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S H A P E – R I S K

SHARING EXPERIENCE ON RISK MANAGEMENT (HEALTH, SAFETY AND ENVIRONMENT) TO DESIGN FUTURE INDUSTRIAL SYSTEMS

Co-ordination Action

Priority 3 : **Nano-technologies and nano-sciences, knowledge-based multifunctional materials, and new production processes and devices – 'NMP'**

Deliverable D 3 (D.3.B)

Synthesis document on WP3

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RE	Restricted to a group specified by the consortium (including the Commission Services)	**X**
CO	Confidential, only for members of the consortium (including the Commission services)	

Reference Workpackage(s)

WP 3	Survey and comparison of common tools and service platforms.

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Abstract

This document aims to present the results of a survey of tools, service platforms, and information systems (ToSPIS) that are used to support compliance with the **IPPC** and **Seveso** Directives (i.e. for prevention, response, crisis management, and mitigation) for discussion in a wider sense. It is based on the WP3 Discussion Document that was prepared for the WP3 Workshop held on November 17, 2004 in Paris. As well as ongoing input, the comments and feedback received from the WP3 Workshop are also incorporated into this document.

INERIS quality approval :

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Synthesis document on WP3 "Survey and comparison of common tools and service platform"

The SHAPE-RISK consortium hopes that publication of this paper (as with its preceding version as a "Discussion Document") will stimulate consideration and discussion of the issues raised.

Any responses to the document would be welcome and should be sent to:

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Synthesis Document

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1. Note for the Reader

This is the final report for WP3 of the SHAPE-RISK project. It is largely based on the WP3 Discussion Document which was prepared for the WP3 Workshop on "Survey and comparison of common tools and service platforms" which was held on November 17, 2004 in conjunction with the SRA-E conference at Chalet de la Porte Jaune, Paris. The SHAPE-RISK project coordinator INERIS organised this WP3 Workshop, together with mainly VTT (The Technical Research Centre of Finland) and JSI ("Jozef Stefan" Institute, Slovenia).

The aim of the WP3 Discussion Document was to provide a foundation for the discussions in the workshop. It was hoped that the content of the document on the current state-of-the-art, together with the presentations and the specifically selected thought-provoking issues would raise absorbing discussion, and both offer some useful feedback and provide a basis for this WP3 Synthesis Document.

Workshops are obviously only as successful as the participants make it, and we therefore invited all to come prepared with questions for discussion. Especially welcome was any input and opinion on the tools used to support Seveso and IPPC compliance. Unfortunately, the selection of the SRA-E conference for this workshop was not especially ideal – it did not provide what was thought to be the most suitable audience, i.e. the SMEs and industry representatives who would be in the best position to provide feedback.

Target audience:

All stakeholders interested in, or working with tools, service platforms, and information systems to support the production of safety reports for Seveso and IPPC compliance.

2. Acknowledgements

This document was compiled as a Deliverable for WP3 of the SHAPE-RISK project. Although this Synthesis Document is still considered to be a work-in-progress, throughout the remainder of the SHAPE-RISK project, we would already like to thank the experts and officials from the various member countries for their contributions and especially their time. The interviewees and questionnaire respondents represented stakeholder experts from industry, consultants, and the competent authorities in the countries of Austria, Finland, France, Germany, Greece, Italy, Slovenia, Spain, and the UK. Some countries provided greater coverage and experiences than others, and it is important to note that contributions from country experts were made in their capacity as experts and are not formal country positions.

We hope that the country insights will especially be of interest to readers, however, as is often the case, not all the information provided could be fully integrated. We therefore invite readers to notify us on where, in their experience, the text could be improved – by further elaboration or addition.

Additions and amendments to both Annex A & Annex B will be especially welcome.

3. Introduction

The overall objective of SHAPE-RISK Co-ordination Action is to **optimise the efficiency of integrated risk management** in the context of the sustainable development of the European process industry by **addressing sustainable waste management and hazard reduction (operational safety and environmental risks) in production, storage and manufacturing**.

This objective will support life-cycle safety in the process industry and minimisation of pollution and wastes, and minimisation of resources depletion, all of them from the producer of raw materials to the direct user of the products of the installation. In this proposal, risk management is related to:

- Environment (referring to the IPPC Directive),
- Major accident hazards (referring to the SEVESO II Directive),
- And occupational health and safety (referring to the safety and health of workers at work Directive, and in particular the ATEX Directives).

In operational terms, SHAPE-RISK Co-ordination Action aims at structuring the activity of a network with the **organisations that provide technical supports to the Public Authorities** in charge of the application of the SEVESO, IPPC and ATEX Directives. This network will interact strongly not only with industry and other stakeholders at a European (and international) level, but also at national and local level.

The SHAPE-RISK Co-ordination Action will consist in defining, organising and managing common initiatives:

Share experiences on the various aspects of risk management, experiences coming from initiatives (projects or networks) funded by national programmes of the Members States and by other RTD project funded in the 4th and 5th Framework Programme,

Identify the needs and breakthroughs for the design of future industrial systems to make them cleaner and safer,

Integrate and structure the risk-related European Research Area by defining common research activities on the various aspects of risk management.

The main deliverable of the SHAPE-RISK process will be **recommendations to design future cleaner and safer industrial systems**.

3.1 Workpackage 3 Discussion Document

The Discussion Document aimed to present the results of a survey of tools, service platforms, and information systems (ToSPIS) that are used to support compliance with the **IPPC** and **Seveso** Directives (i.e. for prevention, response, crisis management, and mitigation) for discussion in a wider sense, but specifically for the WP3 Workshop that was held on November 17 in Paris.

The objective of WP3 was to compare the findings of a survey and describe the state-of-the-art in order to identify the needs for the future RTD activities with an aim to improve the ToSPIS for risk management.

This has been achieved by identifying and mapping the ToSPIS that industry currently uses in order to comply with the Seveso II and IPPC Directives. Stakeholder interviews were expected to support the country-specific summaries supplied by the WP3 and other SHAPE-RISK consortium members.

Feedback to the Discussion Document in general, together with the WP3 Workshop proceedings and a follow-up questionnaire, were all to be used to compile this WP3 Synthesis Document.

3.2 WP3 members

VTT (WP Leader), JSI (WP Deputy)

MAHB, HSL, OvGU, IDEAS/CESD – main members

VITO, UMIST – advisory members

3.3 Interview Aid – see also Annex 3

The aim of the Interview Aid was to provide a tool to enable the mapping of the ToSPIS that are currently used by industry in their efforts to comply with the Seveso II and IPPC Directives, as well as authorities who check this compliance.

It consisted of 3 main sections:

1. Organisation / Institution Profile
2. Seveso Directive compliance
3. IPPC Directive compliance

The Interview Aid was naturally structured around the main areas that need to be covered when complying with the Seveso II & IPPC Directives (Table 1). The sub-sections used to subdivide the checklist allowed the interviewers to target the relevant persons in these diverse and multidisciplinary fields of risk management. It was anticipated that the use of such a systematic approach would ease the overall effort required for the analysis and reporting of the results.

Table 1: The subsections of the Interview Aid are in line with the Seveso and IPPC Directives.

Seveso	**IPPC**
1. Organisation, Personnel & Training 2. Identification & Evaluation of Major Hazards 3. Operation Control 4. Management of Change 5. Planning for Emergencies 6. Monitoring Performance 7. Audit & Review	Preventive and reductive measures against pollution (Sources of emissions from the installation / Conditions of the site & surroundings of the installation / Selection of raw, auxiliary materials and other substances) BAT (Selection of BAT / The development of Best Available Techniques in a country (Article 11)) Waste management Energy efficiency Prevent accidents and limit their consequences (Environmental risk analysis / Preventive actions against environmental accidents and possible consequences) Definitive cessation of activities to avoid any pollution risk and return the site of operation to a satisfactory state Monitoring systems (Emissions/Immissions) Connections to other legislation Public participation 1. Knowledge Management of IPPC issues

Drawing from the national SHAPE-RISK networks that had been developed since the commencement of the project, specific appropriate stakeholders were targeted for interviews.

All the interviewers were expected to adopt a similar approach throughout the interviews, with the underlying approach based on the standard question-set:

1. **Does the section apply to your organisation?**
2. **What Tools, Methodologies, Software, Service Platforms, Portals, Information Systems, Databases, etc. are used to support compliance with the Seveso and IPPC Directives ?**

Example lists were also provided to prompt responses, and the interviewer was especially requested to keep raising the roles of the ToSPIS for the aspects of "**prevention, response, crisis management, and mitigation**".

Each interview was expected to about 30 minutes duration.

Feedback on ToSPIS to support ATEX, SQAS, ICE, Product Stewardship, REACH, etc. were also requested, but due to limited resources, were not specifically addressed.

The Interview feedback remains confidential.

3.4 SHAPE-RISK Workshop

In accordance with the SHAPE-RISK DoW, a one-day workshop was organised by the WP team to collect contributions from the main experts in the field of IPPC and Seveso.

The workshop aim was to assess and comment findings developed in the Discussion Document, and from the Interviews, and to exchange suggestions on how to improve the situation regarding the tools used to support Seveso and IPPC compliance.

It was hoped that the content of the Discussion Document on the current state-of-the-art, together with the presentations and the specifically selected thought-provoking issues would raise some absorbing discussion, and offer some useful feedback for this resulting Synthesis Document which was to be compiled from all the material gathered.

The topical workshop was to be open to all stakeholders and the public. Particular attention was paid in order to try and involve industry representatives, from both industry associations and plant operators. The SRA-E conference was incorrectly deemed to be a suitable venue at which to contact the relevant stakeholders.

The WP leader made the proceedings available on the SHAPE-RISK website, and all relevant feedback was used when compiling this Synthesis Document.

4. "The state of the art"

The Seveso II Directive (European Directive 96/82/EC) requires the production of a safety report for certain categories of installations. Seveso II also requires that the operators safety management system should incorporate procedures to systematically identify and evaluate hazards, and that these procedures should be described in the report. In order to comply with all the sections of Seveso II & IPPC Directives (see Table 1), various tools, service platforms, and information systems (ToSPIS) are usually employed. The importance of these support tools is self-evident.

1. Tools
   - procedures/methodologies
   - software
2. Service platforms
   - portals
3. Information systems
   - databases

To give a quick impression of the diversity of the scope of this area, traditional paper-based tools include a range of standards, guides of best practice, legal publications, procedures and methodologies, and books and journals. Monitoring systems/equipment are nowadays entirely computer-based, as are most of the traditional tools already mentioned. Information systems include databases of accidents and incidents, legislation, hazardous chemicals, reliability information, etc. and many of these are also now often available by subscription over the Internet. Computer-based simulation tools for studying pollutant diffusion and also online safety management training software is becoming the norm. Risk evaluation and assessment, such as fault tree analysis, safety checklists, etc. are accessible via Internet portals. The oft-

used methodologies are increasingly available as software as companies become reliant on electronic knowledge management systems.

The assessment tools themselves used are numerous and although standard procedures and methodologies exist, their application may range according to the specific context. Many tools are adapted to the certain situation at hand. The same applies for the service platforms and Information Systems that have been developed to support the knowledge management.

The aim of SHAPE-RISK WP3 was to conduct a survey to identify the commonly employed ToSPIS used by industry in order to comply with the Seveso and IPPC Directives. An Interview Aid (Annex 3) was developed and used to gather information on the state-of-the-art.

The state-of-the-art in relevant "Publications and reports" (Annex A), "Research projects" (Annex B), and "Conference / Workshop papers" (Annex C) has also been compiled.

4.1 Interview response summary

Predominantly during the period of September-December 2004, stakeholders in 8 EU member countries were interviewed – including Authorities, Industrial Companies, and Consultants (Table 2). An insurance company was also interviewed in Germany, and several were informally approached in Finland.

A total of 26 interviews were completed. The Seveso section of the Interview Aid was applicable to 24 of the interviewees, and 19 of the interviewees attempted to complete the IPPC section – i.e. 43 responses.

Unfortunately, only contributions from the Authorities in Finland, Italy, Slovenia and the UK were received.

The overall level of response was somewhat disappointing, and has made any analysis of the feedback difficult, as trends can not justifiably be inferred.

However, as one of the objectives of the Discussion Document was to evoke discussion, some of the data has been described only on a cursory level.

Table 2: Interview Aid respondents according to stakeholder and country.

Country	Authority	Company	Consultant	Total
Austria	-	1	-	1
Finland	2	3*	1	6
France	-	-	-	-
Germany	-	3	-	3
Greece	-	-	1	1
Italy	1	2	-	3
Slovenia	1	5	1	7
Spain	-	2	-	2
UK	2	-	-	2

* One of the companies also acted as a consultancy.

Note: an insurance-type institution in Germany was also interviewed.

Table 3: Interview Aid responses according to Seveso and IPPC.

Country	Seveso	IPPC	Total
Austria	1	1	2
Finland	5	4	9
France	-	-	-
Germany	4	4	8
Greece	1	1	2
Italy	1	-	5
Slovenia	7	4	11
Spain	2	2	4
UK	1	1	2

Various relevant feedback and additional responses were received in 2005, and the corresponding further analysis, has been added to this Synthesis Document throughout 2005.

4.2 Deficiencies/limitations of the Interview

It had been decided to develop of the Interview Aid in line with the main subsections of the Seveso and IPPC Directives, and many comments and inputs were received in the development regarding the layout and interviewing approach. Nevertheless, with hindsight, various issues could still have been even better addressed.

The direct mass-mailing-questionnaire approach was dismissed for several reasons, but mainly because of the diverse nature of the subject, lack of control of the quality of the responses and the interpretation of the questions, the typically low number of responses, and especially the multidisciplinary expertise (in both the requirements in accordance with the Directives, and knowledge and competency in the ToSPIS) required to complete the sections, the more targeted interview approach has also yielded quite a small sample of responses and then these were also mainly from those countries represented by the members of the WP.

Some of the "interviews" were nevertheless carried out as questionnaires. Several were also done over the telephone.

It was especially noted that many of the interviews took much longer than the 30 minutes duration expected.

The uncertainty on whether the sample is representative remains, because no checks have been done on whether the most appropriate people have been approached.

The issue concerning the somewhat daunting look of the entire questionnaire has been raised, as this may have been disconcerting to prospective interviewees and therefore might also have affected the level of response. Preliminary analysis already indicates that many of the questions were nevertheless interpreted differently, making any in depth analysis difficult.

Additional examples could also have been provided in the prompt lists.

It may have also been useful to simply include a direct question asking about which specific area the interviewee thought further support ToSPIS were needed.

4.3 Country-specific summary

In addition to the stakeholder interviews conducted, various experts were requested to give country-specific summaries with regards to the topic. Both Seveso and IPPC specific summaries were sought and these are included here as Annex 1 & Annex 2 respectively.

For Seveso compliance, the summaries were to include a very brief summary of Seveso implementation in the country, and the number of applicable upper and lower-tier establishments. The "state-of-the-art" was described with the focus on the levels of awareness of supporting ToSPIS, gaps in knowledge of the ToSPIS, and the difficulties and the problems/issues raised by the Directive and the available ToSPIS. The competency of industry compliance using the current ToSPIS was raised, as was the competency of authority in assessing scenarios/reports using those ToSPIS. The experts were also asked to highlight areas that they believe need more support and provide a critical review of the overall situation.

4.4 Relevant "Publications and reports" & "Research projects"

In order to obtain a more comprehensive overview of the currently available ToSPIS, and the ongoing work in this area, further information on associated and relevant "Publications and reports" (Annex A) and similar work in "Research projects" (Annex B) was sought from the members of WP3, and the consortium as a whole. Similar information was contributed for the IPPC summaries. (Annex 2) The bulk of the information in those sections has thus far been provided by VTT.

Additionally, please also refer to the document: SR_R_WP3_Synthesis_Document-Germany(3).doc for more detailed information pertaining to the state-of-the-art concerning the ToSPIS in Germany.

4.5 Workshop proceedings and Feedback

The SHAPE-RISK WP3 workshop was organised in order to collect contributions from the main experts in the field of IPPC and Seveso – especially with the aim to assess and comment findings developed in the Discussion Document, and from the Interviews, and to exchange suggestions on how to improve the situation regarding the tools used to support Seveso and IPPC compliance.

The topical workshop was open to all stakeholders and the public, and the involvement of industry representatives, from both industry associations and plant operators was expected. The SRA-E conference was incorrectly deemed to be a suitable venue at which to contact the relevant stakeholders.

The proceedings of the workshop are available as a deliverable of the SHAPE-RISK project – Document: SR_D3B_Proceedings_of_the_WP3_workshop(2).doc

The informal discussions that were associated with the WP3 Workshop also generated various feedback. The overall integrated approach, objective and intentions of the Workpackage 3 work had been viewed in a positive way. Especially the tool box of instruments that had been reported was seen to give an insightful view of especially the industries' approach to compliance with Seveso and IPPC.

Many of the limitations of the work that were raised had already previously been recognised and reported in the WP3 Discussion Document. The representativeness of the material was a major concern – both with regards to the countries that responded, and the proportion of industry. Also highlighted was the unfortunately broad scope of the field, which together with the lack of overall resources made it difficult get significant focus in the available time period. The lack of involvement of some especially key stakeholders in the IPPC field was also noted, together with the fact that the feedback and focus of the participants at the workshop was Seveso and not IPPC-based.

4.6 Analysis Results

The analysis of the Interview responses proved to be more difficult than anticipated due to the fact that it is an especially labour intensive exercise – compounded by the different interpretations of the questions, together with the extremely diverse nature of the field of study. Even interpreting the responses themselves sometimes proved to be difficult.

A breakdown of Seveso sites according to countries was thought to be useful in order to indicate the overall scope of this issue, but accurate information was not easily available. (In August 2002 – 6347 Seveso establishments reported by SPIRS.)

Various stakeholder responses were still expected during the remainder of 2005, and it is expected that the final analysis will also still be complemented with references to other ongoing work. Annex B presents a list of relevant recent and ongoing research work. Additional information from analysis of recent Safety Reports may also become available and be incorporated.

Initial trends from the Interviews indicated that safety management experience is not necessarily well-developed and especially SMEs may be inclined to contact an external source and get assistance from, for example, consultants or authorities, when preparing the relevant safety documents. It has been observed that a significant number of the submitted reports are rejected by the authorities.

It is hoped that these cursory analyses will promote further discussion.

Additionally, please also refer to the document: SR_R_WP3_Synthesis_Document-Germany(3).doc for more detailed information pertaining to the state-of-the-art concerning the ToSPIS in Germany.

4.7 General information on Respondents

No extensive review of the respondents was performed. Such an analysis was perceived to not be significant (mainly because of the small sample size), and therefore no direct correlation of the respondents to the ToSPIS is currently available. An analysis may yet be forthcoming, but preliminarily, only 11 firms were reported as being Seveso sites that possess a Major Accident Prevention Policy as well as an emergency response plan. Two Seveso organisations claimed not to have a MAPP, but at the same time several non-Seveso organisations claimed to possess Emergency Response Plans. Twelve respondents indicated that they have performed an environmental impact assessment (EIA).

There are 9 IPPC establishments that possess the corresponding permit (and 3 that do not), and 7 firms also cited that a remediation plan exists. A crisis management plan was noted in 8 cases.

Although 9 respondents noted that common tools were in use throughout their (typically multi-company) organisation, it was interesting to note that 5 others claimed that this was not the case in their establishments. This was already an early indication of the size of the challenge involved in trying to harmonise ToSPIS usage.

4.8 Seveso II Response Analysis

The **Seveso "Organisation, Personnel & Training"** section was in general applicable to most of the interviewees, and reflects the commitment to safety. The responses to the section on "Organisation and responsibilities" were exceptionally diverse. The respondents noted that web-browsers and Intranet systems (in databases or based on Lotus Notes) were common and being used for documenting the organisation structure, job descriptions and responsibilities (also for emergencies), procedures, methods, management of change, examples related to scorecard system, permits to work ("hot works"), licensing permits, authority working instructions and audits, managing the EHS-organisation, the emergency response team/fire fighting team information. Many responses simply stated that they had an Integrated Management System in place. The e-Seveso tool & platform was also mentioned, as were Quality Management System and HS(G)65 "Successful health and safety management" (in the UK). Also management systems (SAP) and checklists were mentioned as tools.

The major companies often have their own safety management departments, emergency response teams and fire fighting personnel, and special relationships with the local fire brigade exist. The safety manager of the medium-sized companies rely more on local fire-fighting personnel who are specifically informed about plant details.

The German insurer offers safety consultation and training.

Numerous responses were received for the section on "Education, training, familiarisation". Procedures and methods in place included ISO 14001, authority supervision & audits, and that plans and actions are checked, preparations of annual training plans.

Both company internal training and external sources were used, and internet training (and various links) and intranet documentation and databases were also mentioned. The major companies often provide their own training; while the medium-sized companies may rely more on external support. The types of training typically take the following form: individual (studying the literature, using internet information, etc.), for targeted groups (inspectors, emergency planners, etc.) by means of courses held by external experts. One interviewee stated that they had full time education designers in the organisation, and that line organisation takes care of the education.

The areas of training mentioned included: job-specific, firefighting, first aid, safety, management of change, safety cards, DuPont's action model, IChemE interactive safety training packages, chemical treatment, safety management system, human management, human action/behaviour. Procedures such as safety pairs, safety talks and safety walks were also noted, as was the preparation of a site-specific safety CD for the personnel.

It was noted that a lot of training is performed; however it could be more systematic. The methods range from checklists to SAP software and specifically designed own computer programs. The HS(G)65 "Successful health and safety management" was also mentioned, and it includes the requirements for adequate training. Simulators are sometimes used for training, e.g. simulation of control failure and simulation of accidents for testing emergency response.

Databases are commonly used by industry to maintain training/competency records and various familiarisation documentation.

According to the responses, the "Contractors" section was not applicable only to the Spanish companies. The diversity of the possible contractors makes this a difficult area to surmise, but the procedures that were mentioned included modified internal versions of SCC, permits to work, hot work card, safety cards, national safety card and scorecard system, safety booklets or leaflets prepared for visitors, ISO 9002, ISO 14001, familiarisation education (general + project specific), briefings, and common safety rules for entire industrial park.

The contractors often are required to undergo site-specific training and it was noted that CDs with relevant information are also distributed. Some are also safety audited. Various support databases were also mentioned for maintaining lists of potential contractors and suppliers.

In Slovenia the contractors (usually external consultants) are selected according to the Public Procurement Act. Typically the contractors are chosen based on its knowledge, experience, references related to the subject, but no checklists exist.

Regarding the "Knowledge management of Seveso issues", the respondents reported that procedures are in place for accident and incident (& near-misses) investigation and reporting, auditing (also authority audits), monitoring developments in the legislation (mostly reactive, but also using EHSQ- manager), checking the authorities' and industrial associations' websites to keep updated, circulating journals & accident investigations, regular compulsory safety meetings, safety information sheet for neighbours, testing-reporting (follow-up & training), checking both plans and actions, and according to HS(G)65 "Successful health and safety management". The knowledge management often takes place via internal networks, although exchanges within industrial associations and relevant national and international committees were also mentioned.

Various databases to support the knowledge management activities, but mainly they were related to accidents (accident reports, MARS, SPIRS, RIDDOR, ZEMA, Hazards Intelligence (HInt), IChemE accident database, VARO-register) and regulations and legislation (Finlex, Edilex). Some of these were Internet or Intranet based. Other database systems named were Chemical engineering -magazine, CONCAVE cooperation network for oil refineries, Integrated GIS themes (SDMS 4.1) Acad, MSO for all chemicals, Register of permits (main chemicals included), SHV database, and EGIG.

In Germany, the "Unterausschuß Ereignisauswertung" (sub-committee on the evaluation of events) of the Störfallkommission (the German Major Hazard Commission) where events are evaluated, and the DECHEMA, where even "near misses" are considered, play an important role.

This aspect concerned almost all the interviewees, and a large number of the responses to the **Seveso "Identification & Evaluation of Major Hazards"** cited HAZOP as the main method (together as HAZOP (+ SNEAK) and other modified versions of HAZOP like Operating (& support) Hazards Analysis) for "Hazard identification". Other common responses included FMEA, PHA (especially for existing facilities), vulnerability analysis, various checklists, and safety walks and inspections. The former ICI 6 stage hazard study is common in the UK. Other responses included Action Error Analysis, BREEZEHAZ, COREDAT, Inherent Safety in design, Environment Impact Analysis (EIA), HarsMeth, Exothermic reaction chemical assessment procedures, LOPA, PHA-PRO 6, POA, Seqhaz, Reliability analysis in operation,

safety at work, State-Transition Diagrams, and What-if? It is clear that no specific or recommended method exists, and this has to be done on a case-by-case basis.

Support tools like accident databases, HInt, literature and discussions with the company, SHV Gas historical records, maintenance-planning programme, and cross country safety audits & implementation reporting were also mentioned.

Software for guiding/recording HAZOP is sometimes used, as is software for LOPA, and Excel based documentation systems were also noted.

The "Frequency analysis" section did not apply to a significant portion of the interviewees. The most common responses included Event Tree, Fault Tree, historic statistical data, LiFE, and TNO Purple book. Markov processes, IEC 61508, Availability Block Diagrams, Reliability Block Diagrams, EGIG and internal evidence, the e-Seveso platform & tool, FRED (HSE data), Lees' "Loss Prevention in the Process Industries" and SHV were also mentioned. Several instances of "company own" methods and databases were noted (e.g. HSE's PIPIN in-house code), as was the use of MS Excel to support the calculations.

The Slovenian ministry pointed out that it does not use any special tools to review the method chosen and used by the operator.

The "Consequence analysis" section did not apply to a significant portion of the interviewees, and the most common responses included TNO's Yellow and Green Books, and DNV's PHAST. Other dispersion & consequence modelling software included ACDS, Breeze Haz, and Enviscreen (environmental monitoring), FRED, SAVEII, SEVEX, SuperchemS. TNO's Effects and "multi-energy method" were also mentioned, and HSE have a range of in-house software for various applications. Additional software was noted in the Italian country-specific summary.

IChemE books on explosion modelling, damage effects, thermal radiation, chlorine toxicity, and Lees' "Loss Prevention in the process industries" were noted as being used.

In Finland, the guidelines of the authorities were referred to. It was noted that consultants have been approached when these consequence analyses are required.

In Germany, also other self-developed methods are applied. For atmospheric dispersion, for instance, the use of the VDI-(confederation of German engineers) program is almost universal.

The "Quantitative risk analysis (QRA)" section was not applicable to a substantial portion of the respondents. The guidelines for CPQRA (AIChE) were mentioned most often, together with GIS (associated together with demographic data and manual calculations). Excel spreadsheets were cited as being used, as were the Dow-index, Risk assistant, Risk circles, Risk curves, Frequency/Fatalities Curves, RISKAT (HSE use for land-use planning), RISK-PLOT (ERM), SAFETI (DNV), Shepherd (Shell), and vulnerability analyses.

In Germany, the major companies may make use of tools like SAFETI or use their own procedures. Screening analyses are also gaining importance.

Consultants have been approached, and some discussion has been raised in this area with regards to future requirements.

The "Accident and near-miss analysis" section applied to most of the respondents, and the most common tools mentioned included various accident databases. That is: FACTS (TNO),

one maintained by the Slovenian Administration for Civil Protection and Disaster Relief, the IChemE Accident database, HInt, and several "own" databases (NCR (based on FACTS), etc.). Equipment Failure Rates were mentioned on several occasions, and also was COREDAT (Component Reliability Data Bank). Similarly, Fault tree, AcciMap, LTA & LTAf, SPSS, HS(G) 65, and State-Transition Diagrams were all mentioned as being used.

While some responses implied that accidents and near miss situations were reported in a special way (own applications), and reports are treated "till the end" and checked off if further action is needed, together with details on who is responsible, many others simply stated that a "common sense" approach was used after logically analysing any event. Root cause analysis and the computer code Taproot was mentioned in one case. One interviewee specifically mentioned that no special procedure/method was in place for the accident and near miss analysis, and another that more systematic models for accident and near miss investigation is needed, and that the investigation should be more detailed.

The **Seveso "Operation Control"** part of the interview was especially applicable to all the companies. For the section on "Procedures and instructions for safe operation operating instructions (storage/filling plant) and work instructions & permits for dangerous operations (e.g. pressure vessel, hot work, safe work on pipeline) were raised in some form or another in almost all cases, but in one case the respondent claimed they didn't know how it was all monitored. Most respondents were keen to point out that intranet archives had been established and that paper-based originals were also stored safely.

The HS(G) 65 guidance was mentioned by one respondent, as was a quality management system, and another specifically noted that the work instructions were included in the process flowcharts.

Directives handbooks and SAP and Microsoft software were mentioned under the heading of procedures and instructions for safe operation, and training exists in this field.

The section on "Production management systems (PMS) / Computerised Maintenance Management System (CMMS)" applied to all the interviewed companies – except those in Spain. Various CMMS systems seem to be in use. Systems like BAAN, SCADA (Operation management system), ProjektWise, SAP, Siemens S7, "Internal IT system Navision Attain", and the e-Seveso tool & platform were noted. The RBI (DNV) database was also mentioned. It seems that most organisations at least partially computer operated operations in which some kind of system in place for monitoring parameters, and managing orders, product flow (storage), etc.

The "Maintenance & Inspection" was applicable to nearly all the interviewees and procedures mentioned included RBI (DNV), RBMI, and RCM. Daily safety walks, Periodic visual inspections, Fault-based replacement, above ground and inline inspection of pipelines, and cathode protection were all used, according to a case by case approach.

The inspection plans were based on statutory inspection deadlines and other time schedules, and internal management systems were generally in place. ProjektWise and various other computerised tools had been cited, as were predictive maintenance techniques.

However, one respondent noted that no special tools or activities are needed – just normal maintenance and checking that the alarming rates are correct.

In the process of safety report assessment the competent authority of Slovenia checks whether the operator manages the maintenance/inspection, whether maintenance and inspection activities are proportionate, and related to the results of major-accident analysis... but no special tool is used for this purpose.

One larger Finnish company had developed an internal system that was basically a risk assessment for complex work. It was often related to management of change issues and larger repair works that required shutdowns and included various operations.

The section on **Seveso "Management of Change"** was applicable to all the respondents – for technical, operational and also organisational changes. The proposed changes (& investments) usually demanded a permit, and risks were then assessed using various systems – HAZOP, in-house PHA, integrated safety audit, internal checklists/regulations – often according to HS(G) 65, IEC 61508, UK MOD standard, or US MIL standard or a maintenance management system. Technical changes are also supported by handbooks, and in some larger organisations this is also supported by associated software. One respondent noted that for new products, exothermic reaction chemical assessment procedures were in place. The document management was seen to very important and various systems (ProjektWise, DocHotel, MilSafe, on an Intranet) were highlighted.

Most of the interviewees claimed that the section on **Seveso "Planning for Emergencies"** was applicable for them and accordingly stated that they had an internal emergency response plan. These often took the form of company-specific systems according to national legislation (described in their Seveso safety report, and even developed in cooperation with authorities). They included various types of training and rehearsals (in cooperation with the rescue administration – fire, police, ambulance, etc.), system testing, and documenting electronically. Regularly updating information according to the rehearsals, and sharing experiences in meetings was seen to be important. Alerting stakeholders (e.g. external communities) was mandatory and in the UK information is required to be given to the public within a public information zone (PIZ) surrounding the site (and set by HSE).

The **Seveso "Monitoring Performance"** was widely applicable, and many "Proactive indicators" were noted to be in use. Employed are various safety/EHS/quality audits, (the rate of) safety checks & walks (the new Dupont system), trend reports, near-miss reports, accident rehearsals (and training), "Process Safety Factors" (teamwork organised), balanced scorecard, risk analyses, ISO 14001, HS(G) 65, and the e-Seveso tool & platform. The claim was that the goal should be to make proactive indicators more common, and it was noted that some authorities provide specific guidance on this area and the EPSC are also preparing a book.

It was claimed that it was more common to assess systems using "Reactive indicators". The most commonly used indicators included various types of accidents (work, traffic, environmental), fires, failures, alarm reports, cathode protection, and lost workdays. Monitoring of tank overpressure, leak detection, and inline pipeline inspection were also mentioned. Some authorities also provide guidance on aspects of performance monitoring, and annual statistics are often published. The e-Seveso tool & platform, basic in-house

statistics analysis (reliability & availability) using MS Excel, and the IChemE accident database were cited as being useful supporting applications.

Most of the Interviewees indicated that some system was in place for **Seveso "Audit & Review"**. Some respondents mentioned that systems such as ISRS (DNV) and ISO 9000 & ISO 14001(BVQI) were in place, and it was noted that both internal and external audits and reviews were performed – and various checklists were mentioned. The HarsMeth system was also used by one respondent.

Audits may be separate or together with management system audits (quality, environment and/or safety). Procedures to review accidents, fires, traffic accidents, rate of lost work days, and failures were also mentioned. Organisations have been known to set up an audit plan in MS Excel.

The authority in Finland gets management system audit documents and compares them to authority demands. On the site issues are discussed with the company. The UK authority noted that HS(G) 65 has requirements for both proactive monitoring and audit (separate activities), and that various commercial audit methods are used in different companies. No special tool is used by the competent authority of Slovenia to check the audit and review activity of the operators.

4.9 IPPC Response Analysis

For the section on "Emission identification", a systematic process-oriented approach seems to be the most common according to the interviewees. Possible emissions are simply identified by looking at what the process includes. Process documents and maps of the site and the information from the process control system, emission monitoring (e.g. Dylta, Syncair) and modelling (e.g. Enviscreen) systems, checklists (emissions to air, soil, water, sewer, noise, vibration, smell, future and past, etc.), site remediation plan, BREF documents, websites of the authorities, and numerous other information sources are used to gather the information. Brainstorming sessions as well as some risk analysis methods (such as Walk-through, Fault tree and Action Error Analysis, and in Finland PK-RH and SARA as special environmental risk analysis methods) are used to organise the knowledge gathering. The methodology and systematics of voluntary environmental management system (ISO 14001) was mentioned in two responses – in Finland and in Slovenia. In the UK, there are comprehensive application requirements and guidance to applicants. The H1 software tool is mentioned.

The performance is monitored by measurements at the fence and outside the premises of the plant. In the case of the major companies in Germany, some of the measurement results are directly transmitted to the corresponding state authorities.

In the "Identification of significant effects of the emissions" section, the responses cited that in general those significant effects, that are monitored, are defined in permits or in legislation. In many cases, effects are identified and analysed by consultants who have specific models for doing the analysis, for instance, models for groundwater flow, 3D models for water ecosystems and meteorological models. EIA, BAT, land-use planning, risk assistant, literature, Internet, and scorecard and vulnerability studies were mentioned as useful tools for the identification of significant effects of the emissions. Working environment quality standards, dose concept and MAC-levels are used as a reference for significant effects. The

Environment Agency of the UK mentioned the H1 software and H1 screening methodology in this section, and in Slovenia a method called NOAEL was highlighted.

Significant effects on human health are assessed in all the German respondent companies using MAK and ERPG values, and applying the pertinent regulations on analysing and controlling impacts on human health. Environmental impact assessments are performed, computer codes are in use, and the VDI-dispersion model was named in this context.

In Finland, joint control for environmental monitoring was mentioned by an environmental authority. This means that the company is obliged to join an environmental monitoring system made by, for instance, a town. The company pays a fee to join the system, and the town then takes care of the monitoring. In Finland, there is also a database (maintained by the Environmental Administration) about emissions and the condition of the environment.

Interviewees who responded to the section "Conditions of the site & surroundings of the installation: The environment of the installation" noted that consultants have work to do in this area. Many different kinds of site reviews and audits are performed. Citizen and smell panels and other societal analysis in addition to traffic controls, automatic monitoring and special analysis of the water, groundwater and the soil quality (both inside and outside the premises), as well as air quality monitoring, give data to this topic. EIA reports and GIS maps are applied. For the UK, the databases at http://jncc.gov.uk/, http://www.magic.gov.uk/, and http://www.english-nature.com/ were especially mentioned and again comprehensive PPC application requirements and guidance for applicants exists.

The feedback on the section "Conditions of the site & surroundings of the installation: Land use" indicates that land-use planning is done by the authorities alone – and sometimes in cooperation with companies. Standards for safe areas are used. In Germany, the land use planning in case of existing sites is part of the corresponding authorization by Federal State authorities. So far they have been subject to building regulations. Procedures for implementing Article 12 of the Seveso Directive are, at present, being prepared.

According to the responses to "Maintenance management related to pollution prevention", environmental issues are systematically taken care of in the processes and in maintenance planning. Maintenance management related to pollution prevention is often based on alarms and environmental technology, and additionally ISO management systems, regular walk-arounds and checks of equipment are used. Guidance to applicants as well as various databases on reliability were mentioned.

For the section "Selection of raw, auxiliary materials and other substances", a process-oriented approach typically checks that the process can handle the chemical. MS Excel tables and all sorts of lists and checklists of preferred chemicals are used. Major companies often have their own testing and selection programmes concerning the choice of raw materials, etc. For the medium-sized companies, the production recipes are typically provided by the clients – mostly major chemical companies. Industrial associations provide information, as well as authorities and chemical suppliers. The Internet and literature are in generally quite good sources of information, i.e. MSDS, etc.

For "BAT: Selection of BAT", companies and authorities are participating a BAT meetings at both the European and national levels. The website of the environmental administration (or other ministries) and European BREF documents are the main information source. European BREF documents were noted to be one of the biggest information systems in Europe. In

addition there are mailing lists for networking in BAT issues. In Finland it was especially mentioned that companies are well aware of the BAT-BREF issues in their business field. This however creates a situation where authorities have to depend on what industry says.

In Germany, the state of technology/safety technology has to be complied with by law; and BAT only play a role in the major chemical company, where BREFS and others are complemented by own research and assessment methods. Database and software support is given.

Under "The development of BAT in your country (Article 11)", it was cited that the Environmental Administration is typically responsible for BAT development, i.e. Finnish Environment Institute (Finland) and the Environment Agency (UK). In Finland, the authority organises the BAT meetings. In Germany, the development of BAT is done by operators supported by various groups of experts; relevant data bases are available, and software support is given.

Sorting systems and wastewater treatment systems are common according to the responses of the "Waste management" section. Also incineration, etc. are in use in order to comply with the comprehensive and strict German legislation in the field. Authorities and Internet information sources provide good sources of guidance for waste management. The principle that waste is primarily used as a material and secondarily as energy is followed at least in Finland. There are also national and regional waste management plans. Different kinds of investigations are made for instance about is waste quality suitable for dumping areas. As waste management tools, also storages of waste and exportation of hazardous waste were mentioned.

The responses to the section "Energy efficiency" suggest that voluntary energy conservation agreements are made between companies and governmental organisations. Energy consumption is monitored and audits about energy balance are made. European BREF documents are used as an information source and an emission trading scheme (green house gas emission trading) was mentioned. In Germany, strict laws exist concerning energy efficiency, audits, energy metering and control, and emission trading.

To "Prevent accidents and limit their consequences" general risk analysis methods, such as HAZOP and PHA were mentioned, together with hazard identification alone, and quantitative risk analysis and brainstorming in the context of environmental permits. There are also special environmental risk analysis methods used, often by the larger organisations, like a method called SARA in Finland (developed by VTT). HarsMeth was mentioned as a risk analysis tool in Spain. EIA and insurance companies provide assistance in this area. Safety analyses are required by the authority and a safety report as it is defined in Seveso II Directive is used to cover also environmental risks. This was, however, said to be rather unclear area for most of the people. Also the need to use a consequence analysis to assess conditions of the environment after the accident, like meteorological and hydrogeological models, is not well defined in the regulations. The insurance-related respondent in Germany provides training in the field and offers software developed for the purpose.

In an ideal situation, "Preventive actions against environmental accidents and possible consequences" are taken care of already in the design process – and HAZOP was cited as being useful. Risk analysis methods in general give information for preventive actions. Methods for promoting the safety culture, such as safety walks and talks, safety pairs,

accident and near miss reporting, etc. are also examples of good practices in this context. Process monitoring and environmental techniques, such as safety pools, barriers, safety measures, alarms and water treatment systems, are the basic elements of environmental accident prevention. Rehearsals, rescue administration, training, working instructions and process maintenance were also defined as being useful and common tools, as was the Major Accident Prevention Policy (MAPP) as specified in the Seveso II Directive. In Greece, the interviewee mentioned also the e-Seveso tool & platform as being helpful.

In the section "Definitive cessation of activities to avoid any pollution risk and return the site of operation to a satisfactory state", the respondents mentioned cost benefit analysis, checklists and special cessation plan as well as regular inspection by the authority and guidance from the authority. The German responses noted that obsolete plants typically undergo a HAZOP and other procedures like Man, in addition to the use of checklists, cost-benefit analysis, and LCA.

For "Monitoring systems: emissions", automatic and manual, continuous and periodical monitoring and sampling systems were highlighted as common tools. Mobile monitoring units are also in use at larger organisations. Monitoring demands lots of resources – both material and personnel. Dylta and Syncair (air emission monitoring) were special methods mentioned in Finland, the e-Seveso tool & platform in Greece, and the MCERTS schemes in the UK. Databases and pertinent software are also used.

According to the responses, special analyses are used in "Monitoring systems: immissions" when needed, and the responses were in line with those for the "emissions". Technical procedures and analytical standards give guidance, as in the EQS Database (in Slovenia). Automatic emission monitoring systems, sampling and joint control (in Finland) are also information sources. In one company in Finland, also a special Info-phone line was mentioned – the public can inform the company about effects in the environment. Other notables included the e-Seveso tool & platform (Greece) and the MCERTS schemes of the UK.

There are numerous "Connections to other legislation" but the most common mentioned were the Seveso II and EIA Directives. EMAS was also mentioned, and the VOC-directive, etc. Especially the authorities seemed to find lots of connections between IPPC and other legislation. As a tool to identify connections to other legislation, companies mentioned a multi-professional group where different expertise areas are present. In the Slovenian Ministry, GHG allowances were mentioned together with the internal authority databases on permits, as well as integration and consistency assessment. In Germany, the StörfallVerordnung, EIA directive, and emission trading apply. In addition, the major companies which operate worldwide are familiar with similar legislation, e.g. in Asia, South America and the U.S.

The EIA-procedure, official public hearings and written info for Seveso issues to the public are examples of official regulative tools used in "Public participation". Whereas, press conferences, open door days, cooperation with local land and forest owners, customer visits, panels and info phone lines are tools that encourage informal communication between companies and the public. Enhanced communication schemes, appeal mechanisms as well as internal databases and public registers were also mentioned in this context.

In Germany, public participation is mandatory in the relevant legislation. In addition, the major companies inform the public actively on important issues. While the smaller organisations often use open days to inform the public, the larger companies often also provide information via their websites.

"Knowledge management of IPPC issues" are supported by helpful tools to organise internal knowledge management – the Lotus Notes system the AVAC-system were mentioned. The AVAC-system is a tool used, at least in Finland, where every PC in the company has a screen saver where internal notes concerning, for instance, environmental management, can be shown. The larger companies especially noted the use of paper publications (e.g. quarterly safety bulletin), the Intranet and Internet, and current practice includes active information and participatory processes.

The Internet, BREF documents, legislation in general and paper publications were pointed out as useful information sources. Informal training and the participatory process for targeted groups such as maintenance and management of change were also mentioned as useful tools for knowledge transfer. Authority visits and different kinds of information groups and stakeholder involvement are also applicable. Directions for press releases were meaningful in this context in one response.

4.10 Additional

The issue of a common approach by inspectors was raised especially in the summaries of Italy and Finland. In order to verify each element of the SMS during the inspections, the inspectors have adopted a checklist to create a common and homogeneous framework to conduct inspections.

Feedback also indicated that insurance companies might in some instances demand that certain studies are performed, and specific tools be used, so it was decided to investigate this issue further. In Finland, two insurance companies were approached and questioned about the implementation of such a policy. It was stated that the only expectation is that the companies fulfil all the legal requirements – it is the minimum level and does not affect, for instance, insurance premiums. One insurance company had started using an audit tool to check that legal requirements were fulfilled for the newly implemented Seveso Directive; however this tool is no longer in everyday use.

5. The main lessons

The following chapter outlines the overall topic and the approach used to obtain and assess relevant feedback on the available and used ToSPIS – and especially deals with the deficiencies and concerns.

5.1 Topic and approach

The subject area dealing with compliance with the Seveso II and IPPC Directives is in itself immense – many different aspects need to be considered and many different interpretations and approaches have been cited. The diversity contained in the tools, service platforms and information systems used, together with their application, makes analysis of this area challenging. Various aspects that have not yet been considered – the experience and

competence of applying/implementing the available ToSPIS, etc. – probably should also still be investigated and the cursory analysis reported here was only as expansive as the available resources allowed.

It was especially difficult to draw any definitive conclusions from the points specifically raised at the WP3 workshop (see SR_D3B_Proceedings_of_the_WP3_workshop(2).doc). The two main issues concerned the lack of independent representation, and perhaps even more significantly, the lack of industry representation. Moreover, especially the IPPC aspects were under-represented and this limited the discussion in that session in particular. However, especially the toolbox of instruments that had been reported in the Discussion Document was seen to give an insightful view of especially the industries' approach to compliance with Seveso and IPPC.

Further assessments have since been received and all the material obtained thus far, and the conclusions are described in this WP3 Synthesis Report.

5.2 Further analysis

Various graphical representations to map the gaps were proposed, but due mainly to the limited sample size, no significant effort was directed towards this as no verifiable trends would anyway be able to be concluded. Some indications of the types of sample available can be seen in Table 2 & 3:

- Countries vs Numbers and types of responses (Table 2)
- Breakdown according to stakeholders (Table 2)
- Countries vs Seveso/IPPC responses (Table 3)

Discussions on other methods of categorising the results are still to be investigated. (i.e. guidance (IChemE, authority, own company, etc.), Internet (databases, BREFs, etc.), management systems, no specific method, etc. and may yet be included.

The compilations of "Publications and reports" (Annex A), "Research projects" (Annex B), and "Conference / Workshop papers" (Annex C) may also be supplemented.

Correlation data on the company profiles has not been specifically analysed at present.

5.3 Deficiencies in ToSPIS

A basic map of the areas of deficiencies, as gleaned mainly from the preliminary feedback to the questionnaires, was drawn up. (Table 4) Also, mainly with the aim of promoting discussion at the WP3 workshop, a basic table indicating the anticipated needs for ToSPIS improvement was prepared. (Figure 1)

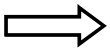
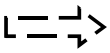
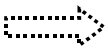
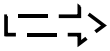
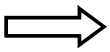
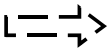
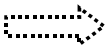
ToSPIS **related to Seveso II and IPPC compliance**		**prevention**
		**response**
		**crisis management**
		**mitigation**
Legend		
	Suitable ToSPIS available	
	Suitable ToSPIS to be further developed	
	Lack of ToSPIS	

Figure 1: Cursory indicator for the needs for ToSPIS improvement.

5.4 Specific ToSPIS concerns

Various issues and some possible directions for discussion were raised at the WP3 workshop. Further analysis of the interview responses may disclose additional interesting directions for discussion. However, some of the trends that had already surfaced, together with issues raised from the country-specific summaries can be seen in the Proceedings of the WP3 workshop "SR_D3B_Proceedings_of_the_WP3_workshop(2).doc". Two workshop sessions were held; the first on SEVESO and the second on IPPC.

A key point concerning ToSPIS and Seveso compliance concerned the differences in understanding (between industry and authorities) of safety, risk assessment, and prevention policy development. With regard to the understanding of risk assessment throughout the EU's states, it has been observed that there are different interpretations of concept and procedure. Also, the risk assessment methodologies used is according to the Authority's demands. The greatest effort in this case should be therefore aimed at unification of methods and criteria by which a risk assessment is conducted. An issue raised concerned the fact that the Authority personnel nowadays may not have industry experience. Improved harmonisation of suitable ToSPIS and better education of all stakeholders may contribute to diminishing the issue.

Regarding the adequacy of tools for data collection and information exchange, it was thought that inter-Authority tools and communications could be improved. One of the reasons for the delay in processing submitted safety reports could be the lack of communication between Industry and the Competent Authorities. Information exchange could be improved based on the ToSPIS adopted by industry to complete the safety reports and the safety management systems (SMS). Improved knowledge transfer and communication tools within the field of Risk Management may remedy the situation.

Safety reports are understood to not only be additional paperwork. As long as they are well-written, concise and trustworthy, they can be viewed as a valuable media, which can restore "long lost" trust regarding safety in industrial establishment, and therefore be a step towards safer plants. There was, however, also a concern that a safety report may lose its effectiveness if too much information and too many parties are involved. Tools that adopt the safety report in order to "maximise the information" included could be useful for plant assessments.

The concept of "uncertainty" in risk assessment was an area that possibly leads to misunderstanding, and it was noted that it is important to realise how uncertainty in all steps of risk assessment influences its use. This would have an impact on the use of current, and the development of new ToSPIS. Harmonised probabilistic approaches could be promoted as there is an opportunity to assess and follow the safety improvements introduced – that can reduce the likelihood of the accident outcome and that can not be identified using only deterministic (more prescriptive) approach for assessing only the consequences. However, more data (and other resources) are typically needed and this is often not (easily) available, but the approach may help identify the more significant focus areas. The challenge is that safety practitioners need simple, quick, and effective tools to support safety and continuous improvement of chemical process systems now required by stringent legislation and customer demands.

Especially the ongoing discussions concerning the integration of various directives (mainly the Seveso II and IPPC) have raised the question of which specific areas need better support ToSPIS. There are advantages for doing so, and at the same time, there are the obstacles. However, the format of the Safety reports is probably not currently sufficient to be used for IPPC. Obviously this has implications on the nature and developments of future tools. A clearer overview may be available as a result of the conclusions of the entire SHAPE-RISK project as many other factors may also play a role. It was noted that many virtual reality tools are being developed, but their use is currently limited.

There is a very wide range in the complexity of the tools that are available for all facets of risk management. Simple tools are in high demand as it seems that less time is nowadays to be allocated for risk assessments. At the same time, many disturbances and possible loss of containment scenarios previously identified by established risk analysis tools are no longer possible in modern plants due to better design and control. Consequently, there seems to be a need for more sophisticated – and thus often less simple – tools in order to identify new types of risks (for instance those related to the process control system, and organisational issues like outsourcing of activities, and down-sizing). This issue needs to be considered when developing and selecting ToSPIS. The Layer of Protection Analysis (LOPA) was noted as a potentially useful tool in such a scenario.

In the same vein, the issue of Qualitative vs Quantitative risk assessment has been raised with regard to the range of support ToSPIS. Quantitative risk analyses are very rare in some countries and most risk assessments are based on a semi-quantitative approach using a risk matrix or a similar tool. If fully quantitative risk analyses are to be required, quantitative ToSPIS should be made available to quantify not only risks with a lethal outcome, but also risks to the environment or risk for non-lethal injuries. Additionally, as quantitative risk assessment is highly resource intensive, the selection and use of ToSPIS that are proportionate to the level of risk should be considered – the intention being to select and apply adequate ToSPIS without overburdening industry.

On the issue of whether a probabilistic approach to safety could produce safer plants than a deterministic one, no substantial discussion was generated. It may be possible to assess occupational safety issues in this way, but it would be more difficult to say for environmental assessments.

It has been claimed that some members of the authorities have no concrete (working) experience in the field of safety assessment, and they do not possess formal training, tools and databases for their work. There is a belief among industry and consultants that the authorities should understand regulatory and licensing in the safety arena more comprehensively, taking into account uncertainty of risk assessment, and that there is no uniform interpretation of the requirements. The differences in understanding between the industry and authorities on safety, risk assessment, and prevention policy development could probably be improved with better ToSPIS. It was deemed that this is rooted in the training of the engineers, and the development of best practice guidelines in some countries is improving the situation.

The survey did not necessarily capture the usability and competence issues or the required commitment of resources. A risk assessment could use perfectly valid ToSPIS but be meaningless due to the fact that the inputs and process not being understood by those performing it. The limitations of the ToSPIS always need to be considered.

An important aspect of risk assessment is identifying what, if any, additional risk reduction is needed. ToSPIS in this area are relatively lacking.

Unfortunately, there was a serious lack of IPPC expertise at the SRA-E conference. Some feedback and conclusions are included here nevertheless.

The lack of ToSPIS concerning the evaluation of environmental risk was raised. The ARAMIS project was mentioned here, as was a UK system for mapping risks, but no specific details were provided.

A trend has been observed that there is a non-uniform application of the IPPC Directive around Europe. It can not be concluded that this is this related to the available ToSPIS. It was noted that Best Practice should be fostered and not necessarily forced.

It has been claimed that some authorities are not adequately following and understanding the developments in BAT (i.e. and IPPC Article 11). The possibility for more dynamic incorporation of BAT could be beneficial and aid the systematic follow-up of BAT developments. No comments were specifically received on what ToSPIS may assist in achieving a satisfactory level of the implementation of Article 11, or aid the evaluation of BAT.

Once again concerning the discussions on the integration of various directives (mainly the Seveso II and IPPC), pertinent questions include: Is a Seveso II safety report a sufficient tool for covering topics of environmental accidents and accidental emissions in the IPPC Directive? How much does a safety report cover the environmental issues in practice? Are there other specific tools to sufficiently take care of preventive actions against accidents and possible environmental consequences?

Safety is not often directly referred to in BREFs. The advantages of doing so were discussed as were the obstacles – can the trade-offs be identified and "optimised" (often economic, environmental and safety issues are involved). The format of the Safety reports is probably not currently sufficient to be used for IPPC. It was proposed that future BREFs should also

cover safety to some extent. More precisely, at least general safety measures/barriers and recognised safety issues should be mentioned for each technology considered. Currently, this topic is not covered to any significant degree.

With regards to the IPPC issues, the general observations (from interviews, IPPC implementation) showed that there are very few special tools in use. The Internet – especially websites of the authorities – is typically becoming more useful, while Intranets are being used as a tool for communication and knowledge management. Voluntary management systems are often useful tools, as are the BREF-documents, and consultants used – especially when modelling the effects of emissions. Annex 4 of the Proceedings of the WP3 workshop "SR_D3B_Proceedings_of_the_WP3_workshop(2).doc" may give more insight into the issues raised.

5.5 Impacts on future ToSPIS

Other areas of the SHAPE-RISK project are investigating the issues related to the integration of the IPPC and Seveso Directives, and more holistic approaches to risk management.

Especially safety management systems are of particular importance within the scope of the SEVESO Directive – emphasis is especially placed on the existence of such a system at an industrial site complementary to the existing technical and procedural measures. Also compliance with the IPPC Directive (especially with regard to the BREF documents) needs the support of a suitable management system.

A good practice already adopted in some countries in the EU, involves installations that are covered by both the IPPC and Seveso Directives: the environmental impact assessment and the safety report are submitted together (as proposed by Article 6 of the IPPC Directive), and then reviewed in a coordinated way by the authorities. Improved synergies between the IPPC and Seveso Directives could lead to the development and use of more harmonised ToSPIS, and especially the use of integrated management systems.

Reporting on the safety management system and its demonstration is currently a requirement under the Seveso Directive. It is expected that existing ToSPIS would be able to handle any similar requirements should they arise in association with the IPPC Directive.

The concept of "safer and cleaner" technologies is currently an area of interest. With all the trade-offs associated with safety and environmental issues, it will always be difficult to identify the optimal solution. Similarly, conflicts arising between the core focal points of the IPPC and Seveso Directives make the each individual scenario unique. Ongoing and recent research into Inherently Safer Design (ISD) may be able to incorporate also the important environmental issues, however, reliable ToSPIS to assess, guide, and document the often contentious "safer and cleaner" technologies would need to be developed in order to create a better framework for the introduction of safer and cleaner processes in industry.

It has been acknowledged that IPPC/BATs (and the accompanying BREF documents) could be the most appropriate tool in which to address both management and techniques, in order to progress towards safer and cleaner systems. The use of the BAT information exchange concept and framework to exchange experience on safety and pollution prevention, together with the development of the next generations of BREF documents to also cover safety issues may provide widespread benefits.

ToSPIS to support the assessment of alternative technology options in the integrated framework of safety and pollution prevention, especially to compare technological and/or managerial alternatives from an integrated (environment+safety) point of view would probably also need to be developed.

Stakeholders currently allocate large amounts of resources towards the permitting, reporting, and compliance checking in accordance with the IPPC and Seveso Directives. In order to ensure that these resources yield the most significant results, in line with the cost of implementation of the directives, the key personnel firstly need to be adequately trained in the relevant ToSPIS. Integration of the directives would probably result in more harmonised ToSPIS, and also probably lower the burden of implementation resources.

One major obstacle to integration is related to interdisciplinarity. The ToSPIS currently used and the overall field is extremely diverse. To educate all the stakeholders in all the necessary additional fields of expertise would probably not be practical.

5.6 Barriers

The barriers to change are numerous as many well-established ToSPIS, authorities, and organisational structures and procedures are nowadays in place. Once again, also the extremely diverse nature of the field plays a big role. Also, changing the ToSPIS used will invariably also change the results of the risk assessments, and it may be difficult to achieve agreement with all the stakeholders involved. And any changes would need to be implemented at a European level (which may currently be popular, but not necessarily desirable), and conflicts with all the other existing regulations will almost certainly also arise. The effort involved for transition to one overall safety report, and a good guidance and recommendations on suitable and preferred ToSPIS that will be relevant for all sectors of the chemical industry, currently appears to be insurmountable. By simply working together more closely, the chemical-related risks may nevertheless be reduced. More transparency and more efficient sharing of information may yield more immediate measurable results.

An important aspect for the acceptance and common use of any ToSPIS is the level of confidence that is associated with using it, and the associated results obtained. Self-devised ToSPIS may be accepted within the organisations themselves; however the authorities and other stakeholders may be more sceptical of the output. This may result in further duplication of work, and the use of additional resources in validating the tools and resulting material.

By building a "common reasonable trust" among the key stakeholders (industry, authorities, consultants), the problem of comprehensively training those who do not want, do not have time, do not have money, do not see real benefit of it, etc., and when all involved parties and countries properly use all the required tools, the problem of harmonised approaches, etc. may be overcome. Namely, if the parties trust each other and agree about what should each of them do, then they can establish an effective network of those who perform risk analysis and apply sophisticated tools instead of "something automatic and easy" (consultants, researchers), those who improve safety based on results of such risk assessments (industry, managers), and those who reasonably check whether the ALARP principle has been implemented throughout.

Trust among the parties at national level on one side, and development of collaboration and interchange among them on the EU level may be a way forward. The latter could be

supported by establishing small groups of persons (three to four each, consisting of experts from different countries) for the purpose of specific consultation in three broader areas: risk analysis, risk management, and regulation. These groups would be "activated" by the EU on the case-by-case basis.

6. Conclusions & Recommendations

The SHAPE RISK project is focussed on the development of integrated risk management in the process industry throughout Europe. Workpackage 3 deals specifically with the state-of-the-art of the common tools, service platforms, and information systems (ToSPIS) that are used to support risk management practices. The intention was to compare ToSPIS among EU member countries and in the context of different uses/users. During the course of the investigations associated with WP3 of the SHAPE-RISK project, many opinions have been received on the state-of-the-art of ToSPIS that are currently used to comply with the Seveso and IPPC Directives. The previous chapters portray only a limited overview of the plethora of methods, criteria and tools that are available, and used to support risk management practices due to the limited cross-section of institutions who responded to the questionnaire in the various EU member states. A number of issues were identified based the various input obtained over the duration of the project, i.e. the questionnaire feedback, the country-specific summaries, and all subsequent analysis together with the discussion document feedback, and the WP3 workshop discussions.

It is envisaged that all the resulting material would be analysed and used in order to identify needs for future R&D to improve the ToSPIS, and therefore lead to the improvement of risk management (prevention, response, crisis management, and mitigation). The responses to the Interview Aid questionnaire may still be further analysed, however, a brief compilation of the trends is already included in this report (see "4.6 ANALYSIS RESULTS", "4.8 SEVESO II RESPONSES ANALYSIS" & "4.9 IPPC RESPONSES ANALYSIS").

The diverse range of ToSPIS used is attributable to the diverse nature of the risk management field, and the corresponding legislative and regulatory demands placed on industry. As was highlighted by the SHAPE-RISK WP2 Synthesis Document, occupational and external safety are dealt with by different bodies (i.e. for policy making and legislation as well as for regulations and enforcement). And other bodies regulate environmental safety.

Many well-established ToSPIS are available, while newer methods and practices are also being developed to comply with upcoming legislative demands. There seems to exist a growing need for these in an "easy and user friendly form" in administration.

In the attempt to comply with all the relevant safety-related legislation, it is often the case that various risk assessments are carried out for slightly different purposes, and some degree of duplication is possible. Industry is consequently confronted with a larger administrative overhead in their compliance efforts – in choosing, learning, using and maintaining all the suitable and necessary ToSPIS, and as was often noted, also developing their own systems. In addition, excessive administrative work contributes to a number of ToSPIS being unwanted by industry (too comprehensive, costly, time consuming in application, etc.); therefore it looks for a system "one tool for all".

It is generally accepted that there is a lack of safety knowledge in SMEs and current information on the most suitable ToSPIS (and their limitations) seems to be limited. More

guidance by authorities regarding the preferred ToSPIS would be beneficial for all stakeholders (although it has been raised that the authorities themselves often also require assistance).

The information and knowledge needed to support and use the ToSPIS must be available to all stakeholders. In the European framework, it would be advantageous to improve the availability and sharing of information and know-how.

Risk assessments in the chemical industry are obviously closely related to the chemicals used in the process and those in storage. The effects of any subsequent accidents may even be very widespread, and several stakeholders are typically involved in managing the associated risk. Common approaches between the various authorised bodies would enable more harmonised reporting and perhaps more standardised ToSPIS to be developed and applied.

Further harmonisation of ToSPIS will certainly be determined by the constraints placed on the organisations – a variety of factors including societal concerns, legislative demands, and available resources and time are typically influential.

Concurring with the other suggestions noted in the SHAPE-RISK WP2 Synthesis Document, semi-quantitative methods and ToSPIS may give directions for improvement. Semi-quantitative methods and supporting ToSPIS were often quoted as being preferred and used because they were less resource intensive. The risk would typically be presented in the form of a risk matrix, thus enabling ranking of the risk, comparison of the risk against (semi-) quantitative risk criteria, and prioritisation of the various risk reduction measures.

As the process industry strives for increased competitiveness, the time needed for training, together with the associated costs, make it difficult to maintain and support the required levels of safety. In Europe, where one trend in the process industry is towards small multi-product plants and increasing complexity, the ever-present potential for chemical-related accidents remains an issue. Even the relatively simple tasks of raising and maintaining safety awareness are often neglected.

Safety practitioners need simple, quick, and effective tools to support safety and continuous improvement of chemical process systems now required by stringent legislation and customer demands. As noted by the European S2S project (see 11.3.4 S2S), the provision of readily available online knowledge and guidance encourages a structured approach to risk management throughout various system life cycle phases.

The complexity of the risk determining methods and supporting ToSPIS must, however, be proportionate to the risk. The burden on all the stakeholders would be reduced, as would the need for extensive expertise and training resources. Typically, the nature and the amount of the chemical substances in process or storage gives a good indication of the associated risk, and hence common sense was often quoted when choosing and using the most suitable ToSPIS.

Quick and easy tools may degrade risk analysis and give false impression about safety of concrete installation. A well-trained consultant doing a risk analysis with appropriate tools would typically be preferred to people with adapted training in risk assessment. It would be a sad situation if authorities apply "quick and easy tools" as a basis for decision-making primarily because they are not competent to use comprehensive methods, data, etc.

Many ToSPIS exist for complying with the diverse aspects covered by the Seveso and IPPC Directives. New methods and ToSPIS to support and improve risk management practices are being developed, both within the companies themselves and also as part of ongoing research efforts. Better ways of sharing information and knowledge will be instrumental in the ongoing reduction of risk and improved prevention, response, crisis management, and mitigation issues in the chemical process industry.

Future ToSPIS will need to not only support the technical risk aspects, but also the safety management, and social and regulatory aspects. Although many obstacles exist, as suggested in the WP2 Synthesis Document, the development of an automated expert system for SMEs based on their specific needs may be beneficial. Recommendations for Research and development would include the development of ToSPIS to support the assessment of alternative technology options in the integrated framework of safety and pollution prevention.

	Seveso								IPPC										
Country	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N=**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**N=**
Austria								1											1
Finland								5											4
France								0											0
Germany								4											4
Greece								1											1
Italy								3											3
Slovenia								7											4
Spain								2											1
UK								1											1

Legend

Well-covered

Covered

Limited coverage

Seveso

1 – Organisation, Personnel & Training

2 – Identification & Evaluation of Major Hazards

3 – Operation Control

4 – Management of Change

5 – Planning for Emergencies

6 – Monitoring Performance

7 – Audit & Review

IPPC

1 – Preventive and reductive measures against pollution

2 – BAT

3 – Waste management

4 – Energy efficiency

5 – Prevent accidents and limit their consequences

6 – Definitive cessation of activities to avoid any pollution risk and return the site of operation to a satisfactory state

7 – Monitoring systems

8 – Connections to other legislation

9 – Public participation

10 – Knowledge Management of IPPC issues

7. Annexes

1 - Seveso summaries

2 - IPPC summaries

A - Publications and reports

B - Research projects

C - Conference / Workshop papers

D - Minutes of meetings

E - Contacts list

3 - Interview Aid

8. Annex 1 : Seveso summaries

Country-specific summaries have been provided for:

Finland

France

Germany

Italy

Slovenia

UK

8.1 FINLAND

In Finland, the Seveso II Directive was in 1999 implemented in one main Decree. In addition, some parts (e.g. land use planning) of the Directive have been taken into consideration in a number of other Decrees.

The number of upper tier installations exceeds 80 and there are more than 120 lower tier establishments. These establishments cover a multitude of different companies ranging from those having a staff of less than ten people to large oil refineries.

8.1.1 State-of-the-art regarding ToSPIS

The Finnish Safety Technology Authority (TUKES) has published guides about how to write Safety reports and Major Accident Prevention Policies. These guidelines have been well received, and many companies have used either of these guides as a starting point for their work on complying with the Finnish major accident hazards legislation. According to these guidelines quantitative risk assessment is not demanded, and consequently most of the approaches used by industry in Finland are qualitative or semi-quantitative.

Most Finnish companies obliged to comply with the Seveso II requirements have been well aware of at least some applicable tools, service platforms and/or information systems. Those companies that have had less experience in safety management have contacted consultants for assistance. TUKES has also given advice in these matters during its inspections.

Perhaps the biggest gaps regarding the tools are related to pro-active indicators of the performance of the company's safety management system. Most measurement tools used have been reactive tools, most typically based on the injury rate.

Many companies that wrote a Safety Report were obliged to amend their report. For instance, 64 safety reports were received in 2001 and these resulted in the following requests for additional information by the authorities:

- MAPP: 30 establishments
- Risk assessment methodology: 53 establishments
- Management of change: 60 establishments
- Indicators: 26 establishments
- List of hazardous substances: 63 establishments

As there are no mandatory tools, most internationally and nationally known tools have been used in parallel with some in-house tools. In Finland, risk analysis tools have been presented at seminars and workshops since the mid-1970's and consequently tools like HAZOP, FMEA, etc. are well known. Many companies belonging to international enterprises use tools that are used world-wide by companies belonging to that enterprise. Simple gas dispersion models are also frequently used, while more sophisticated models are very seldom used.

The use of service platforms varies. Some companies are members of branch organisations with their own service platforms, but the use of service portals seem to be up to the individuals in the companies and is mostly not part of a systematic approach.

Information systems are used on an ad-hoc basis; some companies are taking advantage of web-based systems, while others make use of in-house or commercial databases. The general feeling is, however, that also here the use is up to the individuals in the companies.

The Inspectors at TUKES have assessed the quality of their own work in relation to the Safety Reports. One of the main conclusions from this assessment was that more emphasis should have been put on the hazard identification and consequence assessment sections of the reports than what was the case. There were also some differences between the inspectors assessing the reports. Thus establishments belonging to the same corporation might have received different assessments on common points (mostly related to the safety management system). TUKES have since trained their inspectors and they have carried out an internal benchmarking exercise. The competence of the labour inspectors, who also have a say in relation to Finnish Safety Reports, varies probably even more, as some inspectors lack the proper training regarding major chemical hazards. The third party involved is the environmental protection authorities, which to date have put only little emphasis on those requirements of the Seveso II Directive that are related to environmental protection. Consequently, there is still a need for training here. The fire and rescue authorities are generally fairly well informed about at least the more general tools and methods used for risk assessment.

The environmental aspects have not been covered to any greater extent in the companies' Safety Reports. This is probably mainly due to two reasons: firstly, the environmental aspects are inspected by a different agency, which to date have been concentrating mainly on continuous and not on accidental releases; secondly, there are no generally used tools for the estimation of chemical dispersion, degradation and effects in soil, groundwater, or water courses (most models are developed for minor releases of chemicals).

8.1.2 Critical review

In general, the use of tools, service platforms and information systems are on a high level in Finland, where the use of these tools have been routine in many companies already prior to the introduction of the Seveso II Directive.

Quantitative risk analyses are very rare in Finland. Most risk assessments are based on a semi-quantitative approach using a risk matrix or a similar tool. If fully quantitative risk analyses are to be required, quantitative tools should be made available to quantify not only risks with a lethal outcome, but also risks to the environment or risk for non-lethal injuries.

Simple tools are in high demand as less time than before seem to be allocated for risk assessments. On the other hand, many disturbances and possible loss of containment scenarios previously identified by established risk analysis tools are no longer possible in modern plants due to better design and control. Consequently, there seems to be a need for more

sophisticated – and thus often less simple – tools in order to identify new types of risks (for instance those related to the process control system, and organisational issues like outsourcing of activities, and down-sizing).

8.2 FRANCE

8.2.1 General context

France has transposed the IPPC and SEVESO II directive mainly through a law and a decree. The general legislative provisions, which already existed in the French legislation since 1976 are now contained in the Book V of the "Code de l'environnement". The specific provisions of the directives are implemented by the decree "Décret n° 2000-258 du 20 mars 2000 modifiant le décret n° 77-1133 du 21 septembre 1977 pris pour l'application de la loi n° 76-663 du 19 juillet 1976 relative aux installations classées pour la protection de l'environnement". The number of upper tier SEVESO sites in France was 675 in 2002. The number of lower tier was 570.

Prior to the building of a new plant, this common legislation imposes the writing of an authorisation file which includes a safety report and a study of the potential environmental impact (impact study) of the future plant. Both are the base for a public inquiry, during which the neighbours and the environment defence associations can express their opinion about the project. These two documents are used by the competent authorities to establish the particular rules to which the plant will have to comply. Both the safety report and the impact study must be renewed periodically to take into account the evolutions of the plant and of the technology.

Larger companies often have their own environment and risk division, which can elaborate the safety report and the impact study. Smaller ones use the service of consulting companies. During the procedure, the competent authority can ask for a critical analysis of these studies. These critical analyses are performed by expert consulting companies.

8.2.2 Use of ToSPIS in France

The use of ToSPIS is general in France, with a large variety of general resources available on the Internet. More specific tools to be used for risk assessment in the framework of the safety report or the impact study are also available but remain expensive and accessible only to skilled people.

Knowledge of the legislative and regulatory framework

The environmental legislation is easily available on the internet both on the general legislation website http://www.legifrance.gouv.fr/ and on the specific website http://aida.ineris.fr/, that is specialised in environmental legislation and regulation.

The environmental administration also provides regional information about the industry and its potential hazards. Guides and guidelines are also available both on the website of the ministry of the environment or its local representations (DRIRE) and on the website of INERIS (http://www.ineris.fr/).

General knowledge

INERIS and, to a lesser extend INRS propose industrial hazards material on their Internet site. This material includes a series of basic knowledge reports dedicated to the information and training of the people responsible for health, safety and environment in the industrial

companies. Other resources are presently under development such as the ARI network platform, which proposes to build a knowledge community around risk related themes.

8.2.3 Risk Assessment tools

Risk analysis methods

Several methods are currently used by the French industry and consulting companies. The most classical ones are HAZOP, FMEA, PRA and Fault- and Event Tree methods. Since July 2003, the legal requirements concerning the generation of the safety report and the use of its results for land-use planning have evolved. Initially the approach was mainly deterministic and based on the maximum physically possible scenarios. Probabilities should now be considered, but no method is clearly recommended yet and the direct conversion of classical risk analysis methods into elements for land-use planning decisions is not easy. New methods are currently being developed even at a European level, in projects such as ARAMIS. INERIS is developing computer-based tools to aid the application of these methods.

Databases

Most of the databases available in France concern the properties of chemical substances – and several are available on the INERIS or INRS websites. http://chimie.ineris.fr/fr/index.php

Other databases and tools are proposed by private companies such as PROSIM.

Other types of data are necessary for the risk assessment of Seveso sites, and many of them are still difficult to obtain or even lacking. The most problematic data are regarded to be related to failure frequencies data and more generally the data required to assess the probability of an accident scenario.

Specific modelling tools

An important step in risk assessment is the calculation of the possible effects of an accident. Consequences analyses are performed by computer modelling tools. French companies often use tools developed and distributed by northern European country organisations, i.e. PHAST or FRED. French companies like PROSIM also develop modelling tools, although these are sometimes not specifically for safety. PROSIM Batch can be used to simulate the behaviour of a batch reactor and its potential dangerous functioning. INERIS has long been involved in the development of computer resources for the simulation of accidents. Although these tools were long restricted to internal use only, with the development of PRIMARISK, these tools will now be made available to the public.

8.3 GERMANY

The implementation of the Seveso Directive is by means of the StörfallVerordnung of April 2000. It covers the entire Seveso Directive with exception of land-use planning. Procedures for implementing the latter are currently under discussion. Under the previous Seveso Directive there were approximately 8800 installations covered by the Directive. According to SR_R_WP3_Synthesis_Document-Germany(3).doc, there are currently approximately 4600 Seveso establishments.

8.3.1 State-of-the-art regarding ToSPIS

Within the context of the German deterministic licensing procedure there is a high level of awareness of the ToSPIS. However, probabilistic methods are not well known.

The competency of using **ToSPIS** in industry compliance is considered to be high within the deterministic approach, and the competency of authority in assessing scenarios/reports using **ToSPIS** within the deterministic approach is also considered to be high.

Probabilistic methods are believed to be an area that needs more support.

Especially SMEs – in all sectors – are believed to be more susceptible to problems regarding the compliance and the use of ToSPIS.

Risks of process plants are not assessed **quantitatively** at present. Hence, no officially approved definitions of risk exist. Most frequently used approaches are FMEA and HAZOP. Whilst the definition of individual or locational risk is most likely to be the expected annual frequency of a person being killed at a certain distance from the plant, the remaining attributes like e.g. with or without protection still have to be fixed. The exponent for the volume of damage has not yet been decided upon. Proposals are being worked out in a working group of the "Störfall-Kommission", the German Major Hazard Commission. The possible future use of probabilistic risk assessment for process plants in Germany is described in reference /1/. It should be noted that for nuclear power stations probabilistic safety studies are mandatory in the context of the plant supervision process.

Occupational risk is calculated and published by the Hauptverband der gewerblichen Berufsgenossenschaften (HVBG), which insure the workers of the different branches of industry; no definition of risk is given.

Concerning the "Identification & Evaluation of Major Hazards", quantitative risk analyses (QRA) are not usually done. Risk calculation is generally not performed quantitatively. The operator of a Seveso establishment is obliged to prepare a safety report proving, on the basis of relevant scenarios, that sufficient safety measures have been taken in order to avoid accidents and to mitigate their potential consequences. The approach is deterministic.

Similarly, frequency analyses are seldom done, however, a quality assured compilation of reliability data /4/ and several pilot studies exist /5/-/6/. Consequence analyses usually involve only dispersion calculations for a few scenarios, however, atmospheric dispersion calculations are frequently carried out. The VDI-model (VDI: Confederation of German Engineers) is used for that purpose. It is a Gaussian model covering both heavier-than-air and airborne dispersion. Measured data and experimental results are used in the model to adapt its Gaussian base to specific situations like e.g. buildings in the surroundings of the point of release or the determination of the volume comprised within the limits of flammability. Standardised different atmospheric situations are addressed with the most unfavourable result being selected for the safety report.

With regard to "Accident and near-miss analyses", the collection and evaluation of near misses is done by DECHEMA based on reports from industry.

The performance is often monitored in terms of the number of labour accidents, and "Internal /External audits & Management reviews" are often implemented.

Although no formal definition of risk is given numerous important details are recorded by the HVBG (cf. /2/) such as: number of companies and employees, reportable accidents, new accident pensions, occupational diseases as well as compensation payments and preventive measures. The scrupulously compiled and well documented actuarial information enables one to calculate the occupational risk, which is approximately 10^{-5} per year and worker in the process industry.

Engineering judgement is of course used in the context of safety reports. However, not with the objective of quantification.

The casuistry of accidents may play an important role in hazard identification. The data base ZEMA of the "Umweltbundesamt" /3/ may be consulted to obtain information of past accidents. It is fed by information available at the level of the German Federal States ("Länder") which are responsible for the enforcement of the safety legislation for non-nuclear plants. The reporting period is somewhat above 10 years. During this time span there has been no accident with a casualty outside the plant.

8.3.2 References

/1/ Risikomanagement im Rahmen der Störfall-Verordung

Bericht des Arbeitskreises TECHNISCHE SYSTEME, RISIKO und VERSTÄNDIGUNGSPROZESSE der Störfallkommission, SFK-GS-41, 21 April 2004.

/2/ HVBG-Hauptverband der gewerblichen Berufsgenossenschaften

BG-Statistiken für die Praxis, 53754 St. Augustin, Germany.

/3/ **Ze**ntrale **M**elde- und **A**uswertestelle für Störfälle und Störungen in verfahrenstechnischen Anlagen. http://www.umweltbundesamt.de/zema/

/4/ Hauptmanns, U.: Reliability Data for Process Plants
Prepared by on behalf of the Federal Ministry for Environment, Nature Conservation, and Nuclear Safety for the Technical Committee on Installation Safety and Major Hazard Commission Working Group on Land-Use-Planning, July 2003.

/5/ Hauptmanns, U., Hömke, P, Huber, J., Reichart, G. und H.-G. Riotte:

Ermittlung der Kriterien für die Anwendung systemanalytischer Methoden zur Durchführung von Sicherheitsanalysen für Chemieanlagen, GRS-59, Köln 1985.

/6/ Hauptmanns, U.:
Untersuchungen zum Arbeitsschutz bei An- und Abfahrvorgängen einer Nitroglycol-Anlage, Chem-Ing.Tech. 67 Nr. 2 (1995), pp.179-183.

8.4 ITALY

In Italy, the implementation of the Seveso II (96/82/EC) Directive has been carried out through the legislative decree 334/99, under the responsibility of the Ministry of Environment. The 334/99 decree provides for the issuing of a number of effective measures, targeted to determine the conditions and criteria for its application and the complete implementation of the control systems.

APAT (National Agency for Environment Protection) is the organisation responsible for the regional application and evaluation of the 334/99 decree, which was designated by the Ministry of Environment in order to carry out the following activities: a national inventory of establishments exposed to major-accident hazards involving dangerous substances, according to articles 6 and 7 and article 8 of the 334/99 decree; a database on Safety Reports and consequent conclusions, according to articles 6 and 7.

In Italy the number of upper tier installations exceeds 480 and there are more than 650 lower tier establishments.

The mapping operations involve many different actors, responsible for the "Seveso II" directive implementation: Ministries, APAT, Firing Squads, Regions, ARPA, Prefectures.

8.4.1 State-of-the-art regarding ToSPIS

Normally Italian companies have not a lot of experience in safety management and often they contact consultants for assistance. The consulting companies generally do the safety reports because the establishment's operator and/or the administrator are not capable.

In 2001, 43 safety reports were provided by industry to competent authority.

In 2002, 142 safety reports have been fully assessed by Competent Authorities and the conclusions have been communicated to the operator of the plants. 130 safety reports were accepted and 12 were rejected.

In Italy, 19 safety reports of 19 companies were analysed.

The types of facilities considered included the followings (numbers in brackets are the number of establishments): (4) Storage of combustible, (3) Storage of oils and petrochemical products, (3) Polymers production, (2) Handling of petrochemical products, (2) Synthesis chemical, (1) Industrial waste treatment, (1) Storage of phitopharmacy, (1) Production of raw materials for polymers, (1) Pharmaceutics, (1) Metallurgy.

Hereunder are catalogued some tools listed in the safety reports studied. The accident databases utilised are: (9) MHIDAS (U.K.) - Major incident data service, (8) Analisi storica "Circolare 16 MI.SA 20 giugno 1986", (5) FACTS - Bureau for industrial safety T.N.O, (5) Loss Prevention Bulletin - The institution of chemical engineering- London, (4) Banca Dati SONATA (Tema - Italia), (1) MARS - Major accident reporting system - EU – JRC.

Software for consequences analysis adopted: (6) EFFECTS - TNO Institute for Environmental Science, (6) PHAST professional, (6) Star (Safety Techniques for Assessment of Risk, (5) WHAZAN (I-II) World Bank Hazard Analysis, (1) HGSYSTEM, (1) Eureka, (1) Metodo speditivo ANPA [easy screening method proposed by the Italian national protection agency]

Tools adopted for hazard Identification: (19) HAZOP

Methods adopted for frequency analysis: (19) Fault tree, (19) Event tree

Tools concerning statistical data: (7) AIChE Process Equipment Reliability Date, (8) Lees' Loss prevention in the process industries, (8) Assessment of industrial Risk in the Rijmond Area.

In Italy, tools like HAZOP, FMEA, Event tree, Fault tree, etc. are well known and frequently used. All the 19 safety reports' analysed used the tree tools: HAZOP, Fault tree and Event tree. Many companies that belong to multinational enterprises use tools that are used world-wide by all the companies of the same group. Simple gas dispersion models are also frequently used and well known.

According to the Italian regulation, the municipalities ensure that information for the public on safety measures and on the requisite behaviour in the case of an accident is supplied to person liable to be affected by a major accident originating in upper tier and lower tier establishments. The most utilised modality of active distribution used by the municipalities have been: distribution of brochures, bill posting, meeting of the district committee, notices published on municipalities internet sites, publication on local newspapers.

In Italy, specific inspections on the establishments subjected to the 96/82/CE Directive are performed by an Inspectoral Commission composed, usually, by three members belonging to: Ministry of Environment and Territory, System of the Protection Agencies of Environment (APAT/ARPA/APPA), Fire Brigades, Institute for Accident Prevention and Safety at Work. At present, in Italy a specific staff for this kind of controls don't exist. Every involved

authority gives its technical personnel for the inspections. The carrying out of inspections is based on specific regulation and methodological-technical criteria (laws and guidelines by the Ministry of Environment and Territory).

The tasks of Commission are: to verify the carrying out of SMS stated by the operator and its results; to verify the SMS structure and its compliance with the regulation; to verify the effectiveness of the carrying out of SMS, with particular regard to the technical and managerial systems, its verification, its actuation and the training and control of the involved staff. In order to verify each element of the SMS during the inspections, the inspectors have adopted a checklist that is defined in a guideline issued by the Ministry of Environment and Territory. The aim of this checklist is to simplify the task of the Inspectoral Commission and to create a common and homogeneous framework to conduct inspections.

The fire and rescue authorities are generally well informed about tools and methods used for risk assessment.

In the companies' Safety Reports the environmental aspects have not satisfactorily be covered. The attention is always more focused on human damage than on environmental damage. The environmental aspects are inspected by different divisions into APAT and ARPA, and in different offices into the Provinces.

8.4.2 Critical review

Generally the use of tools and service platform is on a good level in Italy.

In Italy, during the 1990's, after the Seveso Directive's transposition there was an improvement the awareness' level of these tools.

The Decree implies that in every Region a Technical Regional Committee "Comitato Tecnico Regionale" must evaluate all the industries safety reports. Members of the Committee are: APAT, Firing Squads, ARPAV, Districts, Institute for Accident Prevention and Safety at Work. The Committee should complete the assessment of the safety reports in four or, at least six months, but very often the work requires more time. Many of the safety reports provided by industry in 2003 and 2004 are still being assessed.

One of the reasons for this delay could be the lack of communication between Industry and Competent Authority. An improvement in information's exchange about the tools and service platform adopted by industry to fill the safety report and the SMS, and the assessment's conclusions by competent authority, is required.

8.5 SLOVENIA

Slovenia has transposed the Seveso II Directive in 2002 by two Decrees. One deals with general obligations of an operator, major-accident prevention policy, and safety reporting, while the other defines emergency planning. There are 55 Seveso II establishments in Slovenia (23 upper and 32 lower tier). These establishments cover a multitude of different companies including primary chemical processing industry (methanol and formaldehyde production, chlorine and hydrochloric acid production, phthalic acid anhydride production, PU foam production, production of black gun powder and commercial explosives), pulp and paper production, LPG and oil derivatives storage, etc.

8.5.1 State-of-the-art regarding ToSPIS

The Ministry of Environment, Spatial Planning and Energy has published guides about how to write safety reports (these guides are a weak translation of the EU Guidelines - http://mahbsrv.jrc.it/GuidanceDocs.html). The guidelines have not been well received by the industry; there is a lot of repetition and vague interpretations without clear statements what is required and what should be only considered while preparing safety reports. Therefore, these guidelines still operate as "semi-legal" and are formally in a draft form. Quantitative risk assessment is not demanded, however, expected by the authority (?). Consequently, most of the approaches used by industry in Slovenia are in the range from qualitative or semi-quantitative to quantitative.

Generally, there exist significant differences in the lines of reasoning between the authorities and the industry associated with the demonstration of the level of safety of an establishment, understanding of the industrial risk assessment; and preventative risk reduction policy. These can be summarised as follows:

i) Demonstration of safety. Authorities require safety report as a means for the demonstration of safety. Compliance is checked through a review of safety report. This process does not involve site visits, in-situ consultation with operators, inspection of the installations, and audits. The industry, i.e. the operators are unsatisfied with such a process. They argue that in this way the format of safety report is being audited and not safety of an installation. Therefore, they understand such a review process as an additional "paper work" and suggest more in-situ co-operation with the authorities.

ii) Understanding of risk assessment. Operators understand risk assessment as a complex interdependence of an installation (i.e. hazardous industrial activity) and its surroundings (i.e., environment consisting of receptors of risk) which can not be regulated in a straightforward mode. Risk assessment, however, may provide support for the regulation, taking into account uncertainty of risk assessment. Authorities, on the other hand, strive for sharp regulation, in spite this can hardly be supported by risk assessment (neither probabilistic or deterministic). Therefore, the authorities express a need for quick and easy risk assessment methods for regulation purposes.

iii) Preventative risk reduction policy. The Slovenian Seveso II establishments apply the following safety related strategies:

- application of traditional views on safety – "deep defence" based on technology,
- doing only what is required by regulation,
- pro-active behaviour.

While the authorities require prevention, control and reduction of risks in general terms, the operators have to clearly justify that chosen safety measures are satisfactory. Most of the safety managers build their confidence into safety measures on the basis of good engineering praxis and day-by-day work, while the authorities basically seek for responsibility of the operators. They require consideration of concepts such as BAT, ALARA and ALARP. The newest orientation of pro-active operators is the creation of safety culture which integrates safety into the overall management. A comprehensive auditing process is the key element of building trust into safety policy of these establishments

8.5.2 ToSPIS

Most Slovenian companies obliged to comply with the Seveso II requirements have been well aware of at least some applicable tools, service platforms and/or information systems. Those

companies that have had less experience in safety management have contacted consultants for assistance. The Ministry of Environment, Spatial Planning and Energy has given advice in these matters before transposing the Seveso II Directive by commissioning a couple of studies related to risk assessment, available tools and approaches, putting results of these studies on the web (http://www.sigov.si/mop/).

Many companies that wrote a Safety Report by June 2004 were informed that they need to amend their report. Most common inadequacy identified by the authority was related to MAPP. This shows either that the:

- MAPPs presented by the establishments are (really) poor/inadequate in most of the cases?
- authority is not competent to review other components of the safety reports (e.g. hazard identification, accident scenario development, barrier performance evaluation, consequence analysis, probability/frequency estimation, risk characterisation, assessment of uncertainty) and therefore concentrates on the prevention policy development which is easier to grasp? If this is the case, a clarification is needed about how MAPPs are being evaluated.

As there are no mandatory tools, most internationally and nationally known tools have been used in parallel with some in-house tools. In Slovenia, there is a long tradition and relatively high level of safety culture and consequently tools like HAZOP, FMEA, etc. are well known. Many companies belonging to international enterprises use tools that are used world-wide by companies belonging to that enterprise. Simple mass balance models are frequently used (transport and accumulation of substances in the environment), while more sophisticated models are used by consultants and researchers.

The use of service platforms varies. Some companies are members of branch organisations with their own service platforms.

Information systems are used on an ad-hoc basis; some companies are taking advantage of web-based systems, while others make use of in-house or commercial databases.

The Inspectors at the Ministry of Environment, Spatial Planning and Energy have no formal training in relation to the Safety Reports or rather inspecting the safety. Consequently, there is still a need for training here. The fire and rescue authorities are not well informed about the tools and methods used for risk assessment, except for risk of fire.

The environmental aspects are covered in safety reports according to accident scenarios and their expected outcomes. There are no generally used tools for the estimation of dispersion, degradation and effects in soil, groundwater, or water courses – most industry use consultation in this connection.

8.5.3 Critical review

In general, the use of more sophisticated tools, service platforms and information systems are in the introductory phase in Slovenian industry and at authority level. Consultants and researchers apply and develop these tools and methods since 1980.

More precisely:

- chemical process industry possesses high awareness of safety issues. It uses a number of classical hazard analysis tools and databases (e.g., HAZOP, PHA), and is relatively strong in that component of the overall risk assessment. It is, however, more weak in quantitative frequency/probability analysis and QRA. Deterministic consequence analysis is also well developed.

- Warehousing and transportation activities of hazardous substances is well covered by hazard analysis and tools, regarding other components the situation is diverse: some companies are similar as chemical process industry while others are weak.
- generally, industry understands importance of good management, maintenance and training for safety
- most of the companies can not afford complete development & application of safety assessment activities by themselves, or they don't want to exercise these by themselves, therefore they use consultancy. Consultants apply a number of tools and approaches (qualitative and quantitative, probabilistic and deterministic)
- authorities have no concrete (working) experience in the field of safety assessment. They do not posses formal training, tools and databases for their work. There is a belief among industry and consultants that authorities should understand regulatory and licensing in the safety arena more comprehensively, taking into account uncertainty of risk assessment. The reasonably assurance concept should, therefore, be applied.

8.6 UK

The Control of Major Accident Hazard Regulations 1999 (COMAH) implements the Seveso II Directive (96/82/EC) in Great Britain (except Northern Ireland), except for land-use planning requirements which are implemented by changes to planning legislation. They came into force on April 1, 1999.

The competent authority that enforces COMAH is the Health and Safety Executive (HSE) and the Environment Agency in England and Wales, and the HSE and the Scottish Environment Protection Agency in Scotland.

There are about 360 top-tier installations and about 800 lower-tier installations. These establishments cover a wide range of different companies.

8.6.1 State-of-the-art regarding ToSPIS

A range of guidance is available from the UK Health and Safety Authority (HSE). This includes a series of safety report assessment guides (guidance for the assessor's of Seveso II safety reports on assessing the risk assessment) for a number of different dangerous substances and situations (chlorine, chemical warehouses, explosives, highly flammable liquids, methane and whisky) – http://www.hse.gov.uk/comah/index.htm. In addition, the assessment criteria against which the safety reports are assessed are available. Many companies have used this information as the basis for their safety report.

Guidance is available from the Chemical Industries Association (CIA) (*industry body*) on the structure of a risk assessment to be performed for occupied buildings on major hazard sites. Two methodologies are provided: one that is hazard based (and more conservative) and one that is risk based.

Quantitative risk assessment is not required in the UK. In the UK, the level of risk assessment is determined by means of proportionality. The existing HSE published guidance states "the depth of the analysis in the operator's risk assessment should be proportionate to (a) the scale and nature of the major accident hazards (MAHs) presented by the establishment and the installations and activities on it, and (b) the risks posed to neighbouring populations and the environment, i.e. the assessment has to be site-specific." The risks referred to here include both individual and societal risk. The type of risk assessment varies according to this

proportionality from qualitative to semi-quantitative and fully quantitative. The precise level and structure of the risk assessment to be used by industry is not prescribed, as UK health and safety legislation is goal-setting rather than prescriptive.

Many UK companies required to comply with the Seveso II requirements have been well aware of at least some applicable tools, service platforms and/or information systems. However, many companies have used consultants to varying degrees. The HSE has provided feedback as part of the assessment process and during inspections.

Almost all companies in the UK that have submitted a Safety Report to the competent authorities were obliged to amend or resubmit their report.

Many of the larger industrial companies have their own internal guidance on risk assessment. Other sources of guidance include consultancies who offer commercial software for risk assessment and/or consequence assessment; the TNO Purple Book; publications by Institution of Chemical Engineers (UK) and CCPS (USA); and HSE publications and web-based guidance. An increasing number of industrial companies base their risk assessments on guidance and/or software tools developed in support of the IEC 61508 and IEC 61511 standards on safety-related control systems.

There are no mandatory tools in the UK. Many internationally and nationally known tools have been used in parallel with some in-house tools.

The assessment process in the UK is carried out by having a range of specialists necessary to cover each area of by the Safety Report. They follow the assessment criteria, making use of experience, training and guidance. The teams are made up of HSE specialists and an assessor from the EA. and the assessment team is led by an assessment manager from the HSE, which ensures a good level of consistency of assessment.

The environmental aspects of the Seveso II Safety Report in the UK are covered by separate agencies. The EA (Environment Agency) in England and Wales and the SEPA (Scottish Environmental Protection Agency) in Scotland. However, the assessor works on the same teams as the HSE assessors to cover all of the aspects of the Safety Report.

The assessment of major accident risk to the environment usually follows a source/pathway/receptor model in which a major accident is considered possible if all three are present.

Service Platforms and Information Systems include failure rate databases and incident databases (e.g. the IChemE accident database) which inform hazard identification. Many companies use commercial or in-house risk assessment tools that incorporate databases for failure rates, consequence models and substance physical properties and harm criteria.

8.6.2 Critical review

In general, the use of tools, service platforms and information systems are on a high level in the UK, where the use of these tools have been routine in many companies already prior to the introduction of the Seveso II Directive. However, there are also many companies who have little in-house knowledge and tools and rely on consultants and contractors to assist them.

9. Annex 2 : IPPC summaries

Country-specific summaries have been provided for:

Finland

France

Germany

Italy

Slovenia

UK – England and Wales

9.1 FINLAND

The IPPC Directive was implemented in Finland in 2000 in the Law of Environmental protection (86/2000).

The level of awareness of IPPC Directive and environmental issues in general is high in Finland. However, the industrial sector is very variable. Among large and medium-sized enterprises the awareness of environmental demands is better than in smaller enterprises. Environmental authorities do not have the resources to visit and audit all the small companies. In practice this means that the environmental authority comes to the site when something disruptive has already occurred. The culture of the environmental authority is based on emissions permits and reactive actions, not preventive and proactive audits and actions. This is a major concern regarding the Finnish environmental administration concerning the industrial sector.

The level of awareness of ToSPIS that will support the IPPC Directive compliance is also variable. In general, software tools are very rare. Software is mostly used only in consequence analysis (groundwater and soil, as well as air and water surface dispersion models). However, at least in the process industry, most of the process control is based on software tools (e.g. Damatic or Honeywell, etc.) and monitoring of environmental parameters (at least air and water emissions) are linked to these systems. Authorities have an extensive databank of environmental knowledge (called Hertta), e.g. town plans, hydrology, surface waters, groundwater and air emissions. GIS is used in Hertta.

Internet service platforms and information systems, on the other hand, are commonly used, e.g. the www pages of the Safety Technology Authority (TUKES), Finland's Environmental Administration (Regional Environmental Centres, Permit Authorities, Finnish Environment Institute), Finlex (a data bank of Finnish legislation; owned and updated by the Finnish Ministry of Justice) and different industrial associations. For instance all the forms for an environmental permit can be downloaded from the www pages of the Environmental Administration. There are also directions for completing the forms. In general, the work needed to submit the appropriate permit is so huge that even large companies often hire a consultant to collect, prepare, and process the knowledge needed.

Environmental risk analyses are commonly used at least in the forest industry where they it has been mandatory do such analyses from the point of view of water emissions since 1990's.

However, in other environmental sectors the use of risk analyses from the environmental perspective is rare, but does exist. There are, for instance, special procedures for soil and groundwater risk assessments. However, the environmental authorities are not in most cases competent for evaluating these risk analyses. Risk analysis, as a tool, is not well known. Environmental authorities are aware of safety technology, such as safety pools, water treatment systems, alarms, etc. These are also in widespread use in Finnish industry.

Best available technology (BAT) is already well applied in the Finnish process industry, so the idea of BAT and BREF-documents does not bring so much new to Finnish industry. The industry and authorities actively follow the development of BAT (participate the EU-meetings and workshops).

Waste management is the primary issue that companies organise in the site when they start to address environmental issues. Sorting and recycling are well known processes although there are problems related to the recycling of, at least, plastics. Some difficulties have however emerged, for instance, on how to define what is waste and what is a raw material.

As a tool of energy efficiency, companies can enter into a voluntary energy conservation agreement with Motiva Oy, which is a state-owned service organisation promoting a market for energy efficiency and renewable energy sources. Motiva Oy conducts energy saving analyses in the company and makes plans for energy efficiency management.

Public participation is covered, for instance, in EIA procedures and companies make environmental (or social responsibility) reports and arrange open door days for the public. Environmental permits must be made available to the public before decisions are made.

Most of the environmental issues in the IPPC Directive are addressed without any special procedures. This unsystematic approach might result in additional and duplicated work being carried out, and some knowledge may even be lost. Although management systems (quality, environmental and safety) are quite common in Finnish industry, and these systems include knowledge management systems, there might be a lack of efficient information systems where all the different knowledge would be in one place and available. Another serious problem related to this in environmental management concerns the management of change – especially organisational changes where some important knowledge might disappear. A great problem is also the lack of knowledge of the effects of the chemicals in the treatment systems, such as water treatment system, and in the ecosystem.

9.2 FRANCE

See previous section: "Annex 1 – Seveso summaries".

9.3 GERMANY

Preliminary enquiries indicate that IPPC does not play a significant role in German industry. The wealth of relevant existing regulations seems to be considered as sufficient. In any case, the concept of state-of-the-art of technology, whose compliance has to be demonstrated in Germany, ensures that advances in technology are implemented.

The new guideline TA-Luft (2002) apparently reflects most of the concepts of IPPC. It is mandatory for German firms.

Integrated Pollution Prevention and Control (IPPC) is implemented in Germany via numerous laws and regulations, e.g. BImSChV (law on immissions), Wasserhaushaltgesetz (law on

water), TA Luft, etc. The chief difference is that instead of the "Best Available Technology", limiting values for emission are instead specified. These imply that the best available technology is used. This is assured as well by the German notion of the state of the art (Stand der Technik/Sicherheitstechnik) universally applied to all questions related to plant safety and environmental impact.

The key documents for the assessment of IPPC adequacy and compliance are in all three companies

- formal project documentation
- technical documentation on the proposed project or activity
- Environmental impact assessment (EIA) report (including monitoring results for existing installations)
- safety analysis report

9.4 ITALY

The IPPC Directive 96/61EC was ratified in Italy by Legislative Decree No. 372 of August 4, 1999 which introduced into national legislation the Integrated Environmental Permit (Article 2(9)) as the instrument for implementing IPPC. To ensure proper integration of the authorisation process, the regulation provides that every installation must be answerable to a single competent authority, which interfaces via a single conference of services with all the other administrations involved.

Article 2(8) of L.D.372/99 identifies as the "competent authority" the same state authority that is competent to require the environmental impact assessment pursuant to the laws in force, or the authority identified by the region, bearing in mind the need to define a single procedure for the granting of integrated environmental permits. Some regions have identified in the provinces the authorities that are competent within the respective areas.

A specific regulation on the sector (L.D. 7/02, converted by Law 55/02) later identified the Ministry of Production, Enterprise and Trade as the authority competent to grant permits for the operation of newly constructed, large installations for the generation of electrical energy, for which the request for a permit had been submitted by 31 December 2002. Such a permit for operation also includes the integrated environmental permit.

Later, Article 77(3) of the 2003 financial law (Law 289/02) subjected to integrated environmental authorisation all existing installations, including those newly constructed.

In summary, the distribution of competences in December 2002 was as follows:

Class of installations	**Competent Authority**
New large combustion installations	Ministry of Production, Enterprise and Trade
Other IPPC installations (new or existing) subject to national Environmental Impact Assessment (EIA) procedures	Ministry of the Environment
Other existing installations not subject to national EIA procedures	Local (regional or provincial offices)

National law provides that the integrated environmental permit contains all the requirements specified in Article 9 of Directive 96/61/EC, in particular:

- Limit values for emission to air and water – Article 5(1) of L.D.372/99 establishes that the permit must contain limit values for emissions to air and water.
- Minimisation of long-distance or transboundary pollution – Article 5(3) of L.D. 372/99 establishes that the permit must contain the appropriate provisions.
- Protection of soil and groundwater and waste management – Article 5(2) of L.D. 372/99 establishes that, where necessary, the integrated environmental permit must contain additional provisions to ensure protection of the soil and groundwater, appropriate arrangements for the management of waste generated by the installation, and provisions to reduce noise pollution.
- Release monitoring requirements – Article 5(5) of L.D. 372/99 establishes that the integrated environmental permit must contain the appropriate requirements for checking emissions, which specify the methodology used and the measurement frequency.
- Measures relating to abnormal operating conditions – Article 5(6) of L.D. 372/99 establishes that the integrated environmental permit must contain measures relating to abnormal operating conditions, in particular for the start-up and close-down phases of the installation, for leaks, for malfunctions, and for final closure of the installation.

In Italy, the level of awareness of ToSPIS is different from region to region. Larger enterprises in the process industry often rely on software tools, but in general they are not well adopted.

The competent authorities have a databank of environmental knowledge ("banca dati dell'ARPA"). QRA is very rare and risk analysis is only adopted to find the available level of land reclamation. The level of awareness of BAT is medium – and especially SMEs are not well informed about BAT. In the country, no BAT information centre exists yet. Only large enterprises have a high awareness of BAT.

Waste management is common and often adopted in Italy. Measures for the prevention and recovery of waste generated by the installations – like wastewater treatment systems, incineration, LCA, hazardous waste, sorting and recycling – are well known. Energy saving is not satisfactorily developed in Italy – there aren't written agreements on energy saving, and audits are not applied. Public participation is covered in EIA procedures and companies arrange information days for the public. Environmental permits are available to the public but only when they've been officially approved. Management systems such as EMAS and ISO 140001 are common in Italian industry. Italy possessed no previous experience in integrated permitting – thus, the system developed has been based largely on the Directive.

The information reported indicates that, while most of the requirements of the Directive have been transposed into national legislation, there was a certain lateness in the actual practical implementation of all the measures and requirements, and the integrated permitting system envisaged in the legislation did not appear to be fully functional yet, at the time of the reporting, from an administrative and practical (implementation) point of view, as witnessed by the very small number of new or substantially changed Annex I installations with permits reported (even taking into account the fact that this data is qualified as "provisional") – only a fraction of the total number of existing installations.

9.5 SLOVENIA

The IPPC Directive has been transposed in Slovenia in 2004 by the Environmental Protection Act (41/2004) and a Decree (100/2004). There are 176 IPPC establishments in Slovenia (October 2004).

The level of awareness of IPPC Directive and environmental issues in general is high in Slovenia. However, among large and medium-sized enterprises the awareness of environmental demands is better than in smaller enterprises. Environmental authorities do not have time and the resources to visit and audit all the small companies. Instead, two meetings with each establishment is scheduled as to achieve common understanding on what should be done in the process of the implementation of the IPPC Directive and associated licensing or issuing of operational permits. The culture of the environmental authority is based on emissions permits and reactive actions, not preventive and proactive audits and actions. This is to be changed in the near future as to integrate both approaches.

The Ministry of Environment, Spatial Planning and Energy has established a special working group for the implementation of the IPPC directive. Apart from communicating with the establishments this group is working on the issues associated with the improvement of the BREF documents.

The level of awareness of ToSPIS that will support the IPPC Directive compliance is also variable. In general, software tools are very rare. Software is mostly used in the process of EIA. On the other hand monitoring of emissions, immissions and state of environmental parameters is well developed and applied. This is required by regulation. Authorities have an extensive databank of environmental qualities, e.g. town plans, hydrology, surface waters, groundwater, wastewater and air emissions. GIS is also used.

Internet service platform is commonly used, e.g. the www pages of the Ministry of the Environment, Spatial Planning and Energy; Chamber of Commerce and Industry of Slovenia; Ministry of Economy, IPPCB and different industrial associations. For instance links to documents, guidelines, application forms, legislation, etc. is available. In general, the work associated with the IPPC compliance is so huge that even large companies often hire a consultant to assist collect, prepare, and process the knowledge needed.

Environmental accidental risk analyses are not commonly used apart from Seveso II directive (outside Seveso II establishments). Some attempts exist, however, in the framework of EIAs. There is, also, special procedure required for groundwater risk assessments since 2004 (a special Decree). However, the environmental authorities are not in most cases competent for evaluating these risk analyses. In addition, the responsibility for the evaluation is split between the Ministry of Environment, Spatial Planning and Energy and the Ministry of Health. Generally, risk analysis (accidental and non-accidental) as a tool is not widely applied at authority level, however, theoretically it is well known. Environmental authorities are aware of safety technology and measures, such as air and water treatment systems, alarms, fire-fighting systems etc. These are also in widespread use in Slovenian industry.

Best available technology (BAT) is a concept which is not commonly understood in Slovenia. By ones, it is the newest technology available in certain industry, while for the others it is just a review of status in certain industry which has been presented in BREFs by some of the countries (does not represent the EU or world-wide level). The authorities, on the other hand, believe that strict regulation and licensing should (could?) be applied based on BAT concept and information in BREFs, so they enforce this approach. The industry and authorities are interested to actively follow the development of BAT and BREFs (participate at the national

and EU-meetings and workshops), however they do not have resources to do that systematically.

Since 2004 Slovenian SMEs deserve special attention in terms of eco-efficiency. More than 100 SMEs from different industry and service branches are already involved in networking as what is the status, which are possibilities and how to improve situation regarding waste management, energy efficiency, air pollution, licensing etc. This network is increasing. Waste management is the primary issue for most of the companies involved. Sorting and recycling are well known processes although there are problems related to the market of the so called secondary raw materials.

Public participation is covered, for instance, in EIA procedures and companies make environmental (or social responsibility) reports and arrange open door days for the public. Environmental permits must be made available to the public before decisions are made.

Management systems (quality, environmental and safety) are in the process of integration in Slovenian industry. Since these systems include knowledge management systems, there might be a lack of efficient information systems where all the different knowledge would be in one place and available. Another serious problem related to this in environmental management concerns the management of change – especially ownership and organisational changes where some important knowledge might disappear.

9.6 UK – England & Wales

The IPPC Directive was enacted in England and Wales by the Pollution Prevention and Control Act 1999 and implemented by The Pollution Prevention and Control (England and Wales) Regulations 2000. The introduction of the regulations to different industry sectors is being phased between 2000 and 2007.

In England and Wales there are approximately 4500 installations that will eventually be regulated by the Environment Agency under PPC and this includes about 400 installations that are additional to the scope of the IPPC Directive reflecting sites previously regulated under the Integrated Pollution Control (IPC) regime. In addition there are about 15,000 installations regulated in England and Wales by Local Authorities under a regime with similar requirements to the IPPC Directive.

The level of awareness and understanding of the IPPC Directive is generally high in England and Wales. This is helped by previous regulation under IPC, which has many similarities to IPPC Directive.

The use of ToSPIS supporting the IPPC Directive is variable.

Software tools specifically used to support IPPC Directive compliance are rare except where they are provided by the Environment Agency.

The Environment Agency provides the following software tools. The first is a requirement of all operators. The second is not mandatory but is used by almost all operators.

EP OPRA

http://www.environment-agency.gov.uk/business/444217/444661/444671/466170/411964/?version=1&lang=_e

EP OPRA is primarily a risk screening methodology. The EP OPRA scheme has four attributes. Three reflect the environmental hazard of the operation (including its location) and the fourth measures Operator performance. For all of these attributes, the system provides

either a look-up table or objective scoring systems so that an Operator can calculate the EP OPRA Banded Profile when applying for a PPC Permit. The Environment Agency bases operate permitting and compliance costs on the EP OPRA Banded Profile. EP OPRA is supported by Microsoft Excel spreadsheet.

H1 Environmental Assessment and Appraisal of BAT

http://www.environment-agency.gov.uk/business/444217/444663/298441/horizontal/545377/?version=1&lang=_e

This guidance note provides:

- methods for quantifying environmental impacts to all media
- a method for calculating costs of environmental protection techniques
- guidelines on resolving cross media conflicts and making cost / benefit judgements.

The methodology can be used either to:

a) conduct an Options Appraisal of candidate techniques to determine BAT to control selected releases from an installation because:

- deviation from indicative BAT in Guidance Notes is proposed
- several candidate Best Available Techniques exist
- no indicative BAT is provided in Guidance Notes.

or

b) carry out an Environmental Assessment of the overall impact of the emissions resulting from the installation as a whole, in order to:

- confirm that the emissions are acceptable (i.e. do not cause significant pollution)
- identify priority emissions or environmental risks for further improvement.

A software tool has been developed to accompany this guidance. This can be used to input most of the data requirements, perform calculations, and present the environmental impact and cost information. The use of this software tool greatly simplifies the process and helps to ensure that information is provided in a consistent and transparent format. However, the operator usually needs to provide supplementary information in addition to that calculated in the software, which would cover the interpretation and decision-making process as well as any further detailed assessment that has been undertaken outside of the steps included in this methodology.

More generally, specific software tools are commonly used in consequence assessment for transport modelling – groundwater, soil, surface water, air and water dispersion and deposition). There is a mixture provided by either the Environment Agency or third party commercial organisations. Commonly this software incorporates GIS functionality.

Software tools to support the implementation of environmental management systems normally associated with ISO14001 or EMAS are also provided by many commercial organisations. Within industry, process control is extensively based upon software tools (such as distributed control systems (DCS)) and monitoring of environmental parameters is linked to these systems.

Internet service platforms and information systems are widely used. The Environment Agency provides a wealth of information through its website and the "What's in your back yard?" system – http://216.31.193.171/asp/1_introduction.asp?lang=_e

Of the current datasets available the following are particularly relevant to IPPC Directive.

- Discharges to Sea - What substances are being released to the sea?
- Floodplains - Is my installation/house near a potential area of flooding?
- Pollution Inventory - What pollution is being emitted from industrial sites in my area?
- IPC OPRA Scores - How does the Agency rate the pollution hazards and operation of my local factory?
- River Quality - What's the water quality like at the river near my installation/home?
- River Quality Targets - What targets have been set for my local river?

The Environment Agency website also includes all the necessary application forms for making an IPPC application plus a comprehensive suite of guidance.

Other information systems

http://www.jncc.gov.uk (info on European sites and interest features)

http://www.magic.gov.uk (mapping tool allowing installation to be placed in context of European sites)

http://laburnum.aeat.co.uk/archive/laqm/laqm.php (local air quality information)

10. Annex A : Publications and reports

10.1 Seveso II -related publications and reports (national)

10.1.1 Finland

Muje, I. 2003. Teollisuuslaitosten turvallisuusselvitysten keskeisimmät puutteet, TUKES-julkaisu 3/2003. Turvatekniikan keskus, Helsinki 2003. 27p.

Levä, K. 2003. Turvallisuusjohtamisjärjestelmien toimivuus: vahvuudet ja kehityshaasteet suuronnettomuusvaarallisissa laitoksissa. ISBN 952-5095-62-2. TUKES-julkaisu 1/2003. 163p. + app. (A study "… into the functionality of safety management systems in those installations in Finland which run the risk of a major accident.")

Levä, K. & Ritola, S. 2001. Seveso II Turvallisuusjohtamisen pika-arviointi , TUKES-julkaisu 7/2001. Turvatekniikan keskus, Helsinki 2001. 55p.

The Finnish Safety Technology Authority (TUKES) has published reports and guidelines in Finnish:

TUKES-ohje K4-2000. Toimintaperiaateasiakirja. Turvatekniikan keskus, Helsinki 2000. (about major accident prevention policy, MAPP)

TUKES-ohje K1-2002. Turvallisuusselvitys. Turvatekniikan keskus, Helsinki 2002. (about safety reports)

Overview of Risk analysis methods (guidelines & forms) – VTT Industrial Systems.

http://www.vtt.fi/virtual/riskianalyysit/

10.1.2 Germany

Risikomanagement im Rahmen der Störfall-Verordung. Bericht des Arbeitskreises TECHNISCHE SYSTEME, RISIKO und VERSTÄNDIGUNGSPROZESSE der Störfallkommission. SFK-GS-41, 21 April 2004.

HVBG-Hauptverband der gewerblichen Berufsgenossenschaften
BG-Statistiken für die Praxis, 53754 St Augustin, Germany.

Zentrale **M**elde- und **A**uswertestelle für Störfälle und Störungen in verfahrenstechnischen Anlagen. http://www.umweltbundesamt.de/zema

Hauptmanns, U.: Reliability Data for Process Plants
Prepared by on behalf of the Federal Ministry for Environment, Nature Conservation, and Nuclear Safety for the Technical Committee on Installation Safety and Major Hazard Commission Working Group on Land-Use-Planning, July 2003.

Hauptmanns, U., Hömke, P, Huber, J., Reichart, G. und H.-G. Riotte: Ermittlung der Kriterien für die Anwendung systemanalytischer Methoden zur Durchführung von Sicherheitsanalysen für Chemieanlagen, GRS-59, Köln 1985.

10.1.3 Slovenia

The Ministry of Environment, Spatial Planning and Energy has published reports and guidelines in Slovene, and it has also initiated some research projects related to this topic together with the Ministry of Defence. The Ministry of the Environment is also active in related activities at the EU level (MAHB, JRC Ispra).

Ministry of Environment, Spatial Planning and Energy, Pripravljenost na nesreče z nevarnimi snovmi v Sloveniji, 2002, http://www.sigov.si/mop/

Ministry of Environment, Spatial Planning and Energy, Primerjalna študija uporabe različnih metod za izdelavo ocene tveganja za okolje ob izrednih dogodkih, 2003, http://www.sigov.si/mop/

10.1.4 UK

HSG190 Preparing safety reports: Control of Major Accident Hazards Regulations 1999 COMAH, HSE Books, 1999.

L111 A guide to the Control of Major Accident Hazards Regulations 1999, HSE Books, 1999.

Reducing Risks Protecting People HSE's decision-making process, HSE Books, 2001.

10.2 IPPC -related publications and reports (national)

10.2.1 Finland

IPPC implementation in general in Finland

Silvo, K., Melanen, M., Gynther, L., Torkkeli, S., Seppälä, J., Kärmeniemi, T. & Pesari, J. 2000. Yhtenäinen päästöjen ja ympäristövaikutusten arviointi. Lähestysmistapoja ympäristöprosessin tueksi. *(Integrated assessment of emissions and environmental impacts – supportive approaches for environmental permitting.)* Suomen ympäristö 374. Suomen ympäristökeskus. Helsinki.

Working group for assessing the implementation of the Environmental Protection Act (chair Simo Mäkinen). 2003. Ympäristönsuojelulain täytäntöönpano. *Implementation of the Environmental Protection Act. Assessment of experiences.* Suomen ympäristö 661. Ministry of the Environment, Helsinki.

Peltonen Terhi, Suoheimo Pirke, Huimala Ulla, Pennanen Jaana and Sahivirta Elise, 2004. Vapaaehtoiset ympäristöjärjestelmät ja ympäristölupaprosessi EU-jäsenvaltioissa (Voluntary environmental management systems and the permitting procedure in the EU member states). Publication series: The Finnish Environment 677. Finnish Environment Institute. 31p. ISBN 952-11-1628-5 (nid.) 952-11-1629-3 (PDF) - http://www.ymparisto.fi/julkaisut/

See also: http://www.ymparisto.fi/

Environmental risks – accidental emissions in Finland

Lonka, H. 1998. Öljy- ja kemikaalivahinkojen torjuntavalmius Suomessa – ympäristövahinkojen torjunnan näkökulma. *(Preparedness for responding to oil and chemical accidents in Finland – the point of view of environmental hazards.)* Suomen ympäristö 193. Suomen ympäristökeskus. Helsinki.

Lonka, H. 2001. Ympäristöriskien hallinta. Tutkimuksen ja kehittämisen suuntaviivat. *(Environmental risk management. Outline of research and development.)* Suomen ympäristö 480. Ympäristöministeriö. Helsinki.

Molarius, R. & Wessberg N. 2003. Ympäristöriskien hallinnan tehostaminen – poikkeus- ja häiriötilanteet. *(Preliminary study on the rationalisation of the management of corporate*

environmental risk in abnormal and potential emergency situations.) Suomen ympäristö 625. Pirkanmaan ympäristökeskus, Ympäristöministeriö. Helsinki.

10.2.2 Slovenia

IPPC implementation is in general in Slovene – http://www.sigov.si/mop/index.htm

Recent EIA reports are available for different industries – a database of the Ministry of the Environment, Spatial Planning and Energy.

Ministry of the Environment, Spatial Planning and Energy

10.3 Other Seveso II -related publications and reports

"Guidance on the Preparation of a Safety Report to meet the requirements of Council Directive 96/82/EC (Seveso II)" - http://mahbsrv.jrc.it/GuidanceDocs-SafetyReport.html

"Guidance on Inspections as required by Article 18 of the Council Directive 96/82/EC (Seveso II)"; EUR 18692 EN; ISBN 92-828-5898-7; CL-NA-18-692-EN-C. - http://mahbsrv.jrc.it/downloads-pdf/inspecf.pdf

"Guidelines on a Major Accident Prevention Policy and Safety Management System, as Required by Council Directive 96/82/EC (Seveso II)" - http://mahbsrv.jrc.it/GuidanceDocs-SafetyManagementSystems.html

"Directive 96/82/EC, "SEVESO II", Article 9(6), EXPLANATIONS AND GUIDELINES"

Report EUR 18124, Edited by Jürgen Wettig and Neil Mitchison. - http://mahbsrv.jrc.it/downloads-pdf/Twg6-en.pdf

Green Book (CPR 16E) – Methods for determining the possible damage to people and subjects resulting from releases of hazardous materials. The book contains damage models for exposure to heat radiation, explosion effects on structures and humans, toxic products released during a fire, acute intoxication, indoor protection against toxic substances. The Green Book models have been available in the form of the PC package DAMAGE (latest version 5.0). The Green Book consist of 1 volume, 325p., English language, latest version 1992

Yellow Book (CPR 14E) – Methods for the calculation of physical effects resulting from releases of hazardous materials. TNO has been involved for many years in the field of hazardous materials, undertaking both experimental and theoretical research into modelling the effects of accidental releases. It has developed an extensive set of effect models for the Dutch government; these models are published collectively in the Yellow Book, which is internationally recognised as the common standard in safety studies. The theoretical background, including basic data formulae, diagrams, is given for the effects: outflow, turbulent free jet, spray release, evaporation, heat radiation, dispersion, vapour cloud explosion, rupture of vessels, etc. The Yellow Book consist of 2 volumes, 820 p., in English language, latest version in the 3rd edition, 1997. The Yellow Book models have been made available in the TNO PC software program EFFECTS (4.0 latest version).

Red Book (CPR 12E, issued 1997) – Methods for determining and processing probabilities. 1 Volume, 400p.

Purple Book (CPR 18E) – Guidelines for Quantitative Risk Assessment (latest version 1999).

Evaluation of safety management systems and safety weighting policy, 1998

Safety management systems (SMS) are a principal requirement in Seveso II Directive. Common industrial SMS element structures can be modelled but limitations arise from an important factor in SMS implementation, the local culture. Several industrial approaches among the EU were examined for the arbitrarily chosen relative weighting factors of their SMS elements. Flexible legislation, without preferences on weighting policy, allows for a wide variety of applications but reduces the content of central guidance of safety performance communication between industry and authorities. The evaluation of system performance is examined for its sensitivity to classification schemes and weighting policies which can be used for the benefit of useful methodological tools.

PAPADAKIS G, LOUPASIS S, Paper presented: Loss Prevention and Safety Promotion in the Process Industries, Barcelona (ES), May 4-7, 1998. Available as Paper EN 41356 ORA

The use of geographic information systems in major accident risk assessment and management, 2000

The paper discusses the use of modern information technologies, and in particular Geographic Information Systems, in the management and control of major accident risk. For this purpose, the regulatory framework of the recent "Seveso II" Directive is briefly described. This asks for more transparent procedures and decision-making, and requires consultation of the public in land-use and off-site emergency planning. Correspondingly new demands are put to support tools being developed. The main features of tools dealing with hazard sources mapping, risk assessment, risk management, and emergency planning are discussed and examples are given. Moreover, it is argued that, if appropriately designed, their use can enhance the dialog between plant operators, authorities and the public to facilitate a consensus on risk issues. Finally limitations in the use of these tools and prospects for future developments are discussed.

CONTINI S, BELLEZZA F, CHRISTOU M, and KIRCHSTEIGER C., ART: 90116. Journal of Hazardous Materials 78 (2000) pp.223-245

MARS (Major Accident Reporting System). An Electronic Documentation and Analysis System for Industrial Accidents Data. Technical Guideline on Reporting Accidents to the MARS Database, 2001

This "Technical Guideline on Reporting Accidents to the MARS Database" intends to provide the local database owner of MARS 4.0, i.e. the Competent Authorities of the participating countries, with technical background information on which type of information should be included in the MARS 4.0 database fields; in other words, how the headings of the data reporting forms should be interpreted.

Background: The European Commission's Major Accident Reporting System (MARS) is based on the requirements of EU Directive 96/82/EC ("Seveso II") and dedicated to collect in a consistent way data on major industrial accidents involving dangerous substances from the Member States of the European Union, to analyse and statistically process them, and to create subsets of all non-confidential accidents data and analysis results for export to all Member States. In its new version 4.0, MARS represents a modem information exchange and analysis tool which is made up of two connected parts: one for each local unit (i.e., for the Competent Authority of each EU Member State), and one central part for the European Commission. The local as well as the central parts of this information network can serve both as data logging systems and, on different levels of complexity, as data analysis tools.

While the functioning of the MARS 4.0 software tool is described in "C. Kirchsteiger: MARS 4.0- An Electronic Documentation and Analysis System for Industrial Accidents Data, EUR Report, Ispra, 2001", the report in hand gives definitions on the technical background of the data to be reported. The overall aim is to obtain a better understanding of and consistency in the way how accidents are reported to MARS.

KIRCHSTEIGER C., EUR 19768 EN (2001). Free of charge, from Documentation Service JRC Ispra (IT) Fax +39-0332-785818

Hurst N. (1997) From research to practical tools - developing assessment tools for safety management and safety culture, Journal of Loss Prevention in the Process Industry, Vol.10, n.1, pp.63-66, Elsevier, United Kingdom.

10.4 Other IPPC -related publications and reports

Integrated Pollution Prevention and Control – Reference Document on Best Available Techniques in Common Waste Water and Waste Gas Treatment / Management Systems in the Chemical Sector – February 2003. - http://europa.eu.int/comm/environment/ippc/brefs/cww_final_0203.pdf

11. Annex B : Research projects

11.1 Seveso II -related research projects (national)

11.1.1 Finland

The Finnish Safety Technology Authority (TUKES) has initiated some research projects related to this topic in Finland.

11.1.2 Italy

Developed by INERIS on behalf of the French Ministry of Ecology and Sustainable Development, the results of the PRIMARISK project – Plate-forme de Ressources Intégrées pour la MAîtrise des Risques (Integrated resource platform for risk assessment and management) will be made available on the Internet at the end of 2005, initially for the administration in charge of the control of hazardous industrial plants (competent authorities) and later for the industry and consulting companies. PRIMARISK will contain general information, modelling tools, databases. The information will be accessible either directly or in relation with risk assessment processes among which is the making of the safety report required by the Seveso II Directive.

11.1.3 Italy

The project e-Seveso aims to accelerate the relation between the operators and the competent authorities with web tools.

The e-Seveso tool may solve the communication's gap existing in Italy between the Competent Authority and industries. The resolution of this gap might help to cancel the delay related to the safety reports' assessment by Competent Authority.

A project about the comparisons of common tools, service, and information systems that exist to deal with Seveso and IPPC aspects is the Project SIMAGE. It aims to realise an integrated system for the environmental monitoring, and Industrial Risk Management and Emergency in the area of Porto Marghera (Venice). The project is being carried out by ARPAV (Veneto Region Agency for Environment Protection).

11.1.4 UK

The UK Health and Safety Authority (HSE) has published reports and guidelines, and has also carried out a wide range of research projects related to this topic. Many of these are available on the HSE website. - http://www.hse.gov.uk/

11.2 IPPC -related research projects (national)

11.2.1 Finland

Rationalisation of environmental risk management – environmental risk analysis (YMPÄRI-project)

The implementation of the regulations in IPPC Directive concerning the management of accidental emissions seems to be unclear in Finland. In most cases, concerning accidental emissions, in Finland, the environmental authorities refer to the Major Accident Prevention Policy (MAPP) or the Safety Report, which are regulations in the Seveso II Directive

(96/82/EC). These regulations force companies to build a safety management system. From the environmental point of view this, however, is not enough. The Seveso II Directive addresses only major-accident hazards involving dangerous substances. Environmental harm may also be the result of, however, smaller accidents or from the release of substances which are not classified as dangerous. Therefore the MAPP and the Safety Report do not completely cover environmental risk management. There is also a clear lack of cooperation of the environmental authorities and the safety authorities.

According to previous studies and the problems mentioned above it has been found that criteria of environmental risk analysis concerning accidental emissions are unclear among authorities as well as companies and consultants. The purpose of this project is to develop such criteria. At the same time concepts related to environmental risk management and environmental risk analysis is rationalised. Consequence analyses (e.g. dispersion models) are also surveyed.

The project is financed by the Finnish Ministry of the Environment, the Finnish Safety Technology Authority and VTT.

11.2.2 Italy

A project about the comparisons of common tools, service, and information systems that exist to deal with Seveso and IPPC aspects is the Project SIMAGE. It aims to realise an integrated system for the environmental monitoring, and Industrial Risk Management and Emergency in the area of Porto Marghera (Venice). The project is being carried out by ARPAV (Veneto Region Agency for Environment Protection).

11.3 Other Seveso II & IPPC -related research projects

11.3.1 ARAMIS

The objective of ARAMIS (Accidental Risk Assessment Methodology for IndustrieS in the framework of SEVESO II Directive) is to develop a European harmonised risk assessment methodology to evaluate the risk level of industrial establishments by taking into account the prevention tools implemented by the operators. The project work plan is built to result in the characterisation of the risk level. The characterisation of the risk level is based on the determination of Reference Accident Scenarios and integrates: Consequence severity evaluation of scenarios; Prevention management efficiency (preventative, protective and mitigation measures); Environment vulnerability estimation. For the characterisation of the Risk Level, the integration of the three components will be studied. The methodology will be validated with case studies. Efforts are given to disseminate the methodology to decision-makers in charge of the control of major accident hazards. The end-users of the methodology are both the industrial companies and the Competent Authorities responsible for the implementation of the SEVESO II Directive (96/82/EC). - http://aramis.jrc.it/index.html

11.3.2 e-Seveso

e-Seveso solution is intended to make the administration services (mainly those at local level) more accessible to the people that could benefit from them: industries, local residents. e-Seveso is a tool that will help to implement regulations and voluntary codes. Although e-Seveso motto is "Seveso II Directive" on major accidents hazards on certain industrial activities, e-Seveso applies equally to those industries that handling or not dangerous substances, falling or not within any directive, want to add or improve preventive measures for their industrial security. e-Seveso is specially suitable for SMEs with scarce means (human, economic) for accessing any costly/private security system. Most of these SME industries are allocated inside Industrial Parks or industrial districts, where special requirements frequently arise from the often (if not in all cases) close proximity of the establishments and their interconnectedness. The danger of the domino effect prevails in this situation.

- http://www.e-seveso.net/en/

11.3.3 SMMARTEN

The SMMARTEN project aims at developing effective safety management systems to fit the needs of participating small and medium enterprises which operate industrial installations involving dangerous substances. Small and medium enterprises are generally concerned with enhanced legislative requirements that may postpone or divert planned expansion of their activities. Nine companies participating in the core group are small sized enterprises that fall under the requirements of the Directive "Seveso" II. All companies have substantial experience in handling risks since they follow the same activities since many years but because of their size they do not have the required resources to formalise the way they manage safety. The large majority of the companies is active in the field of pesticides and agrochemicals (production, packaging and transporting hazardous chemicals). It is their desire to exploit the results of this project to improve their position regarding: their know-how on SMS development and assessment, their internal decision-making process related to corrective actions and investments on safety measures, their effort to fulfil legislative requirements, measure and communicate safety to authorities and their image to the local authorities, their own personnel and the citizens living near by. - http://www.library.tuc.gr/smmartenWeb/

11.3.4 S2S

S2S project started on October 1, 2002. The main objectives of this initiative on process and plant safety are to: create a European Research area; combine the knowledge available in the different networks and countries; create a web portal and be an electronic references point; document and update the competence and state of the knowledge; offer safety guidelines and training activities especially for SMEs. - http://www.s-2-s.org/

11.3.5 ACUTEX

ACUTEX (Methodology to establish acute exposure threshold levels in case of accidental chemicals release) is aimed at the development of innovative approaches to define a set of Acute Toxic levels to be used in both areas, land use planning as described in Seveso II Directive and also in emergency planning. A methodology, software tools and Technical Guidance Document (TGD) for establishing European Acute Exposure Threshold Levels (EU AETLs) in case of accidental chemical release will be defined. Compared to currently used methodologies, innovative elements are introduced. This methodology will be validated by cases studies. The methodology will support the harmonised implementation of Seveso II Directive. Efforts are given to disseminate the methodology to decision-makers in charge of the control of major accident hazards. Thus, the project will be monitored by a critical review panel gathering, risk experts from industry, EU Competent Authorities in order to ensure the widest acceptance of the results. - http://chimie.ineris.fr/en/lien/expositionaccidetelle/projeteuropeen/acutex.php

11.3.6 ARTEMIS

ARTEMIS aims to pilot telematics systems to streamline management action in emergencies which are often aggravated by inadequate planning and coordination, insufficiently trained staff or lack of technical information resources. Appropriate systems can offer the networks and software to support good decisions in an emergency. This project will first focus on a system for industrial accidents and floods, with a view to wider applications. Among its longer-term benefits will be integrated monitoring and planning functions, a firm basis for inter-agency coordination of action plans and sound training for crisis management.

11.3.7 HITERM

Within the framework of HPCN Information Management and Decision Support, HITERM (High-Performance Computing And Networking for Technological and Environmental Risk Management) aims at expanding the application of HPCN to decision support in new domains: the central focus is the interface between technological risk management and the environment. Using distributed parallel computing, the project aims at reaching better-than real time performance for the simulation of accidental release of hazardous substances into the atmosphere and ground and surface water. This information will be used, in the framework of interactive, on-line decision support and advisory systems for the adaptive routing of hazardous transports integrating environmental risk criteria with other road information and the support of emergency management tasks (and related staff training) for transportation accidents involving hazardous substances and for hazardous installations, as foreseen by the amended Post-Seveso Directive (82/501/EEC, 87/216/EEC, COM(94)4). In addition to connecting the HPC simulations to various on-line monitoring data sources, the project will explore the on-line integration of uncertainty and error analysis based on Monte-Carlo methods and on-line interactive data interpretation and visualisation for dynamic, spatially distributed, and probabilistic model results. - http://www.ess.co.at/HITERM/

11.3.8 COMPASS

The overall aim of the COMPASS (Risk comparability and integrated risk management) project is to contribute to the establishment of an internationally accepted non-prescriptive platform that will allow policy makers, experts and the general public to understand the relevance of a specific accidental risk and the quality of its assessment, and to compare and integrate risk figures from different sources. More specifically, COMPASS has the following three main objectives:

1. Develop a template for the characterization of the risk figure - i.e. identify the main features of the risk-analysis methodology, the procedure and the data sets used. This template will enable a better understanding of the real meaning of the qualitative or quantitative risk figures used or compared with each other during the decision-making process.

2. Develop a template for the qualification of the risk figure - by assessing the whole risk-analysis process leading to the risk figure. This will facilitate the verification of the quality and the confidence level of the risk figure and will thus help determine the completeness and adequacy of the performed risk analysis.

3. Develop a method for the assessment of the integrated risk - for individuals, society and the region and for risk-informed/risk-based decision-making to ensure transparent, effective risk management and priority setting.

The successful achievement of these objectives will constitute a first step towards standardisation in the area of risk comparison. - http://compass.jrc.it/index.html

11.3.9 BEQUAR

BEQUAR (Benchmark Exercise in Quantitative Area Risk Assessment in Central and Eastern European Countries) Follow up to the 5th Framework Programme JRC Project PA26: " Management of natural and technological hazards" and part of the JRC Enlargement Action for 2004. - http://www.jrc.cec.eu.int/mahb/bequar/

11.3.10 REHRA

The methodology for the pilot REHRA (Pilot project on rapid environment and health risk assessment) of industrial operations is based on analysis and inventory tools and on existing risk assessment and ranking methods. Analysis and inventory tools include those provided by:

- the Conventions on access to information, public participation in decision-making and access to justice in environmental matters (Aarhus Convention) and on environmental impact assessment in a transboundary context (Espoo Convention)
- (list of potentially hazardous industrial activities);
- the Seveso II Directive of the European Union on dangerous substances; and
- the Joint Research Centre (JRC) of the European Commission (EC)
  (Major Accidents Reporting System and Seveso Directive implementation guidelines);

Existing risk assessment and ranking methods are those defined by:

- international agencies (for classification and prioritisation of risks*, gravity ranking system for accident consequences**, offsite consequence analysis guidance***); and
- national authorities (such as the Italian rapid method for emergency planning and the Dutch guide to hazardous industrial activities).

* United Nations Environmental Programme (UNEP), WHO, International Agency for Atomic Energy (IAEA), United Nations Industrial Development Organization (UNIDO)

** EC/JRC

*** United States Environment Protection Agency (US EPA)

- http://www.euro.who.int/watsan/CountryActivities/20030729_10

11.3.11 e-EcoRisk

e-EcoRisk (A Regional Enterprise Network Decision-Support System for Environmental Risk and Disaster Management of Large-Scale Industrial Spills) will create a regional enterprise network information management and decision support system that will provide environmental and civil protection agencies and other relevant

governmental and non-governmental organisations with improved information and insight on the potential and actual risks (impact) to the environment of large-scale industrial spills for their prevention, mitigation, and control. This will be implemented in a timely, up-to-date, and easily accessible manner through the application of innovative information and telecommunication technology. e-EcoRisk will allow access to the system in real time from fixed and mobile wireless devices via a regional enterprise network (Internet), using terrestrial and satellite high bandwidth telecommunication systems.

11.3.12 ASSURANCE

Assessment of the Uncertainties in Risk Analysis of Chemical Establishments, Contract ENV4-CT97-0627.

11.3.13 Environment

Auditing and Safety Management for Safe Operation and Land Use Planning. A Cross National Comparison and Validation Exercise, EV5V-CT92-0068.

11.3.14 I-risk

Development of an Integrated technical and management risk control and monitoring methodology for managing and quantifying on-site and off-site risks. Contract ENVA-CT96-0243.

11.3.15 LUPACS

Land Use Planning and Chemical Sites. Contract ENV4960241.

11.3.16 PRISM

PRocess Industries Safety Management – thematic network on human factors. http://www.prism-network.org/

11.3.17 RASE

Explosive Atmosphere: Risk Assessment of Unit Operations and Equipment. EU Project No: SMT4-CT97-2169 - http://www.safetynet.de/EC-Projects/Rase.html

11.3.18 SAFETYNET

Contract BRRT-CT9805062. - http://www.safetynet.de/

11.3.19 SOCRATES

Safety Optimisation Criteria and Risk Assessment Tools for Emergencies and Siting, EU Contract, STEP-CT90-0093.

11.3.20 SPASE

Small Plants - Assistance with Safety and Environment. Contract ENV4-CT96-0280. - http://www.vtt.fi/tuo/44/projects/spase/

12. Annex C : Conference / Workshop papers

Seveso II -related material

Many relevant conferences and the associated papers are listed at:
http://mahbsrv.jrc.it/Proceedings.html

More specifically:

Seminar on "Industrial Parks and Multi-Operator Sites". Calgiari, Italy. 15 October 2003. http://mahbsrv.jrc.it/IndustrialParks/indparks-general.html

"Major Industrial Hazards in Land-Use Planning". Seveso II Conference. 12-14 February 2002. Lille, France. http://mahbsrv.jrc.it/Lille/LUP-general.html

Implementing Seveso II. An international conference on the CONTROL OF MAJOR ACCIDENT HAZARDS. MAHB. 6-8 November, 2000. Aldgate East, London , E1.

http://baldwin.butterworths.co.uk/search/sql/dataitem.asp?id=10922&tid=7

Seminar on "Progress in European research on major accident hazards", Antwerp, Belgium. 10 October 2001. http://mahbsrv.jrc.it/antwerp/antwerp-general.html

Seveso 2000 conference, 10-12 November 1999, Athens, Greece.
http://mahbsrv.jrc.it/Proceedings/Greece-Nov-1999/Athens.html

Seminar on "Software Tools to the Seveso II Directive". Turku, Finland, 13 October 1999. http://mahbsrv.jrc.it/turku-overview.html

(with Committee of Competent Authorities of the European Union)

Hazards XVIII: Process Safety - Sharing Best Practice. 22-25 November 2004, UMIST, Manchester, UK. http://www.icheme.org/hazardsxviii/

Programme & synopses: http://www.icheme.org/hazardsxviii/Hazards.pdf

International conference on probabilistic safety assessment and management, 2004. PSAM 7 / ESREL 2004. June 14 to 18, 2004 - Hotel Inter-Continental - Berlin, Germany. http://www.psam7.org/

Loss Prevention 2004. 11th International Symposium - Loss Prevention and Safety Promotion in the Process Industries. 31 May - 3 June 2004. Praha, Czech Republic. http://www.lossprevention.cz/

Hazards XVII, Process Safety - Fulfilling our responsibilities. 24-27 March 2003, UMIST, Manchester, UK. http://www.icheme.org/events/hazardsxvii/

IPPC -related material

"Assessing the Environmental Consequences of Industrial Accidents and Associated Emergency Response" Seminar. 10 April 2002. Huelva, Spain. CCA.

13. Annex D : Minutes of meetings

SHAPE-RISK – Kick-off meeting – INERIS, 22 & 23 April 2004

Document: Report_of_the_kick-off_meeting-final.doc

SHAPE-RISK – WP3 Kick-off meeting – INERIS (Primevère Room) 23rd April 2004

Document: SR_M-WP3_M01a.pdf

SHAPE-RISK – WP3 Preparatory meeting – JSI (room 106) 27th September 2004

Document: SR_M-WP3_Preparatory-2.pdf

SHAPE-RISK – WP3 workshop – SRA-E conference (Room F) 17th November 2004

Document: SR_D3B_Proceedings_of_the_WP3_workshop(2).doc

14. Annex E : Contacts list

FINLAND

TUKES – Safety Technology Authority
P.O. Box 123
FI-00181 Helsinki
http://www.tukes.fi/

Ministry of Social Affairs and Health
P.O. Box 536
FI-33101 Tampere
http://www.stm.fi/

Ministry of the Environment
P.O. Box 35
Kasarmikatu 25
FI-00023 Government
http://www.environment.fi/

VTT
Technical Research Centre of Finland
Industrial Systems – Reliability and Risk Management
P.O. Box 1306
Tekniikankatu 1
FI-33101 Tampere
http://www.vtt.fi/tuo/44/

JRC - MAHB

EC - Joint Research Centre
Major Accident Hazards Bureau
via E. Fermi, 1
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Italy
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EPSC

European Process Safety Centre

165-189 Railway Terrace

Rugby CV21 3HQ

United Kingdom

http://www.epsc.org/

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Health and Safety Executive

Rose Court

2 Southwark Bridge

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15. Annex 3 : Interview Aid (Checklist and Supporting Questions)

Interview Aid – WP3: Survey and comparisons of common tools and service platforms

Contents

Introduction / Objective – for Interviewer

Survey of tools, etc. used that deal with **IPPC** and **Seveso** aspects (prevention, response, crisis management, and mitigation). To compare the findings of the survey on the topic, and describe the state of the art, and then identify the needs for the future RTD activities with the objective to improve the tools, etc. for risk management.

i.e. map the currently used tools, etc. that industry uses in order to comply with the Seveso II and IPPC Directives.

i.e.

1. Tools
   - procedures/methodologies
   - software
2. Service platforms
   - portals
3. Information systems
   - databases

Basis, and information we need to get from the Interviewee

In developing the Interview Aid, it was thought best to structure the checklist around the main areas that need to be covered when complying with the Seveso II Directive. The sub-sections are therefore used as titles to subdivide the checklist so as we can approach the relevant persons. A similar approach has been adopted to glean information about IPPC compliance. We think this gives us a structured approach, and hope it will make it easier to analyse and report the results.

The Interviewer should adopt a similar approach throughout… approaching each section with a standard question-set –

Does the section apply to your organisation?

What Tools, Methodologies, Software, Service Platforms, Portals, Information Systems, Databases, etc. etc. are used to comply with the Seveso and IPPC Directives ?

The example lists (marked in yellow) should be used as prompts.

The Interviewer should especially try to keep raising the aspects of "**prevention, response, crisis management, mitigation**".

Consideration:

Limit for completion should be maximum 30 minutes.

Miscellaneous:

Tools, etc. to support ATEX, SQAS, ICE, Product Stewardship, REACH, etc. could also be considered ?

Introduction / Objective – for Interviewee

This interview aid checklist aims to map the support tools, methodologies, service platforms and information systems that are currently used by industry in their efforts to comply with the Seveso II and IPPC Directives, as well as authorities who check this compliance – especially concerning prevention, response, crisis management, and mitigation. The ultimate goal is to identify the needs for the improvement of these tools, service platforms and information systems for risk management.

It consists of 3 main sections:

1. Organisation / Institution Profile
2. Seveso Directive compliance
3. IPPC Directive compliance

Please complete Section 1 and whichever section (2, 3, or both) that applies.

The entire interview should take only a maximum of about 30 minutes.

Interviewer's name: Mr / Ms _____ **Date:** _____

Interviewee's information:

Name: Mr / Ms _____

e-mail: _____@_____

phone: _____

Note: *Your contact details will not be directly associated to the information supplied (in the analysis of the Interview data).*

Please send the completed Interview information to:

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33101 TAMPERE
Finland

Fax: +358 20 722 3282, **e-mail:** jari.schabel@vtt.fi

1. Organisation / Institution Profile

Organisation/institution name: _____

In which country is your organisation/institution? _____

How many employees in your organisation/institution? _____

What is the age of your organisation/institution? _____

In what industry is your organisation?

- ☐ Manufacture of:
- ☐ Pulp and paper products
- ☐ Refined petroleum products
- ☐ Pharmaceuticals
- ☐ Chemicals
- ☐ Fertilisers
- ☐ Explosives
- ☐ Other (e.g. Basic metals) _____
- ☐ Extraction of crude petroleum and natural gas
- ☐ Mining extraction and quarrying
- ☐ Warehousing (Storage)
- ☐ Transportation (Land / Sea / Air)
- ☐ Utilities (Electricity / Gas / Water / Waste)

- ☐ Emergency response (Fire-fighting, first-aid, hospital, etc.)
- ☐ Facilities Management, other

Are you a Seveso II site? ☐ Yes, **(☐ Top tier / ☐ lower tier)**

☐ No, ☐ Don't know

Do you have a MAPP? ☐ Yes, ☐ No, ☐ Don't know *(i.e. Major Accident Prevention Policy)*

An Emergency Response Plan? ☐ Yes, ☐ No, ☐ Don't know

Have you performed an Environmental Impact Assessment (EIA)? ☐ Yes, ☐ No, ☐ Don't know

Are you an IPPC establishment? ☐ Yes, ☐ No, ☐ Don't know

If yes, do you have an IPPC permit? ☐ Yes, ☐ No, ☐ Don't know

Other plans:

☐ Site Remediation Plan?

☐ Crisis management plan? What does it consist of (key points)?

_____

Are you a ☐ single or ☐ multi-plant company?

Are common tools used throughout the company or not? ☐ Yes, ☐ No, ☐ Don't know

Do you have a Safety Management System? ☐ Yes, ☐ No, ☐ Don't know

☐ OHSAS18001, ☐ BS8800, ☐ ILO-OHS2001, ☐ Other

Do you have an Environmental Management System? ☐ Yes, ☐ No, ☐ Don't know

☐ ISO14001, ☐ Other

Have you been certified by EMAS (Environmental Management and Audit Scheme)?

☐ Yes, ☐ No, ☐ Don't know

Other systems:

☐ ISO9001

☐ integrated system (which ones?) _____

☐ Responsible Care

If you are an <u>authority</u>, which subject do you cover:

☐ IPPC – permits

☐ IPPC – inspectorate

☐ IPPC – BAT

☐ IPPC – emissions

☐ SEVESO

☐ Other (please specify) _____ (e.g. EMAS)

2. Seveso

***Note**: Also need to consider all "**multi-company-site**" tools.*

Organisation, Personnel & Training

- Organisation and responsibilities

  - e.g. management system, structure, licensing permits, changes, follow-up of BAT, safety manager, groups, emergency response team/fire fighting team, … Involvement and commitment of personnel?

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

- Education, training, familiarisation

  - e.g. internal, external, software, Internet training…, systematic, specific job related, first aid, fire fighting, safety , external companies, … Safety cards? Involvement and commitment of personnel?

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

- Contractors

  - e.g. Safety card (FIN), Safety Checklist Contractors (SCC), …

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

- Knowledge management of Seveso issues

  - e.g. how monitored? – Via industrial associations, corporate (internal networks); Regulations; Accident reports, accident databases (FACTS (TNO), MARS, SPIRS, EGIG data (European Gas pipeline Incident data Group - see http://www.egig.nl/), …); Auditing; Testing-reporting (follow-up & training); …

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

Identification & Evaluation of Major Hazards

- Hazard identification (*planning, design, engineering, construction, commissioning, development activities, operation, maintenance, decommissioning, former activities, natural hazards, changes*)

  - e.g. tools (PHA, HAZOP, What-if, BBS, Safety walks, Six steps, Inherent safety), … Vulnerability Analysis, FMECA, Operating Hazard Analysis, LOPA, Integrated Risk Assessment (by ETH Zurich); IAEA-RRA (rapid assessment) tool, ……

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

- Frequency analysis

  - e.g. tools: Event tree, Fault tree, Generic (Purple Book/Red Book…), Historic data, Markov processes, Fred, …

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

- Consequence analysis

  - e.g. tools: Yellow Book/Green Book, Phast, Damage, Effects, Aloha, Archie, Sevex, Trace, Breezehaz, "domino effects"…

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

- Quantitative risk analysis (QRA)

  - e.g. Guidelines for CPQRA (AIChE), Risk-Curves, Safeti, Integrated Risk Assessment (by ETH Zurich); IAEA-RRA (rapid assessment) tool, …

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

- Accident and near-miss analysis

  - e.g. tools (AcciMap, Synergi, …), accident databases (FACTS (TNO), MARS, EGIG data (European Gas pipeline Incident data Group - see http://www.egig.nl/), …), equipment failure rates, …

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

Operation Control

- Procedures and instructions for safe operation

  - e.g. work instructions and permits …

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

- Production management systems (PMS) / Computerised Maintenance Management System (CMMS)

  - PMS e.g. computerised Operation Control or PMS like… SAP R/3, Xis and Production Man. System, Powered, Honeywell Total Plant, JFS and JRMA, NORAPP ACELLA, Siemens & Bailey, L&G SCADA supported by various optimisation tools, Own or internally developed, …

  - CMMS e.g. Own or internally developed, Maximo, Arttu, SAP R/3 PM-module, Power Maint, Carelmaint, API, TRIDENT, Rubin, JFS and IRMA, EMPRV, …

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

- Maintenance & Inspection

  - e.g. Risk-based Maintenance, Risk-based Inspection, Risk based maintenance and inspection (RBMI) … Total Productive maintenance, Reliability Centred Maintenance (RCM), predictive methods, support for decisions on maintenance strategies for plant and/or equipment …

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

Management of Change

- Technical changes (*Minor / major*); Operational changes (*Products, Raw materials*); Organisational changes

  - e.g. …

	Tools / Service platforms / Information systems		
☐ Applied	Procedures / Methods	Databases	Software
☐ Not applied			

Planning for Emergencies

- Internal emergency response plan

  - e.g. Updates, training, alerting stakeholders, …

	Tools / Service platforms / Information systems		
☐ Applied	Procedures / Methods	Databases	Software
☐ Not applied			

Monitoring Performance

- Proactive indicators

  - e.g. number/rate of safety checks, safety audits, risk analyses, safety-trained workers, safety improvements, near-miss reports, safety walks, …

	Tools / Service platforms / Information systems		
☐ Applied	Procedures / Methods	Databases	Software
☐ Not applied			

- Reactive indicators

  - e.g. number/rate of lost workdays, accidents, fires, failures (OREDA database), reliability, availability, traffic accidents, environmental accidents, …

	Tools / Service platforms / Information systems		
☐ Applied	Procedures / Methods	Databases	Software
☐ Not applied			

Audit & Review

- Internal /External audits & Management reviews

o e.g. checklists, CHASE (UK), ISRS (DNV), SafetyMap, …

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

3. IPPC

Which is the key (basis) documentation on which responsible authority assesses adequacy and compliance of the installation or a project submitted by an applicant in the licensing process?

☐ formal project documentation,
☐ technical documentation on the proposed project/activity
☐ EIA report (including monitoring results for existing installation)
☐ safety analysis report/risk assessment report

***Note**: Common tools / techniques for EIA include:*

ad-hoc methods, checklists, interaction matrices, map overlays, etc.

Preventive and reductive measures against pollution

Sources of emissions from the installation:

- Emission identification?

o e.g. brainstorming, specific blank-sheets, walking through methods, ... / databases, software..., noise and vibration also included, emissions to water surface/sewer/air/soil, waste, analysis of trans-boundary effects, ...

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

- Identification of significant effects of the emissions

on human health (primary emission limits/standards based on exposure modelling, environmental epidemiological studies, health risk assessment, etc.)

- e.g. MAC, NOAEL, IDLH, dose concept, working environment quality standards, …

on the environment (secondary emission limits/standards based on substance fate & transport modelling, ecotoxicology, etc.)

- e.g. measuring, Environmental Impact Assessment (EIA), environmental vulnerability studies, MAC, BAT, land-use planning, ...

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

Conditions of the site & surroundings of the installation:

- The environment of the installation

- e.g. special analysis of the water or the soil quality, societal analysis, fence around the site, guarding, GIS-maps (e.g. Corine Land Cover), environmental audits, site audits, ...

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

- Land use

- e.g. space planning, strategic environmental assessment, sectoral planning, co-operation with the authorities, neighbours, ...

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

- Maintenance management related to pollution prevention

- e.g. regular walk-arounds and checks (tanks are checked regularly), maintenance planning, alarms, ...

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

Selection of raw, auxiliary materials and other substances:

- Selecting of raw and auxiliary materials as well as other substances related to pollution prevention. How?

  - e.g. when choosing new items a checklist that reminds about dangerous or polluting substances is used, comparative assessment of BAT, technology assessment, HAZAN, databases/service platforms about dangerous or polluting substances, …

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

BAT

- Selection of BAT

  - e.g. BREF documents, comparative assessment of BAT (for example chlorine vs sulphuric acid technology for TiO2 production), technology assessment, service platform/database/..., who is responsible for following and implementing of BAT, ...

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

- The development of Best Available Techniques in your country (Article 11)

  - e.g. who is responsible, databases, service platforms, ...

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

Waste management

- Measures for the prevention and recovery of waste generated by the installation

  - e.g. sorting systems, wastewater treatment systems, incineration, LCA, hazardous waste, ...

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

Energy efficiency

- Analysis of energy efficiency, actions for energy efficiency

  - e.g. blank-sheets, written agreement of energy saving, audits, greenhouse gas emission trading, energy metering and control, fuel price comparisons, ...

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

Prevent accidents and limit their consequences

- Environmental risk analysis

  - e.g. hazard identifications, special environmental risk analysis, general risk analysis methods, environmental risks included in safety and health analysis, consequence analysis, quantitative risk analysis, ...

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

- Preventive actions against environmental accidents and possible consequences

  - e.g. barrier selection and maintenance, training, safety culture development, operational safety of the process or activity, working instructions, safety measures, shielding pools, wastewater treatment system, alarms, rehearsals, training, implementation of SMS, ...

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

Definitive cessation of activities to avoid any pollution risk and return the site of operation to a satisfactory state

- Obsolete and abandoned activities and installations, decommissioning

  - e.g. checklists, databases, LCA, costs/benefits analysis, ...

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

Monitoring systems

Emissions

- Measures to monitor emissions into the environment

  - e.g. automatic and remote emission* monitoring systems, sampling, radiation monitors, ...

  *NB: "Emission" includes **substances**, **vibrations**, **heat** or **noise** introduced to the air, water or land.*

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

Immissions

- Measuring significant effects of the emissions

  - e.g. automatic and remote emission* monitoring systems, sampling, GIS maps (e.g. Corine Land Cover), ...

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

Connections to other legislation

  - e.g. Seveso Directive, EIA Directive, Greenhouse gas emission trading Directive, …

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

Public participation

  - e.g. open-door days, panels, enquiries, communication, EIA procedure, ...

☐ Applied
☐ Not applied

Tools / Service platforms / Information systems		
Procedures / Methods	Databases	Software

Knowledge Management of IPPC issues

- "Internal knowledge" management

  - e.g. BREF additions, BAT information centres, multi-criteria evaluations – development of methods and training, accident analysis, ...

☐ Applied
☐ Not applied

Paper publications	
Internet publications	
Active information	
Participatory process	

- "External knowledge" management

  - e.g. lessons learnt, BAT, tools, education, training, legislation, accident analysis, ...

☐ Applied
☐ Not applied

Paper publications	
Internet publications	
Active information	
Participatory process	