450 facilities, including 155 establishments of dairy industry, 107 establishments of fruits and vegetables processing branch and 81 establishments of meat industry. Most storage facilities were hydrocarbon liquid fuel depots (107 establishments) and objects possessory the propane-butane (49 establishments). The most common municipal establishments are water-works (35 establishments), water treatment (21 establishments) and ice-ring (12 establishments). Other positions refers to, e.g., objects of the public utility, scientific units.

Table 2. Type of non-Seveso establishments; based on databases of the Headquarters of the State Fire Service (Gajek et al., 2010)

Establishments	Number	Percentage (%)
Industrial	796	66
Storage	273	23
Municipal	92	7
Other	33	3
In liquidation	11	1
Total	1205	100

Non-Seveso establishments used different dangerous substances. There were over 3000 occurrences of hazardous chemical compounds in non-Seveso establishments. Ammonia was the most frequent compound (487 times) followed closely by inorganic acids (452 times) (Gajek et al., 2010).

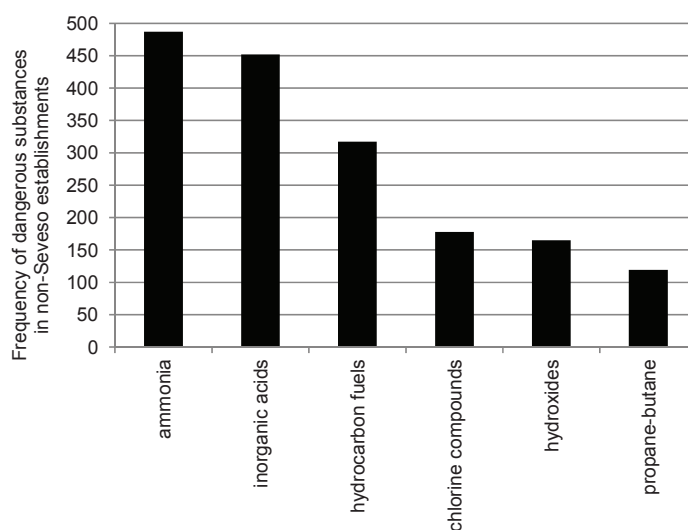
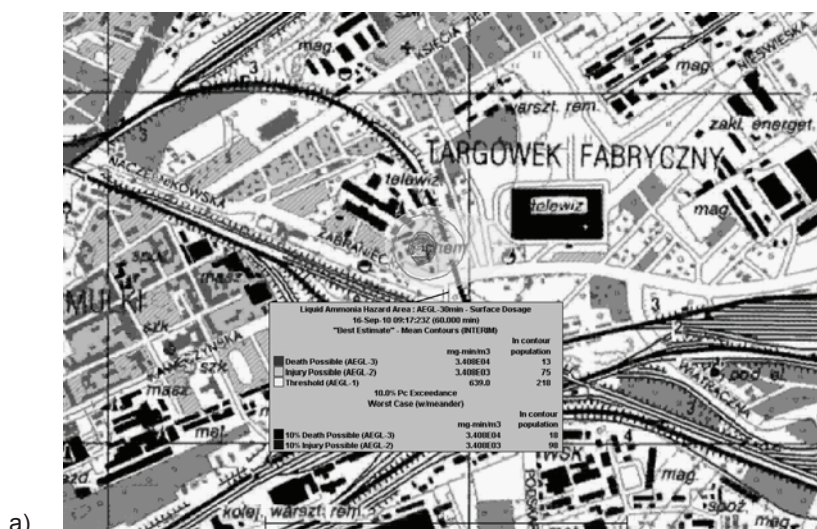


Figure 4. Dangerous chemical compounds most frequently in non-Seveso establishments (>100 times) found in establishments (Gajek et al., 2010).

## 5. Computer simulation

Computer simulation was used to make a series of forecasts of possible consequences of most frequent in non-Seveso establishments substances release in major accident (PL) cases. Computer predictions were made for the toxic and corrosive effects to human and for the effects of fire-explosive scenarios for selected substances: ammonia, concentrated acids (hydrochloric, nitric and sulfuric acid), liquid fuels (gasoline), chlorine, sodium hypochlorite, sodium hydroxide and LPG. All the simulations included the total release of analyzed chemical substances. The amount of substance released was 5 % of the statutory threshold for upper-tier establishments. In the case of hydrochloric acid, which is a non-Seveso substance we adopted 10 tonnes. The simulation concerned the consequences that might arise after 1 h from the time of the accident. Selecting the location of an establishment takes in to account the most common situation in Poland, where the neighbourhood of industrial establishment is living quarter. Figure 5a shows the result of a simulation of a release of 10 t of ammonia. 10 t is a 5 % of the threshold value for upper-tier establishments. The forecast shows 13 possible fatalities and 75 possible injured people. For muriatic acid, which is a non-Seveso substance, possible casualties and injuries are much higher – 124 and a 474 respectively (Figure 5b).



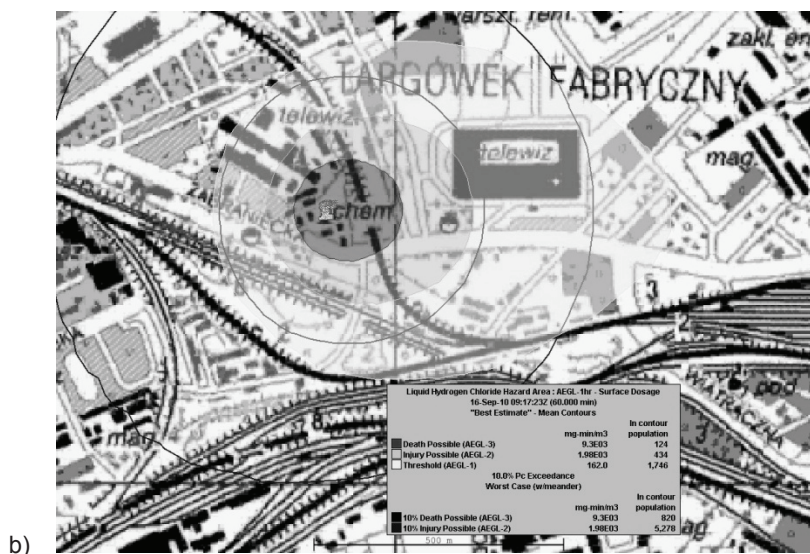


Figure 5. Hazard zones following the release from an installation in an urban area of a) 10 t of ammonia b) 10 t of hydrochloric acid (Michalik et al., 2011)

Certain effects (their severity and ranges) of the selected hazardous substances depends mostly on some of their physicochemical properties (liquid or gas, volatility, specific gravity and other properties that determine the ability of the substance to spread in the air). In general, the number of possible casualties and injuries depends on the location of the establishment and physicochemical properties of dangerous substances (Michalik et al., 2011).

## 6. Inspections

As part of the cooperation between the Central Institute for Labour Protection and the National Labour Inspectorate, on doing together research in agreed specific areas, the inspectorate inspected over 200 installations in non-Seveso establishments. In 82 % of inspected establishments, there was evidence of negligence in planned prevention of industrial accidents and reduction of their effects. It mostly reflected lack of comprehensiveness of the plans, which were also out-of-date.

National Labour Inspectorate inspections showed that, e.g.:

- Only 20 % of establishments implemented occupational safety management systems, which include control of industrial accidents;
- In 35% of establishments the employer did not inform the local population how to behave in situations posing risk to their life or health;
- In 70 % of establishments the employer did not provide a sufficient number of people trained to take part in rescue operations.

In general, they showed an insufficient level and scope of safety management in the context of the threat associated with the potential of a major accident (PL) and higher occupational risk due to the presence of large quantities of hazardous chemicals in the establishments (Gajek et al., 2010).

## 7. Conclusion

Non-Seveso establishments posed the events with the attributes of a major accident, which can be a major accidents, it is necessary to raise awareness and improve management of the risk of major accidents (PL) in non-Seveso establishments and also to properly implement existing legislation on assessing the risk of major accidents (PL) at those establishments. The proposals for a program and procedures of safety management for control of major accidents (PL) were developed. The proposed solutions reflect the requirements for major accident prevention policy (MAPP) established by Seveso II Directive, after they have been adapted for non-Seveso establishments (Gajek et al., 2012).

## Acknowledgements

This paper has been prepared on the basis of the results of a research task No. 5.R.03 carried out within the National Programme "Improvement of safety and working conditions" partly supported in 2008–2010



within the scope of research and development by the Ministry of Science and Higher Education. The Central Institute for Labour Protection – National Research Institute has been the Programme main coordinator.

## References

- EU, 2012, Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing council directive 96/82/EC, Official Journal of the European Union, L197,1-37.
- Gajek A., Michalik J.S., 2008, The hazard assessment of the events with attributes of a major accident by non-Seveso establishments, *Chemia przemysłowa* 5(395), 40-45 (in Polish).
- Gajek A., Michalik J.S., Adamczyk A., Sakrajda S., Rybacki W., 2010, Non-Seveso establishments: branches and types of establishments, dangerous chemical substances and major accident risk management (in Polish), *Bezpieczeństwo Pracy* 4(463), 14-18.
- Gajek A., Michalik J.S., Sakrajda S., Rybacki W., 2012, Assessment of safety management in non-Seveso establishments in the context of major accident control (in Polish), *Bezpieczeństwo Pracy* 1(484), 16-19.
- GIOS (Chief Inspectorate of Environmental Protection), 2011, The report on occurrences of the events with the attributes of a major accident (in Polish), <[www.gios.gov.pl/zalaczniki/artykuly/raport-powazne\\_awarie\\_2010.pdf](http://www.gios.gov.pl/zalaczniki/artykuly/raport-powazne_awarie_2010.pdf)> Accessed 31.08.2012.
- Michalik J.S., Gajek A., Słomka L., 2011, The risks posed by hazardous substances in the event of a major accident in non-Seveso establishments - conditions for the qualifying procedure for these establishments (in Polish), *Przemysł Chemiczny* 90, 1966-1973.
- Polish Parliament, 2008, Act on the Environmental Protection Law of 27 April 2001, consolidated text: Notice of the Marshal of the Polish Parliament of 23 January 2008, on the publication of the consolidated text of the Act - Environment Protection Law, *Journal of Laws in Poland (DzU)*, 2008, No. 25, item 150 (in Polish)