The implementation of the SEVESO II legislation in Polish major hazard industry

A.S. Markowski
Process and Ecological Safety Division
Technical University of Lodz
90-964 Lodz, Wolczanska 213, Poland
Tel/fax+48-426313745, e-mail: markows@wipos.p.lodz.pl

Abstract
The European major hazard legislation was driven by the Flixborough, Seveso, Bhopal, and Mexico City catastrophes. Poland has adopted the revised European SEVESO II Directive since 2003. The paper presents the implementation of the SEVESO II Directive in Poland. Particularly, a systematic approach to the realization of MAPP, Safety Report and Emergency Plan is shown. It takes into account the real technical and organizational standards of the Polish major hazard industry as well. The impact of the implementation of SEVESO II Legislation on safety performance changes in particular major hazard companies was assessed using the questionnaires method of data collection. The fundamental question of that survey was: Did that exercise improve safety performance or was it just a “paper work”? The majority of survey reported more positive than negative comments. The conclusions were drawn and some suggestions were made to improve major accident control in Poland.

Keywords: major hazard, safety performance, risk assessment

1. Introduction

Safety issues have been important in Polish process industry for many years. However, pressures arising from environmental concern have been changing rapidly in the past 20 years. It demanded a lot of changes in the design and operation of industrial plants and will continue in the coming years. No doubt it was straightforwardly related to the Flixborough, Seveso, Bhopal, Mexico City catastrophes as a result of which an appropriate major hazard regulation was developed in EU. Poland has been accepted as a member of EU this year but SEVESO II Directives concerning major hazard have been fully implemented into Polish Environmental Law earlier (Environmental Protection Framework Act of 27 April 2001). The framework was supplemented by appropriate detailed regulations as follows:
The overall coordination and control functions were assigned to the National State Fire Services with participation of the Chief Inspectorate for Environmental Protection Competent Authority-CA). To our big surprise the National Labor Inspection was not invited to take part in that.

The sites with “lower and upper” threshold quantities are required to prepare a major accident prevention program (MAPP) which sets out their safety management systems for preventing and mitigation of major accidents. Additionally, the sites with “upper” threshold quantities must prepare a safety report (SA), internal emergency plan (IEP) and provide appropriate information for external emergency plans (EEP). All those elements form the prevention and mitigation system to eliminate and limit major accident hazards and there is an essential interrelation between all these components. The joint component is a risk assessment.

Basically, the safety report is a key element in that system and must demonstrate that:

- MAPP and safety management system is implemented,
- major accident hazards have been identified and measures taken to prevent and limit their consequences for people and environment,
- there is adequate safety and reliability in the design, construction, operation and maintenance of any installation of major accident hazard,
- internal emergency plans have been drawn-up and information supplied to enable off-site plans to be drawn up.

Most of those legal requirements are rather new in Polish practice of the industry and administration, however some of those are covered by different acts like Labor Code (occupational health and safety), and regulations concerning the fire protection and Fire State Services.

Appropriate detailed regulations were introduced in the mid 2002 in Poland and accordingly approved formal time scale, all Polish operators under SEVESO II had to submit appropriate documents to the Competent Authorities by the end of September 2003. So, the
time was extremely short (slightly longer than 1 year). Moreover, some Polish chemical and process industries revealed the same technical and organization deficiency mostly connected with the lack of experience in the implementation of a safety management system, required by SEVESO II. On the other hand, some mistakes in transposition of the European regulation (e.g. Polish Environmental Law requires demonstration that a plant fulfills the conditions for the implementation of safety system, whereas SEVESO II Directive explicitly requires demonstration that safety management system has been put into effect (art. 9 of SEVESO II Directive), limited the number of professional consultants and computer tools. The lack of competent guideline materials for drafting safety reports caused problems for all parties involved: an operator needed to struggle with the requirements for demonstration of safe operation, regulators with the assimilation of all new difficult to understand documents and both alike have met the challenge of the workload involved in SEVESO II.

Majority of Polish major accident plants fulfilled the requirements of Environmental Framework in 2003 and most of them were positively accepted by the authorities. Some others were inadequate and passing corrections. Now CA is moving from assessment to inspection of SEVESO II establishments, which seems to be a very important element in approaching the success of SEVESO II to prevent or at least control major accidents. The question is: what was the effect of SEVESO II legislation on safety performance in Polish major accident industry? The answer is difficult because it can be verified only by accident statistics based on at least 5-year periods. However, basing on practical experience that has been gained by the author during the implementation of SEVESO II in Poland and self-assessment of the industry, one can say generally that SEVESO II legislation has brought a number of benefits in safe operation of chemical plants in Poland.

2. Major accident statistics in Poland

Accident and loss statistics are important measures of the effectiveness of safety programs. Some Polish accident statistics are given in Table 1 (Markowski 2001).

Table 1. Polish accident statistics

<table>
<thead>
<tr>
<th>Statistical Parameter</th>
<th>For the whole Polish economy</th>
<th>For the process industry sector (refineries, petrochemical and chemical)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of accidents</td>
<td>117503</td>
<td>80500</td>
</tr>
<tr>
<td>---------------------</td>
<td>--------</td>
<td>-------</td>
</tr>
<tr>
<td>Number of fatalities</td>
<td>651</td>
<td>520</td>
</tr>
<tr>
<td>Fatal accident rate per 100,000 employees (FAR)</td>
<td>4.7</td>
<td>4.9</td>
</tr>
<tr>
<td>Number of major hazard accident</td>
<td>15</td>
<td>14</td>
</tr>
</tbody>
</table>

The above selected figures indicate that Polish accident statistics provides a good performance in relation to FAR (i.e. the FAR for the UK, Switzerland is about 1, for France and Germany about 4.5 and for Spain and Italy from 8 to 9). Partly, it may be connected with closing down of some non-competitive industry but also with systematic improvements in environmental performance due to the new environmental law. This is clearly connected to changes of production profile and changes in companies’ policy. Most of the Polish process industries have accepted voluntarily the “Responsible Care Program” and environmental management systems PN-EN ISO 14001. Only a few companies are under way to the established occupational health and safety management system PN-N-18001.

3. Safety management in Polish major accident plants

At the moment Poland has got about 120 different chemical and process plants complying with SEVESO upper-tier requirements. The number of lower-tier plants is about 165. Most of the upper-tier plants, especially belonging to chemical and petroleum industry, represent quite good safety performance level which is confirmed by the statistics of major accidents. It does not mean that all safety performance requirements of the Polish industry under Seveso Directive are fulfilled. This refers mainly to the safety management systems which are only partly introduced by some operators of chemical plants. The advantages and disadvantages of Polish organization measures used in major hazard industry are presented in Table 2.

Table 2. Advantages and disadvantages of Polish organization measures (Markowski 2004a)

<table>
<thead>
<tr>
<th>Advantages of Polish organization measures</th>
<th>Disadvantages of Polish organization measures</th>
</tr>
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<tbody>
<tr>
<td>- general conformity to the technical standards and other professional procedures and guidelines,</td>
<td>- lack of safety policy in companies,</td>
</tr>
<tr>
<td>- quite good technical and technological standards (some of the plants belong to BAT),</td>
<td>- limited process safety staff involved in process safety management,</td>
</tr>
<tr>
<td>- well organized health and safety services</td>
<td>- not enough specialists, software and appropriate guidelines required for process risk analysis,</td>
</tr>
<tr>
<td></td>
<td>- limited application of risk analysis in the</td>
</tr>
</tbody>
</table>
departments,
- well-prepared occupational health and safety staff,
- well-organized accident investigation process and rescue system.

life cycle of projects, operation safety improvement and changes, etc.
- no systematic approach in the area of process safety management
- rather poor safety culture.

The above specification indicates inadequacy of the risk assessment/safety management system to the one referred in SEVESO II. Therefore some changes to these arrangements for managing major hazards can be expected as a result of the implementation of Safety Report Regulation in Poland. Probably, a similar situation will be met in technical safety measures required to improve safety standards. This inadequacy cannot be completed immediately, hence a supplementary plan with additional measures should be forwarded jointly with Seveso documentation.

The above remarks were taken into account in the proposed strategy to fulfil the Polish Seveso II Directives.

4. Strategy in the implementation of SEVESO II in Poland

An effective implementation of Seveso II in Poland requires equal participation of three actors:
1. Operators of major accident plants which are responsible for preparation of a Safety Report and on–site emergency plan.
2. Authorities responsible for the control of Seveso II implementation and enforcement
3. Public which is to “approve” the Information to the Public.

A flow diagram of the general framework which was applied in SEVESO II requirements in majority of Polish hazardous installation is shown in Fig.1. It takes into account the real technical and organizational safety solutions of the Polish major hazard industry and can be beneficial for continuous improvement (Markowski, 2004a).
Fig. 1. General framework for implementation of SEVESO II in Poland

4.1. Operators

The main part of the system presented in Fig. 1 belongs to the operator of the hazardous establishment.

Formal Polish regulation in major accident area describes only what should be contained in the required documents, i.e. MAPP, SR, and IEP. There is no approved framework methodology for the realization of those documents. During implementation, majority of the companies had used different EU guidelines as well as had made use of a few consultants. In such a way there is a variety of approaches which can be grouped into two categories:

1. structured ones, where all formal requirements (MAPP, SR, IEP) documents are combined and form one integrated system with clearly defined goals, tools and results for demonstration of safe operation

2. casual (stochastic) ones, only descriptive, devoted to the presentation of required information without judgment of safe operation assessment.

Unfortunately, according to our knowledge, at least 60% of Polish operators of hazardous establishments follow the second approach which is not in line with SEVESO II requirements. Hopefully, the inspection process will identify that problem.
Polish SEVESO II regulations require companies to analyze the hazards on their establishment, to define the risks and ensure appropriate arrangement in place to prevent and mitigate against major accidents. The content of safety report contains in general the following:

a. Description of safety management system
b. Assessment of site location and impact of a major accident
c. Description of activities/processes that are sources of major hazard risks
d. Identification of dangerous substances
e. Potential consequences of accidents
f. Probability of accidents and consequences
g. Adequacy of existing safety measures

These have been done by a competent company personnel itself or by third parties. The consultants used to be specially involved in points “e” and “f”.

An important part of that job was the Initial Report on a particular installation as part of Company resources. It has contained information such as:

1. Description of installation and its surroundings
2. The inventories of hazardous materials, safety properties and process conditions
3. Organization and management system with a description of roles and responsibilities
4. The details of multilayer safety system concerning prevention, protection and response means used for safety assurance
5. Historical data on previous accidents

This Report has required an intensive effort from different safety and process specialists but also allows to identify missing documentation, drawings, procedures and responsibilities. Special difficulties were with the identification of the management aspects according to SEVESO II requirements. This is because the Polish major accidents company management system is not completed and not consistent with the system requirements. Some elements are well represented, e.g. training or accident investigation, but some are totally missing, e.g. hazard analysis. Those deficiencies were identified and formed an additional organization plan which was part of the risk management program (RMP).

The key issue for overall implementation of Safety Report, Domino Effects and Emergency Plans is connected with the safety performance assessment. This is used to be realized by risk assessment where risk criteria should be determined by MAPP assumptions. It is a fundamental component which must be recognized and understood by all parties involved, including Fire Brigade Services and Environmental Inspection. Risk assessment requirements
are explicitly specified in the Polish legislation. They refer also to the number of Polish regulations, e.g. Labor Code, ATEX Regulations, as well as Safety Report Regulation (Markowski, 2004b). More specifically, the Polish Safety Report Regulation requires the probabilities of accident scenario and their potential consequences to be assessed which means a so called “probabilistic approach” is being applied. This statement is in conflict with the practical experience faced during assessment phase when CA frequently considered not the level of risk but the range of hazardous zones. We feel that the Polish Safety Report Regulation should be supplemented with an additional Appendix where the concept of safety assurance assessment should be suggested including the clarification in the use of threshold limit values for particular physical effects like toxic concentration, heat radiation and overpressure as a result of releases of dangerous substances. Moreover, the guidelines for safety audits in the industrial establishment would be recommended.

Polish SEVESO II regulation does not require the use of QRA or any other risk assessment methods which are available. The appropriate selection and effective use of the risk assessment methods, belong to the operator who needs to prove their use. During assessment period we recommend to apply typical hazard identification methods like PHA or HAZOP and for risk assessment Layer of Protection Analysis [Markowski, 2004c]. The level of expertise in risk assessment/safety management system in Polish major accident industries has not been satisfactory yet, but due to training postgraduate courses offered by some educational academic centers has increased and raised the knowledge in the matter and is better developed than within the country as a whole.

In many Polish major accident hazards companies the risk assessment induced necessity for additional risk control measures which together with missing organizational measures have formed the risk management program (RMP). We hope that during the inspection phase that program will be verified by CA.

The most difficult problems faced by industry was how to demonstrate the safe operation, what sort of arguments are to be used for justification of applied safety measures. It is partly connected with poor understanding of the hazard analysis and risk assessment demonstration. But even demonstration by comparison with approved standards or guidelines, in many cases especially for storage and distribution centers of LPG (majority of high tier establishments) failed because there is no knowledge on that topic. This is also the area for future cooperation between CA and industry during the inspection phase.

Unfortunately, the result of MAPP, SR in majority of Polish establishments, failed to be fully communicated both to shareholders and to line managers. This is supposed to be living
document used not only for fulfillment of required regulations but also for normal day-to-day activity. The situation is better within the IEP which is being used for emergency training purposes. No confirmation of such approach is in Polish industry.

### 4.2. Competent Authorities

The second partner in the effective implementation of SEVESO II in Poland are the Fire Brigade Services and Environmental Inspection as a Competent Authorities – CA. The issue of Seveso II was also new to those authorities and the level of expertise within risk assessment is not widespread and cannot be overestimated. It also refers to the appropriate information systems, as well as risk assessment software.

The CA must possess the availability to assess adequacy of the safety report and other documents. That process is quite complex process which requires good knowledge on the performance measures for assessing the information in the safety reports and helping to judge whether the necessary demonstration has been made. The assessment should be done by the team of experts, e.g. where the main role should be played by risk assessors. However, the knowledge and experience in the above topics, as well as availability of appropriate risk assessment tools, especially on local and regional level is rather poor.

Polish Competent Authorities were supplied by the Ministry of Economy with special Safety Report Assessment Manual based on HSE Manual (HSE, 2003). However, the content of the manual was not adjusted to Polish specific conditions and that guidebook was not very useful for assessors.

During the preparation phase of SR and IEP no cooperation between industry and CA was observed. Even in the known case, a proposal to authorities to take part in preparation of safety report since the safety report started to commence, was neglected; it might be caused by a typically communist approach connected with the separation of the authorities from the rest or with poor staff preparation to these exercises. Such a cooperation started initially during the assessment phase, which is still on for at least 40% of Polish establishments. This was a noticeable change of approach by CA in terms of requirements which sometimes were like “Good Wishes” (e.g. very demanding threshold limit value of physical effects). Also the probabilistic approach, preferred in Poland, was more often taken into account during assessment of the result by CA.
A very important role of the CA is seen during the inspection phase. We hope that the CA will be able to verify all information and demonstration presented in reports. We have no experience in this area yet because it will go for the first time in Poland.

4.3. Information to the public

The information provided to the public is always challenged, because neither industry nor the public have much experience in dealing openly with industrial risk. Polish public is very sensitive to all chemical risks and good preparation guidelines is required to deal with. At the moment in Poland public has not protested yet but there is some dispute. Most of them has a political background and the result cannot be predicted. Land use planning as a guide, based on consequence analysis, to manage the planning decision, unfortunately does not exist in the Polish practice, e.g. no consultation distance approach is applied.

5. The result of short survey of the SEVESO II implementation process

In order to identify all problems connected with the implementation of SEVESO II regulation in Poland and possibly to assess if some changes occurred to improve safety performance, we have asked industry to answer some questions which were sent by post in the form of a questionnaire. The fundamental goal of that survey was: Did these exercises improve safety performance or was it just a “paper work”. The questionnaires were sent to all 120 high tier establishments under SVESO II receiving unfortunately only about 30% response. However, among responders were all chemical and petrochemical plants. No response was obtained from other industrial and process plants, like LPG storage and distribution. 26 questions with final overall global assessment was set up. The results of overall self-assessment is presented in Table 3. In all six aspects an essential improvement is noticeable, especially in terms of the use of hazard analysis and safety awareness. The weakest point is still a safety management system which requires some more time to be seen. It is a suggestion for CA to verify it during the inspection phase.

Analyzing results of the survey it can be also noticed that some of companies had treated SEVESO II as a business opportunity (less than 30%) but some of them did a simple job: repacking the existing technical and organizational solutions into a new wrapping and called it Safety Report and it was accepted by CA!!!!!! This attitude requires more time to be changed in our industry.
Table 3. Overall self assessment of SEVESO II exercises by industry

<table>
<thead>
<tr>
<th>Aspect</th>
<th>When</th>
<th>V. good</th>
<th>Good</th>
<th>Average</th>
<th>Weak</th>
<th>Bad (lack)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard of SMS</td>
<td>Before Seveso</td>
<td>6</td>
<td>20</td>
<td>10</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>After Seveso</td>
<td>7</td>
<td>22</td>
<td>8</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Standard of technical measure</td>
<td>Before Seveso</td>
<td>4</td>
<td>12</td>
<td>14</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>After Seveso</td>
<td>6</td>
<td>16</td>
<td>13</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Use of Hazard analysis</td>
<td>Before Seveso</td>
<td>4</td>
<td>6</td>
<td>16</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>After Seveso</td>
<td>6</td>
<td>22</td>
<td>6</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Safety culture</td>
<td>Before Seveso</td>
<td>6</td>
<td>20</td>
<td>12</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>After Seveso</td>
<td>8</td>
<td>22</td>
<td>9</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Safety awareness</td>
<td>Before Seveso</td>
<td>6</td>
<td>14</td>
<td>12</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>After Seveso</td>
<td>12</td>
<td>18</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Emergency</td>
<td>Before Seveso</td>
<td>5</td>
<td>22</td>
<td>10</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>After Seveso</td>
<td>6</td>
<td>24</td>
<td>10</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

6. Final conclusions

1. The application and full implementation of SEVESO II Directive in Poland, introduced among others due to Bhopal tragedy, can bring a substantial number of benefits, notably a decreased number of major accidents with loss of human, property and environment.

2. In terms of Polish safety conditions, all SEVESO II documents, must be supplemented by additional measures, specially organizational ones, in order to fulfil requirements connected with the safety management system. There is need to work out appropriate guidelines to support industry in this matter.

3. Effective implementation of SEVESO II Directive in Poland will take time. The availability of appropriate expertise and implementation tool could accelerate this time frame. Special attention should be paid to clarification of the Polish version of
SEVESO II and upgrading facilities and control capabilities on the local and regional level authorities.

4. Only full cooperation between industry, CA and consultants (all parties involved) in the whole process of preparation, review and control could effectively implement SEVESO II regulation; additionally Polish Labor Inspection should be included in that process.

5. Process safety science and education in Polish universities are not represented sufficiently. The universities curricula should be extended for process safety and reliability courses especially in the frame of the chemical engineering education.

6. Communication to public and its subsequent scrutiny can be considered as a special community license, without which there are no chances for doing business. Polish society is very sensitive to all chemical hazards and could effectively block the operation. This is a common business of industry and authorities which should provide necessary support in that matter.

Nothing in this paper should be interpreted as a statement of CA in Poland.

7. Literature


