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Foreword

Back in the early 1980s, the European Commission responded to a number of serious accidents in European process industry (notably the explosion in Flixborough and the dioxin release in Seveso) by issuing the "Seveso" directive. This directive was an attempt to set out minimum requirements throughout the member states of the European Community (nowadays the European Union, EU) to prevent major accidents in process industry. Building on required experience, this directive was replaced by the "Seveso-II" directive in 1996. The Seveso-II directive lays a number of obligations on operators of potentially hazardous process installations and establishments, and on authorities that are in charge of permitting and controlling them. The obligations include among others that operators are requested to perform risk analysis, to implement accident prevention plans and safety management systems, and to document these actions in the so-called "safety reports".

Reason to take action at Union level was not only to protect man and environment throughout the Union, but also to ensure that conditions for operating process plants throughout the Union are equal and no national or regional advantages occur due to lesser strict local requirements. But, as the Directive sets the objectives and is less precise on the minimum requirements, we have to acknowledge that national implementations and methodologies used in fulfilling its obligations actually differ considerably, and the content of the safety reports in one state, may be different in another. It is obvious that more stringent requirements are implemented in the more densely populated nations; though even among them, considerable differences exists in methodology and criteria.

Since the first Seveso directive, cooperative research has been undertaken (much of this co-financed by the research programmes of the European Commission) to support the implementation of the directives. This research addressed risk analysis methodologies, consequence assessment, prevention and mitigation, etc. From the beginning models and methodologies showed large differences in outcomes and many of the research efforts, including a couple of benchmark exercises (ASSURANCE project, Assessment of the Uncertainties in Risk Analysis of Chemical Establishments) were directed to identify and understand the causes of these differences. For instance, the ASSURANCE project, throughout the risk analysis process, many uncertainties exist: uncertainties in the choice of accident scenarios, uncertainties in the likelihood of (extremely rare) events, uncertainties in human behaviour, uncertainties in physical effects, uncertainties in the damage to be expected. Due to these uncertainties, it is no surprise that scepticism is expressed regularly as to the overall use and validity of risk analysis, especially when results of risk analysis are expressed numerically. But some form of quantification cannot be avoided when one has to address decision making as to the acceptance of potentially hazardous activities, where risk is expressed by some combination of likelihood and adverse consequence.

The way forward is to find a suitable compromise between using scientifically sound data and methods, as to remain as close to reality as possible, on one hand, and to develop and agree on harmonised datasets and approaches on the other hand. The ARAMIS research project, that ran from 2001 to 2004, is an attempt to answer the inconsistencies pointed out by the ASSURANCE project, covering the whole risk analysis process, from hazard identification to severity mapping. As such, it was probably the most comprehensive risk analysis research project in recent years in Europe. The aim of the project was to develop a series of methodologies covering the main requirements of the Seveso-II Directive, which would allow application and adoption in many EU Member States, respecting the national traditions and implementations of the Directive. As such, the project resulted in suggestions for methods and indicators for hazard identification and hazard (scenario) analysis, integration of the severity for various hazardous impacts, methods to assess safety management effectiveness, and ways of addressing the various vulnerabilities of the areas adjacent to the hazardous plants.

Thanks to the structure of the project and the consortium composed with partners coming from 10 Member States (France, Italy, Belgium, Spain, Denmark, Poland, The Netherlands, United Kingdom, Slovenia, Czech Republic), the project was a formidable opportunity to exchange on practices and to converge to an acceptable method appropriate for a large number of Member States.

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Moreover, a Review Team composed with the Authorities in charge of the Seveso Directive from Belgium, Germany, France, The Netherlands, Spain, Austria, Ireland, Sweden, Slovenia, Hungary and representatives from Industry (European Process Safety Centre), Consulting organisations (Sicherheitsinstitut in Switzerland, Lacoursière Inc., Canada), and an international organisation (United Nations Environment Programme – UNEP, Division Technology, Industry and Economics – APELL) was created to enable the endorsement of the developments of the project. As an additional final result, the project succeeded in the exchanges of best practices not only between the partners but also among the Reviewers. Therefore, the project can be acknowledged to have contributed to the convergence of view in the EU regarding risk assessment for Seveso plants. It is a step forward towards harmonisation.

This special issue of *Journal of Hazardous Materials* includes papers describing the scientific progress produced during the ARAMIS project, in combination with some papers that describe the general state of the art and the views of industry and some authorities within and outside the EU on the control of major accident risks.

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