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Comparison of Approaches to Major Accident Prevention between the European Union and Russia

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Operation of equipment containing hazardous chemical substances and products is very dangerous area related to risk of major accidents and injuries. Currently, safety of employees and residents is considered as one of the most important factors to be taken into account in any activities. The development of legislation is important for industrial safety which regulates the minimum requirements for industrial processes. Legislative requirements vary from state to state; in advanced countries they are based on the fundamental principle - the employer is responsible for health of workers.
The article compares legislation in the field of industrial safety in the European Union and Russia. The novelty of comparison is based on changes of Russian regulation on safety of major accident prevention. There is considered a system of major accidents prevention and basic requirements for industrial enterprises that deal with chemical substances; limit amounts of hazardous substances are compared too.
A new approach to major accident prevention in Russia and a comparison to recent “Seveso Directive” have not been described in international conferences yet.

1. Russian and European legislation in the field of industrial safety

Major accidents in chemical industry have occurred world-wide. In Europe, the Seveso accident in 1976 prompted the adoption of legislation aimed at the prevention and control of such accidents. EU Member States adopted the so-called Seveso Directive in 1982 in order to give a common legal basis to precautionary measures against major industrial accidents in the EU. This directive was reviewed and updated in 1996 resulting the Council Directive 96/82/EC more commonly known as the Seveso II Directive. The scope of the Seveso II Directive deals with the dangerous substances in process industry. It covers both, industrial "activities" as well as the storage of dangerous chemicals.
In Russia, industrial safety requirements until the nineties of the last century were established in the rules of safety, rules for safe operation, state standards, building codes and other regulatory technical papers focused on specific technical problems. Russia's integration into the world community, including (in the future) the World Trade Organization and the signing of the 1992 Convention on the Transboundary Effects of Industrial Accidents caused Russia's adoption of measures to reduce the risk of major accidents in the operation of hazardous production facilities. Currently there are following major federal laws in the field of safety on chemical facilities:
- Federal Law "About ratification of the Convention of Prevention of Major Industrial Accidents (Convention No 174)" dated November 30, 2011, No. 366 (GARANT,2012);
- Federal Law "On industrial safety of hazardous production facilities" dated July 21, 1997, No. 116 (GARANT,2012);
- Federal Law "On Protection of Population and Territories from Natural and Man-Made Emergencies" dated December 21, 1994, No.68 (GARANT,2012).

2. Prevention of injuries, accidents and incidents in the chemical industry in the European Union and Russia

Approaches to prevention of accidents, incidents and accidents in the EU and Russia are similar, but have their own characteristics. A comparison of these approaches is shown in Table 1.

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Table 1: Prevention of injuries, accidents and incidents in the chemical industry in the EU and Russia

	EU	Russia
Responsible authorities	• Ministry of the Environment; • Ministry of the interior; • Mining Offices; • Environmental Inspectorates; • Regional offices; • State Labour Inspection Offices; • Administrative offices for fire protection civil protection and the integrated rescue system; • Regional health offices; • Integrated control of major accident prevention.	• Government of the Russian Federation; • Federal service for ecological, technological and nuclear supervision; • Authorities of the Russian Federation; • Local authorities; • Voluntary associations.
The distribution of objects	• 2 groups	• 1 group
Methods and means	• Analysis and Risk Assessment; • Safety program for prevention of major accidents; • Safety Report; • Training of personnel; • Control over compliance with requirements for safety; • The plan of physical protection of the building or equipment; • Emergency plans.	• Risk Analysis; • Implementation of measures to prevent accidents; • Preparation of the plan localization and liquidation of an emergency; • Training of personnel; • Control over compliance with requirements for safety.
State control	• Territorial management of the building permit; • EIA (Environmental Impact Assessment of environment); • Process of IPPC (integrated authorization operation); • Building permits; • Approval of safety documentation; • Registration of hazardous production facilities in the state register; • Assessment of safety; • Liability insurance for damage caused by major accidents; • Technical investigations into the causes of accidents; • Regular inspection of dangerous object.	• License in the field of industrial safety; • Registration of hazardous production facilities in the state register; • Assessment of safety; • Compulsory liability insurance for the owner of a dangerous object injuries in an accident at hazardous installations; • Technical investigations into the causes of accidents; • Regular and irregular (unscheduled) inspections dangerous object.
Informing the public	• Information to the public for discussion and approval of safety documentation; • Information to the public about major accident hazards, the preventive measures and behaviour of citizens in the event of a serious accident; • Information to the public during an accident.	• Information to the public during an accident

2.1. Methods and means of prevention of injuries, incidents and accidents in the European Union

1. Analysis and evaluation of risks, which mainly contains the following parts:

a) Identification of sources of risk (hazard);

b) Identification of accident scenarios of events and their causes;

c) Estimation of the impact of accident scenarios on the health and lives of people, livestock, environment and property;

d) Estimation of likely accident scenarios;

e) Determination of the level of risk;
f) Evaluation of the acceptability of the risk of serious accidents.
2. Plan of physical protection of industrial object, which focuses on the following aspects:
a) Analysis of the possibility of unauthorized activity or a possible attack on buildings or equipment;
b) Regime measure;
c) Physical safety;
d) Safety of technical means.
3. Safety Program (or a safety report) to prevent serious accidents, which mainly contain the following parts:
a) Principles of prevention of major accidents;
b) Composition of safety management system to ensure the health and lives of people, livestock, environment and property;
c) Determination of principles of safety and reliability according to risks identified during construction, operation and maintenance of any facilities, equipment and infrastructure connected with its operation, which represent a major accident hazard (only applies to a safety report);
d) Development of principles of the internal emergency plan and provision of information to create external emergency plans in order to take necessary measures in case of a serious accident (applies only to the safety report);
e) Provision of appropriate information to the competent public authorities and municipalities to reach a decision in terms of new activities or developments around existing buildings or facilities (only applies to a safety report).

2.2. Methods and means of prevention of injuries, incidents and accidents in Russia
1. Risk analysis, which mainly contains the following parts:
1.1 Analysis of known accidents:
a) A list of accidents and summary information on incidents that occurred in existing facilities;
b) A list of the most dangerous consequences of accidents that have occurred in similar facilities;
c) Analysis of main causes of accidents.
1.2 Analysis of conditions of formation and development of the accident:
a) Identification of possible causes of the accident and factors contributing to the formation and development of the accident;
b) Identification of accident scenarios involving hazardous substances;
c) An explanation of physical and mathematical models and methods used in risk analysis;
d) Assessment of the quantity of hazardous substances in the accident;
e) Calculation of the probable consequences of the accident;
f) Assessment of the likely number of casualties, including deaths, among workers in buildings and other persons;
g) Assessment of potential damage.
1.3 Risk assessment of accidents, including data on the probability of accidents, risk assessment. Damage of employees, employee's property and environmental damage.
2. Development of measures to reduce external intervention to activities at the declared site, or against possible terrorist attacks.
3. Staff training for response on emergency situations as well as regular testing of knowledge in the field of industrial safety.
4. Control over observance of work safety requirements.

3. Comparison of the limit amount of hazardous substances in the EU and Russia

In order to ensure industrial safety, Seveso Directive and Federal Law No.116 established limit amount of hazardous substances which are produced, used or stored in the enterprise. Table 2 shows differences in the limit amounts of hazardous substances in the EU and Russia.

Table 2: Comparison of the limit amount of hazardous substances in the EU and Russia

Hazardous substances	EU		Russia
	Quantity [t]		
	Group A	Group B	
Ammonium nitrate:			
- Fertilizer capable of spontaneous decomposition	5,000	10,000	10,000
- Quality of fertilizers	1,250	5,000	-
- Industrial quality	350	2,500	2,500
- Unsuitable material required specification and fertilizers that do not meet the requirements of detonation tests	10	50	50*
Potassium nitrate:			
- Mixed fertilizers based on potassium nitrate with potassium nitrate in the form of granules or microgranules	5,000	10,000	-
- Mixed fertilizers based on potassium nitrate with potassium nitrate in crystalline form	1,250	5,000	-
Acrylonitrile	5*	20*	200
Ammonia	50*	200*	500
Bromine	20	100	20*
Chlorine	10	25	25
Ethylene oxide	5	50	50
Arsenic oxide, arsenic acid and its salts	1	2	20*
Arsenic trioxide, acid or salts	-	0.1	20*
Nickel compounds in powder form	-	1	200*
Ethylenimin	10	20	20*
Fluor	10	20	20*
Formaldehyde (concentration> = 90%)	5	50	200*
Hydrogen	5	50	50*
Hydrogen chloride (liquefied)	25	250	200*
Lead alkyls	5	50	50
Liquefied extremely flammable gases (including LPG) and natural gas	50	200	200*
Acetylene	5	50	50*
Propylene oxide	5	50	50*
Methanol	500	5,000	-
4.4-Methylenebis (2-chloranilin) or salt in powder form	-	0.01	200*
Methyl isocyanate	-	0.15	0.15
Oxygen	200	2,000	-
Toluene diisocyanate	10	100	200*
Carbonyl dichloride (phosgene)	0.3	0.75	0.75
Arsine	0.2	1	20*
Hydrogen phosphide (phosphine)	0.2	1	20*
Chloride, sulfurous	-	1	-
Sulphur trioxide	15	75	75
Petroleum products	2,500	25,000	-
Polychlorinated dibenzofurans and polychlorinated dibenzodioxins	-	0.001	-
Carcinogens	0.5	2	-
Hydrogen cyanide	5*	20*	20
Hydrogen fluoride	5*	20*	50
Hydrogen sulfide	5*	20*	50
Carbon dioxide	-	-	250

* - Limit is based on properties of chemical substances

Quantity of hazardous substances defines basic obligations for industrial enterprises in the field of safety.

3.1. Basic obligations for industrial enterprises in the EU

The diagram on the Figure 1 shows the basic obligations for industrial enterprises in the EU.

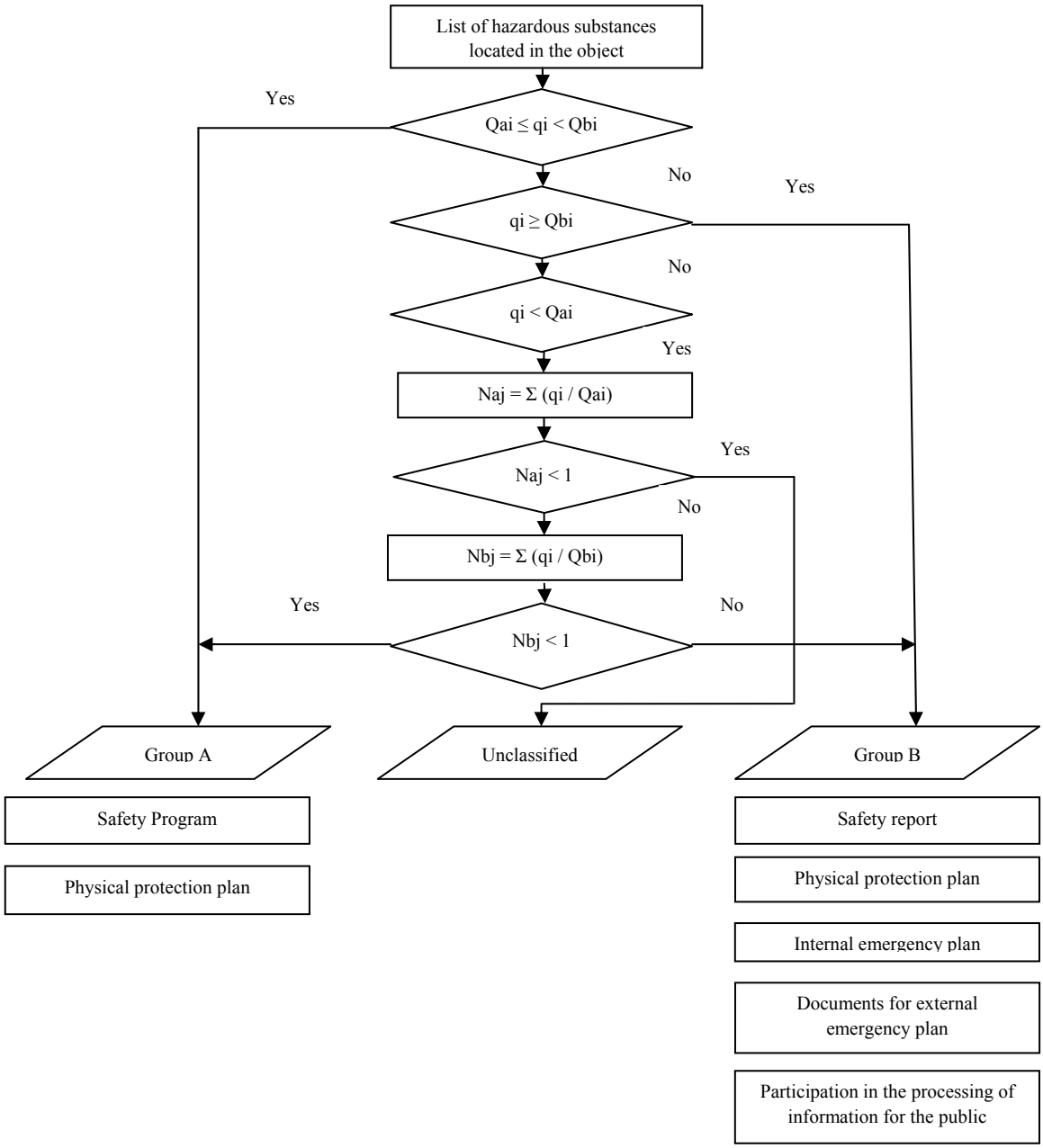

Figure 1: Flow chart of basic obligations for industrial enterprises in the EU

Note:
Qai = classification of dangerous substances for inclusion in Group A;
Qbi = classification of dangerous substances for inclusion in Group B;
Qi = quantity of hazardous substances located in the object under examination;
Na = index representing the sum of the ratios of qi to Qai;
Nb = index representing the sum of the ratios of qi to Qbi;
i = 1 .. n, n = number of dangerous substances;
j = 1 .. m, m = number of hazardous properties of chemical substances.

3.2. Basic obligations of industrial enterprises in Russia

Figure 2 shows the basic obligations of industrial enterprises in Russia. In Russia there are limits of the amount of hazardous substances used to determine the obligation to create a declaration of industrial safety.

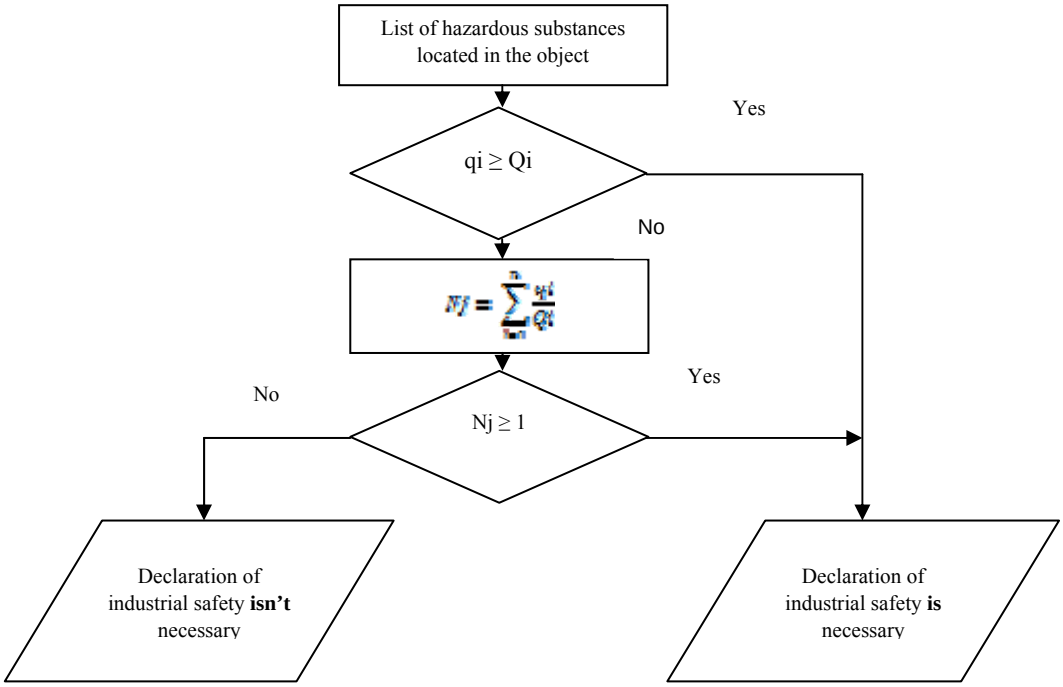

Figure 2: Flow chart of basic obligations for industrial enterprises in Russia

Conclusion

This article discussed approaches to the prevention of accidents in European Union and Russia, namely, requirements of the Seveso Directive and Russian federal law No.116. In this comparison, it was found out that most of the limit amounts of hazardous substances in Russia are similar to the limit level of group B in the EU, and further, that the requirements for Group A are stricter than for category B. This means that the requirements on the amount of hazardous substances in the facility in the EU are more challenging than in Russia. Significantly different requirements and restrictions are laid on the amount of acrylonitrile, ammonia, arsenic oxide, arsenic trioxide, nickel compounds, formaldehyde, 4,4-methylenebis, arsine and phosphine. Moreover, in Russia there are no requirements on the amount of methanol, oxygen, sulphur chloride, petroleum products, polychlorinated dibenzofurans and carcinogens. In the EU there are no requirements on the amount of carbon dioxide. So, it seems reasonable to revise presented amount of substances in accordance with changing of production technologies and new safety measures. Too much restriction in the amount can be a barrier to the development of industrial processes in the enterprise; on the other hand, too soft requirements can lead to serious consequences, so it is a necessary to have a balance that allows enterprises to develop efficiently and safely.

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References

Council Directive 82/501/EC of 24 June 1982 on the major-accident hazards of certain industrial activities.
Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances.
GARANT, 2012. *Federal Law n. 366 of 30 November, 2011*. Available at: <garant.ru/products/ipo/prime/doc/12092451>. Accessed 15 August 2012.
GARANT, 2012. *Federal Law n. 116 from 21 July, 1997*. Available at: <base.garant.ru/11900785/1/#1111>. Accessed 15 August 2012.
GARANT, 2012. *Federal Law n. 68 from 21 December, 1994*. Available at: <base.garant.ru/10107960>. Accessed 15 August 2012.