E-SEVESO: A WEB-BASED TOOL FOR THE CONTROL OF MAJOR-ACCIDENT HAZARDS

Efthimiadou Irini
Intelin S.A., Antonis Tritsis 21b, 570 01 Thessaloniki, Greece

Alborg Miguel
IDI Eikon, Benjamin Franklin 27, Parque Tecnologico de Valencia, 46980 Paterna –Valencia, ES

Vontas Apostolos
Altec S.A., Michail Kalou 6, 546 29, Thessaloniki, Greece

KEYWORDS: accident, monitoring, performance measurement, prevention, risk management, safety management

ABSTRACT

e-Seveso is an innovative web-based tool that deploys services, intended to help implement statutory requirements on environmental and safety compliance monitoring and reporting, such as European directive 96/82/EC on the control of major-accident hazards involving dangerous substances (Seveso II). It is comprised of a set of services, emphasizing the preventive aspects of industrial safety, in order to improve risk management in industrial activities and surrounding areas, due to major potential of industrial hazards. Currently, e-Seveso services are being validated with regard to market potential and requirements, in a project co-financed by the e-TEN programme of the European Commission (www.e-seveso.net).

Ευθυμιάδου Ειρήνη
Intelin Α.Ε., Αντώνη Τρίτση 21β, 570 01 Θεσσαλονίκη

Alborg Miguel
IDI Eikon, Benjamin Franklin 27, Parque Tecnologico de Valencia, 46980 Paterna –Valencia, ES

Βώντας Απόστολος
Altec Α.Ε., Μιχαήλ Καλού 6, 546 29, Θεσσαλονίκη

ΠΕΡΙΛΗΨΗ

Το e-Seveso είναι ένα web-based εργαλείο παροχής υπηρεσιών υποστήριξης της εφαρμογής νομικών απαιτήσεων συμμόρφωσης, σε σχέση με την παρακολούθηση και αναφορά περιβαλλοντικών δεδομένων και δεδομένων ασφάλειας, όπως αυτές που θέτει η Ευρωπαϊκή οδηγία 96/82/ΕΕ για την αντιμετώπιση των κινδύνων μεγάλων ατυχημάτων που σχετίζονται με επικίνδυνες ουσίες (Seveso II). Αποτελείται από ένα σύνολο υπηρεσιών, με έμφαση σε θέματα πρόληψης, για την βελτίωση της διαχείρισης των κινδύνων από βιομηχανικές δραστηριότητες σε γειτονικές περιοχές υψηλού κινδύνου. Οι υπηρεσίες e-Seveso αξιολογούνται σε σχέση με τη δυναμική και τις
1. INTRODUCTION

The industrial and technological development, especially in certain sectors, such as the chemical sector, has brought up new hazards and risks, which could cause major accidents with disastrous consequences on the environment and on people.

The European Community has recognized these hazards right after the accident in Seveso - Italy, and has brought into force the Directive 82/501/EEC, on the major-accident hazard of certain industrial activities (Seveso Directive), thus defining the concept of a major-accident. The Directive was amended by Directives 87/216/EEC and 88/610/EEC.

The analysis and experiences at European level have shown that the majority of major accidents are the result of managerial and/or organizational shortcomings. Therefore in 1996 the Directive 96/82/EC, on the control of major-accident hazards involving dangerous substances (also known as Seveso II) was brought into force [1]. The Directive focuses mainly at the prevention of major-accidents, which involve dangerous substances, and secondly on the limitation of the consequences on people and the environment in case of a major-accident, based on the following guidelines:

- The identification of establishments, which include major-accident hazards, is not based on the type of activity but on the type and quantity of dangerous substances.
- The prevention of major-accidents, as well as the response to it, is based on the planning and implementation of the appropriate safety management systems and land use planning and the identification of potential risks and hazards.
- The registration of data and the communication and exchange of information between all the involved parts at all levels (operators, authorities, public, member states, European Commission) is established, so that significant data, valuable experiences and lessons learned can assist in preventing future accidents.

The first revision of the Seveso II Directive was approved on 9 September 2003. The Directive is now strengthened in a number of areas, (i.e. information to the public, training for emergencies, obligation of industrial operators to produce risk maps etc). As far as the communication on European level is concerned, the following has been added:

- The Directive requires Member States to provide the Commission with minimum data for all the establishments affected by the Seveso II directive, within their territory. The Commission then has to create a database containing all this information and allow access by the competent authorities of each country and/or certain authorized people.
- The Commission has to create by the end of year 2006 a technical database including risk data and scenarios to help assessing the compatibility between the buildings during land use planning. This database has to take into account as far as possible the evaluations and information from the competent authorities and the operators.

At the same time that Seveso II was being amended and in parallel to this initiative, the European Commission’s White Paper Strategy for a Future Chemicals Policy proposed a new scheme called...
REACH (Registration, Evaluation and Authorisation of Chemicals). Following the publication of the White Paper on “Strategy for future Chemicals Policy” in February 2001 and the public internet consultation in May-July 2003, the European Commission adopted its final proposal for the Regulation on Registration, Evaluation, Authorisation and Restrictions of Chemicals (REACH) on 29 October 2003, launching the Interim Period [2]. Its basic principles are the following:

- **Registration:** There is a general obligation to register substances manufactured or imported in quantities starting at 1 tonne. Failure to register means that the substance cannot be manufactured or imported.

- **Information in the supply chain:** The information flow through the supply chain ensures that all users of substances have the information they need to use them safely. This requires information to be passed both up and down the supply chain, and between all actors in that supply chain. The primary tool for information transfer is the safety data sheet, as set in the REACH scheme, which replaces the current Safety Data Sheets Directive (91/155/EEC).

- **Downstream Users:** These provisions oblige downstream users to consider the safety of their uses of the substances, based primarily on information from their supplier, and to take appropriate risk management measures.

- **Evaluation:** There are two types of evaluation:
  - Dossier evaluation, a) aiming at preventing unnecessary animal testing and b) giving authorities the task to check compliance of registration dossiers with the requirements of the registration title;
  - Substance evaluation, which provides a mechanism for an authority to require industry to obtain and submit more information in case of suspicion of a risk to human health or the environment.

- **Authorisation:** An authorisation system for use and placing on the market of substances is established for the substances of very high concern.

- **Restrictions:** The restrictions enable risk reduction measures to be introduced across the Community where this is shown to be necessary.

- **European Chemicals Agency:** For the appropriate implementation of the REACH scheme, the creation of a new organization called the European Chemicals Agency is announced. This Agency will have the responsibility to manage the technical, scientific and administrative aspects of the REACH system, and ensure consistency of decision making, at Community level.

- **Classification and Labelling Inventory:** The provisions for a classification and labelling inventory ensure that classifications (and consequent labelling) of all dangerous substances manufactured in, or imported into, the EU are available to all to ensure the smooth running of the REACH system.

- **Information:** It is ensured that non-confidential information on chemicals is available, for example to allow to those exposed to chemicals to make decisions on the acceptability of the related risks. This is done in such a way that the interests of the public’s ‘right to know’ is balanced with the need to keep certain information confidential.
After many years of the Seveso directives implementation, the number of affected establishments is still one of the hardest figures to know, even for the Commission services. Some Member States still have difficulties in knowing and controlling the number of affected establishments. The only figures to which there is public access are those reported in the MARS database, operated by the Major Accident Hazard Bureau. However, the focus of the MARS database is more on the number and information of notified industrial accidents rather than the number of affected establishments. There is also the SPIRS database, which contains geographical risk information but at the moment there is no public access to the relevant information. Based on output from the SPIRS database, the latest figures (August 2002) reported by JRC refer to 6437 affected establishments in the EU [3].

However, apart from those establishments, directly affected by Seveso II Directive, potentially affected establishments may include the whole chemicals industry sector, which is one of the most competitive and innovative industries in Europe. It is the third largest manufacturing industry, composed of about 35,000 companies [4], which employ about 2 million people and account for more than 30% of the world chemicals production. Besides that, the output of the chemical industry covers a wide range of chemical products and supplies in all sectors of the economy, which may also be affected by the REACH scheme, including a wide range of downstream industries other than chemical industry. Around 20% of the 20,455,000 enterprises in Europe [4] carry out some chemical processing operation, which means that about 4,000,000 enterprises (downstream users) have some kind of involvement with the directives related to industrial safety and the REACH scheme.

2. DESCRIPTION OF E-SEVESO TOOL AND SERVICES

e-Seveso is an innovative web-based tool that deploys services, intended to help implement statutory requirements on environmental and safety compliance monitoring and reporting, such as European directive 96/82/EC on the control of major-accident hazards involving dangerous substances (Seveso II).

It is primarily targeted to the Small and Medium-sized Enterprises (SMEs), affected directly or indirectly by Seveso II directive. They include manufacturers, distributors, importers and downstream users of dangerous substances, who are either subjected to Seveso II Directive, or could be subjected to major technological risks, such as chemical emergencies, explosions, fires, structural failures, that may require specific risk management and emergency tools. Most of these SME industries are located inside industrial parks or industrial districts, where special requirements frequently arise due to the close proximity of the establishments and their interconnections, in which case the “domino effect” prevails and e-Seveso services pay special attention to this. e-Seveso can be understood as a Joint Safety Policy tool, providing advanced coordination of the policies of all operators involved in the overall hazard.

Additionally, local authorities and communities of the area in which a group of co-operating enterprises reside can be provided on-demand with aggregated data, allowing evaluation of general safety performance in the area. Furthermore, these institutions can be provided with relevant (pre-agreed) warnings and alerts, addressed to key personnel in emergency services, so that local protective measures can be undertaken immediately upon the occurrence of hazardous situations.

e-Seveso is comprised of a set of services, emphasizing the preventive aspects of industrial safety, in order to improve risk management in industrial activities and surrounding areas, due to major potential of industrial hazards, including:
At the level of Companies:
- Continuous Monitoring and performance measurement of the Critical Control Points set by the operator according to his safety management system to prove that a systematic approach is present;
- Monitoring of releases from products (if these are considered critical control points);
- Connection of sensors (if available);
- Capturing critical parameters coming from automatic devices (sensors or other devices) plugged into the net or manually introduced;
- Saving and distributing this information to support SMS;
- Interacting with the stakeholders through the sharing of an alarm system (alert mechanism responding to external signals);
- Information to Authorities;
- Information to the public.

At the level of Local Authorities and Communities including local governing bodies, industrial associations, and local communities' representatives:
- On-line access to the information for monitoring operator’s performance;
- On-line Reception/Notifications to and from establishments;
- Interacting with the stakeholders through the sharing of an alarm system (alert mechanism responding to external signals);
- Information to the public.

*e-Seveso* could also help to implement some of the requirements of the new chemical policy *REACH* that complements and reinforces the Seveso II Directive, by serving as the tool for the assessment step focusing on collecting data at hazard endpoints needed to compile the *REACH* Safety Report and by assisting the communication flow on the supply chain and especially in the sharing of information for the downstream users forming consortia.

*e-Seveso* tool is comprised of a monitoring system, (with three monitoring modalities) and a Real Time Alert System:

- **“Remote sensing” monitoring**: it introduces the capability of detecting different patterns for triggering proactive notifications, integrating different “physical networks” in just one “logical network”.

- **Continuous “proactive” monitoring**: it is a direct synchronous contribution of information coming from measurement devices and updated without human intervention. It is the most advanced, but also expensive, system of collecting information.

- **Manual monitoring and Logistic Traceability**: it includes the indirect asynchronous contribution of information coming from manual stack sampling, portable equipments and data-loggers plus “factual human decisions”. This alternative is very important for SMEs and small stakeholders, if devices will not be available for monitoring in continuous mode, because, at least, they can easily satisfy “on time” the information requirements.

- **Real Time Alerts System**: *e-Seveso*, with its Real Time Information Warnings of four (or more) levels, offers the possibility to react immediately to emergencies collected by the net, sending early warnings or firing alarms not only to safety managers, but also to other stakeholders (vicinity companies, authorities), assisting in minimizing risks due to industrial
hazards. It can also produce positive effects in the management of hazardous sites, fostering improvements and arising preventive awareness.

Currently, e-Seveso services are being validated with regard to market potential and requirements, in a project co-financed by the e-TEN programme of the European Commission (www.e-seveso.net).

3. METHODOLOGY FOR IMPLEMENTING E-SEVESO SERVICES

The implementation of Directive 96/88/EC (Seveso II – Directive) can be realized by three main processes: a) prevention, b) response after a major accident and c) accident evaluation, as shown in figure 1.

![Figure 1 - Seveso II generic requirements – main processes](image)

In each process, different actions on behalf of the operator, the authorities and the Commission have to take place and information has to be exchanged between all the parties involved, as shown in figure 2.
In each process, there are various procedures that have to be followed by the operator, the competent and other related authorities and the Commission. Tables 1, 2 and 3 show how the e-Seveso tool can be used to offer corresponding services to the corresponding parties in the various procedures of Seveso II implementation.

**Table 1. Implementation of e-Seveso services for accident prevention**

<table>
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<tr>
<th>Responsibility of the Operator</th>
<th>Procedure</th>
<th>Services by using e-Seveso tool</th>
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<tr>
<td>Notification from operator to competent authority and through it to other responsible authorities</td>
<td>• Registers all necessary general data of the operator (name, address etc).&lt;br&gt;• A map can be attached as document that shows the immediate environment.&lt;br&gt;• Can be used for identifying and reporting all dangerous substances in the operator’s establishments. It can also keep an inventory of the substances, including information such as the maximum quantities.&lt;br&gt;• Material Safety Data sheets can be attached as documents to the records.</td>
<td></td>
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<tr>
<td>Development of Prevention Policy and communication to competent authority and through it to other responsible authorities</td>
<td>• Creates groups with certain responsibilities and different access permits, including warning groups (internal or external), responsible in case of alarms.&lt;br&gt;• Full description at all levels of the establishment.&lt;br&gt;• Monitoring performance, since it can be used to control if all the required safety systems and plans exist.</td>
<td></td>
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<tr>
<td>Responsibility of the Authorities</td>
<td>Procedure</td>
<td>Services by using <em>e-Seveso</em> tool</td>
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| Development of Safety Report and communication to competent authority and through it to other responsible authorities | • Maps, description of surrounding land and buildings can be attached.  
• Description of the installation, locations, equipments, processes and operation at each equipment.  
• Inventory of dangerous substances and all related characteristics.  
• Identification of risk sources in the establishment (possibly with special codes).  
• Emergency plans can be attached as documents. |
| Development and communication of Internal Emergency Plan | • Warning groups definition.  
• Setting-up alarms. |
| Measuring, monitoring and control for risk minimization | • Connecting to sensors measuring different parameters and storing and/or publishing measured data in real time, or just monitoring and giving alerts for all measured parameters.  
• Manually measured data can also be monitored and stored.  
• Identification of possible trends (through reports and figures).  
• There can also be connection with cameras that will survey certain locations (e.g. risk sources of the establishment), giving on-line access only to authorized persons. |
| Responsibilities of the Authorities | Safety report evaluation, registration and communication of results | • On-line access to all the documents required from the operator  
• On-line communication with the operator. |
| Inspection and control of the operator | • The operator can prove to the authority that he is taking all the necessary safety measures, and he can also prove the continuous monitoring and performance measuring of the critical control points specified in the safety report  
• Conducting on-line inspections and controls  
• On-line access and communication of information and documents, including communication of certain information to the public (by giving restricted access to data, according to regulations requirements and/or the operators choice) |
| Drawing up of external emergency plan | • Access to certain information, needed for the external emergency plan |
To deliver an effective solution, the needs of all participants must be met both individually and in aggregate. **e-Seveso** services will be deployed around the normal activities of the operator, starting from an analysis of the activities of the corresponding enterprise. Existing **Safety Management Systems** can be used to identify the critical control points to be monitored. In its absence, this will be the first step to define. To begin with, demands will not be too high in order for the organization to cope with and they can increase progressively at the organization’s request. The steps to be followed for the deployment of **e-Seveso** services at the operator’s site include:

- Step 1. Assessment of the risks on site.
- Step 2. Definition of the Critical Control Points (information to capture).
- Step 3. Definition of the equipment needed (if already not in place).
- Step 4. Definition of data to be shared; definition of users authorized to see it; alarms definition.
- Step 5. Implementation of the services.
- Step 6. Users training.

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|                | Exchanging information on safety measures with potentially affected stakeholders | • Specific access can be given to on-line data and attached documents, according to who the affected stakeholder is  
• Messages can be received from the public in which they express their opinions |

**Table 2. Implementation of **e-Seveso** services for responding to an accident**

<table>
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<tr>
<td>Responsibilities of the Operator</td>
<td>Detection of unusual or dangerous events</td>
<td>• Detecting unusual events, or even the trend for an unusual event, if connected to the respective sensors, and setting the necessary alarms on.</td>
</tr>
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</table>
| | Notification of responsible authorities in case of an unusual or dangerous event | • Responsible authorities can receive an alarm  
• They can have access on views from real time camera if permission is given by the operator |
| Responsibilities of the Authorities | Response to an accident – Real time management and notification to the public | • On-line access to all data concerning locations and current quantities of dangerous substances, in order to make the appropriate decisions  
• On-line access to the necessary information from safety report and/or emergency plans |

**Table 3. Implementation of **e-Seveso** services for accident evaluation**

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| Responsibilities of the Operator | Information from the operator to the competent authority of a major accident | • On line exchange of information and data  
• Major accident report can be attached as a document |
| Responsibilities of the Authorities | Actions and recommendations to the operator by the competent authority | • Assisting the exchange of information between authorities, member states, European commission  
• Assisting in drawing risk maps and keeping lists of all directly affected Seveso enterprises |
The above steps result in an agreement on the essential safety parameters to be monitored, taking into account that all obligations will be met. Other non-essential parameters may also be included at the organization’s request. The connection of e-Seveso tool with the measurement devices, if available in the operating enterprise, will follow. Measurements can be taken from any source and/or existing measurements of the industrial process can be indirectly linked to e-Seveso (if it is allowed). The data, which will be provided in raw format and/or processed format, will be collected and returned using a variety of leading-edge tools, to match the corresponding needs of the operating organization (web presentation is the basic form, but other mechanisms such as SMS, GSM, Satellite or DTV for special situations, including alerts, can also be used).

The data will also be supplied to the Competent Authorities giving them instant access to up-to-the-moment complete records of safety performance of each participating enterprise, regardless of the location of the Agency/ Administration (or even of the individual officer concerned). The regulatory agency will be able to interact with the establishments via e-Seveso or directly, if any immediate parameters or longer-term trends need a reaction. Emergency messages will also be sent to selected individuals when necessary (extreme results or certain pre-programmed situations). A last set of data will be on offer to Administrations, showing aggregated data for areas or sectors, suitable for presentation to the public (i.e. via Web/WAP/TV-Text etc.).

4. CONCLUSIONS

e-Seveso wants to deploy services through Europe for monitoring safety management, and increasing the collective protection of people, goods and environment by means of the effective sharing of the resources of the Information and Communication Technologies (ICT), so much private as public, and dedicated so much to the prevention as to the response capacity, without damaging privacy.

The uniqueness of the e-Seveso services is based on providing data in Real Time from measuring instruments or manual input and facilitating the interchange of information among all the actors of the information chain, that in the case of the EU Chemical Policy influences almost all industrial value chains far beyond the chemical industry.

With respect to Seveso II directive requirements, e-Seveso services offer to both operators and responsible authorities:

- A simple and cost-effective tool for on-line preventive monitoring of parameters;
- A user friendly tool for respective data and information exchange between stakeholders;
- Assistance in responding quickly and effectively to any respective alarms;
- Easy access to historical data for accidents evaluation and risk minimization.

REFERENCES
