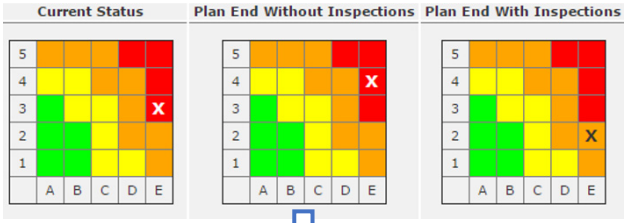
STEINBEIS ADVANCED RISK TECHNOLOGIES - R-TECH

Innovation at work …

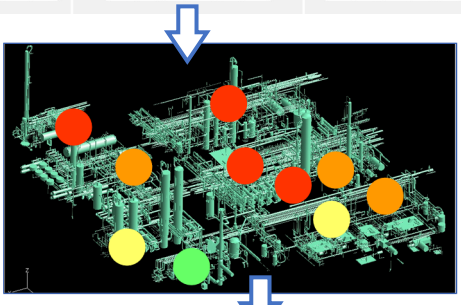
iRiS-Petro *–*
integrated
RISK MANAGEMENT SYSTEM
for Petrochemical plants

…integrates all relevant aspects of risks in petrochemical plants: RBI (Risk-based Inspection), RCM (Reliability Centered Maintenance), RCFA (Root Cause Failure Analysis) and HSE/HSSE (Health, Safety, Environment / Security), as a company-wide Intranet-Extranet-based platform. Includes risk monitoring, assessment and management as well a all levels staff involved (inspectors, operators, high-level management …)



RBM, RBI, RCM, RCFA, HSE, HSSE …

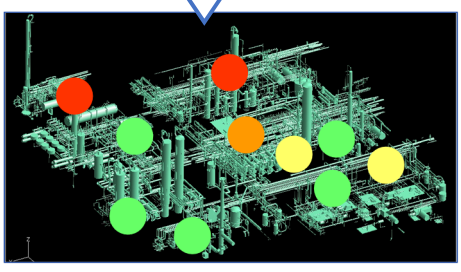
RBM (Risk Based Management), RBI, RCM, RCFA, HSE and HSSE systems allow to include safety, environmental, business and reliability considerations into the decision making process and, thus, provide better targeting of resources and improving the results of the run-replace-repair decisions, as well as in the overall operation, safety, inspection and maintenance. This is accomplished by considering the risks of possible undesirable events, the risk itself being expressed as the likelihood of the event (in a given scenario) multiplied by its probable consequences. Properly developed, implemented and used, the RBI, RCM, RCFA and HSE/HSSE systems help to significantly optimize plant key performance indicators (KPIs) and assure safe, economical and, hence, competitive operation.



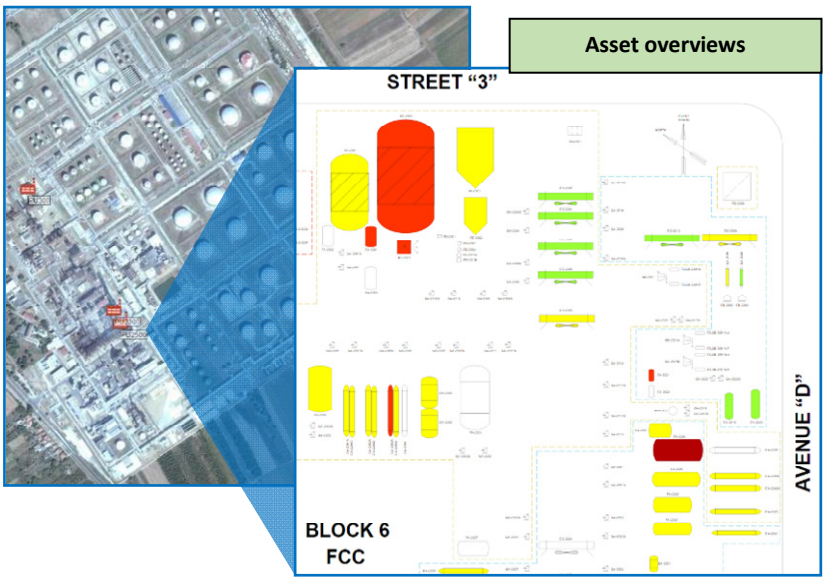
Steinbeis Advanced Risk Technologies Solution: The iRiS System

R-Tech proposes a RBI, RCM, RCFA and HSE/HSSE solution which is transparent and affordable. This solution is based on innovative, but recognized methodologies (USA, EU), widely used nowadays by the leading industrial companies, and use of the state-of-the-art methods and software tools (all Inter- / Intra-/ Extranet based).

The R-Tech solution provides support for the client to understand the major items needed to understand the RBI, RCM, RCFA and HSE and to apply these efficiently in the shortest possible time and, in most of the cases without having to change/replace the existing system(s).



Data/Asset Management:



Web-based overview of assets:
The software allows a web-based view of the complete assets, starting from a geographical distribution of the assets using predefined or GIS-based maps, towards true 2D or 3D models of the units, equipment and components.

The models are based on 2D drawings and 3D models from existing CAD software.

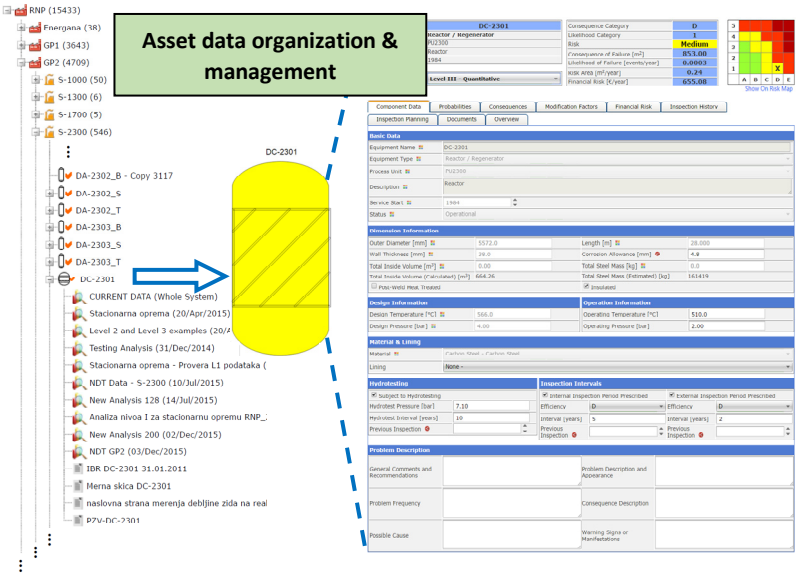
Furthermore, the module allows users to visually identify the equipment, components and locations where certain actions are performed.

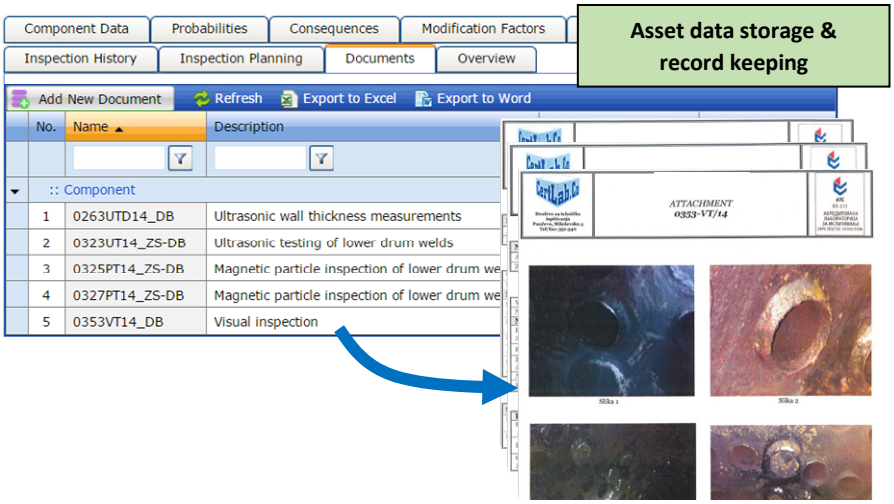
The overview allows the users to get all the information needed (e.g., design information, risk level, analyses and planned or performed inspections) from one central point.

Data asset management:
Each piece of equipment in the system gets an appropriate data sheet for the given type of equipment that can hold all the information as required per standard specification (i.e. EN, API or ASME). This way, the engineering and asset knowledge is centralized in one single point.

The iRiS-Petro software can be connected with the user's CMMS and other data storage and management systems.

The asset data in the system can be organized and structured according to the user's needs, applying a tree-structure system with the Plant Group-Process Unit-Component-Component Part breakdown, or according to equipment type, for easy navigation, identification and work with large numbers of equipment.



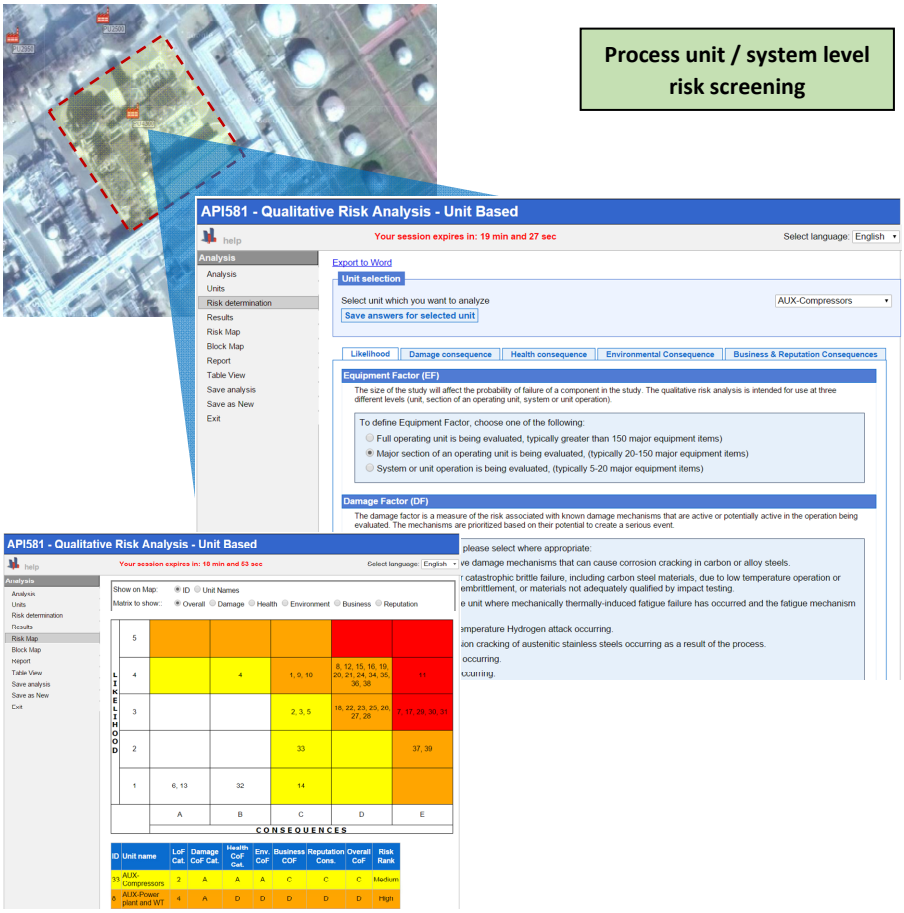


Inspection record keeping:
For each piece of equipment, the appropriate records of performed inspections are kept. This way, it is traceable how the equipment state has changed trough time, and the early signs of problems can be easily identified and pinpointed. Furthermore, the inspection records can be directly used in RBI and RCM evaluations.

RBI:

The iRiS-Petro RBI software suite consists of the following software modules:

1. API 581 qualitative analysis (unit-based) system for unit-based approach (screening)
2. API 581 qualitative (component-based) – Level 1, semi-quantitative – Level 2 and quantitative – Level 3 analysis modules
3. Management System Evaluation Module (MSEQ)
4. Risk-based decision making tools
5. Damage mechanism identification and analysis
6. EN Risk Based Inspection Framework / RIMAP-based assessment (option to be agreed with the end-user in each particular case)



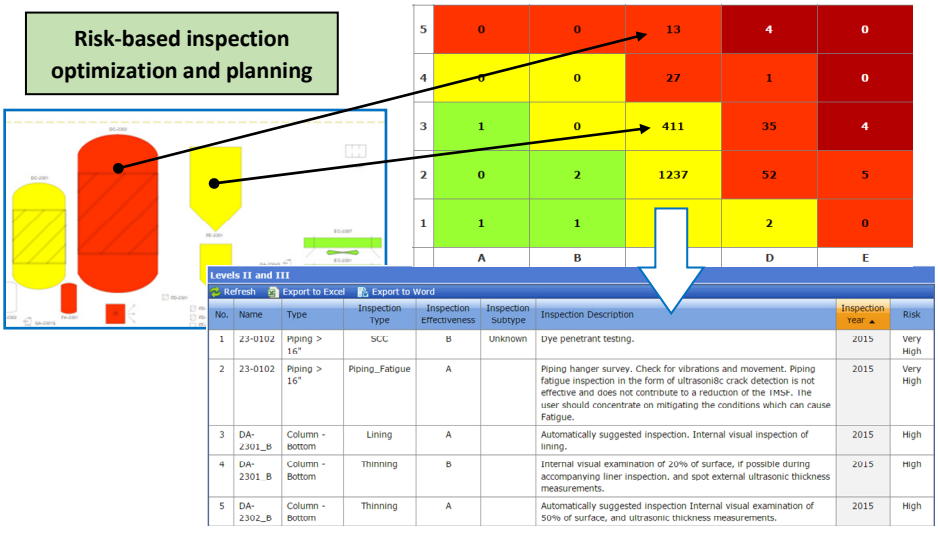
API 581 qualitative analysis system for unit-based approach (screening) – QLTA:

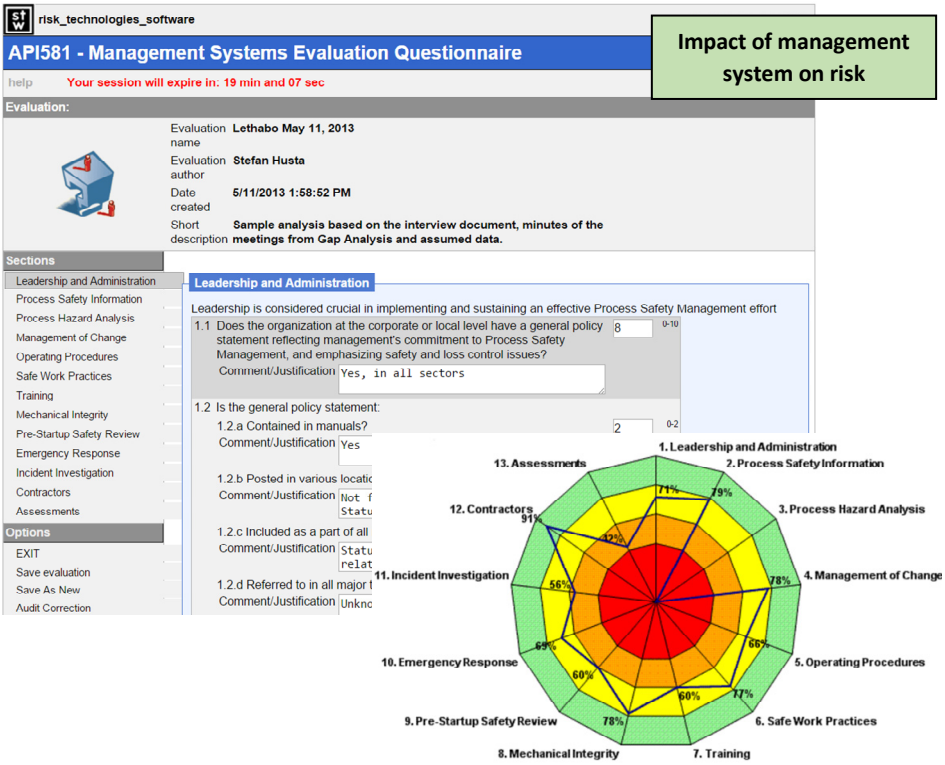
R-Tech's QLTA is based on the Workbook for Qualitative Risk Analysis given in Appendix A of the API581 Base Resource Document

QLTA is used to determine the Likelihood and Consequence Category for a given unit. Depending on the nature of the chemicals in a unit, the Consequence Category can be determined based on the flammable or toxic hazards for the unit. Flammable consequences are represented by the Damage Consequence Category, since the primary impact of a flammable event (fire or explosion) is to damage equipment. Toxic consequences fall under the Health Consequence Category, since their impact is usually limited to adverse health effects.

API 581 qualitative (component-based) – level 1, semi-quantitative – level 2 and quantitative – level 3 analysis modules

iRiS-Petro performs all the tasks necessary to determine the risk rank of the equipment and **optimize the inspection plan**, according to API581, based on the qualitative approach (level 1), semi-quantitative approach (level 2) or quantitative approach (level 3).





Impact of management system on risk

Management system evaluation module:

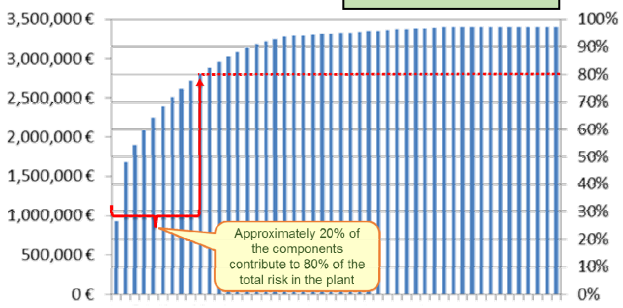
The MSEQ module is a questionnaire -based software for evaluation of Management Systems made according to the APPENDIX D in the API581 Base Resource Document.

The management evaluation module covers all areas of a plant's PSM system that directly or indirectly impact on the mechanical integrity of pressure equipment. The management system evaluation factor influences the Probability of Failure (PoF), by increasing or decreasing it, based on the plant's overall MSEQ score.

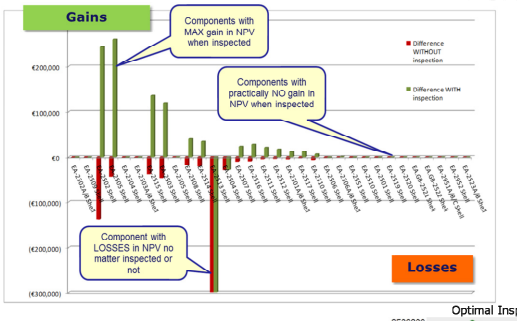
Risk Based Decision Making Tools

Advanced tools, based on risk, aiding in the decision making process, to identify the most critical components based on cumulative risk, Net Present Value of components (based on risk before/after inspection) and inspection optimization, based on component criticality. Using the results of these assessments, it is possible to perform risk ranking and quantify the effects of the future inspections in function of risk reduction.

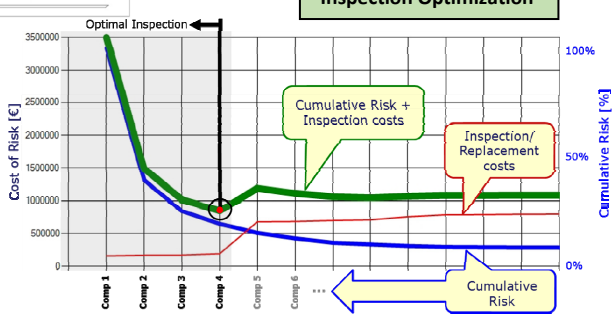
Cumulative Risk

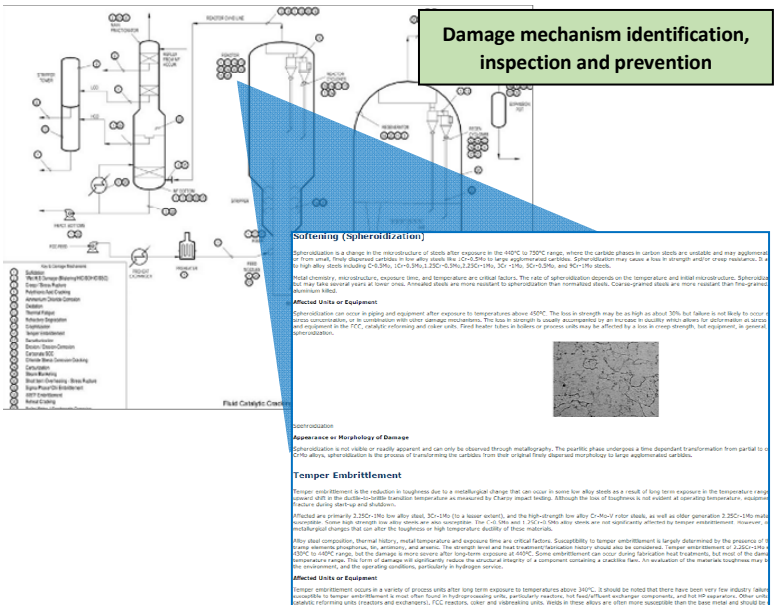


Gain-Loss / Component NPV



Inspection Optimization





Damage mechanism identification and analysis

With the damage mechanism analyzer module, it is possible to link process units to appropriate P&ID diagrams which show typical equipment and the locations and types of possible damage mechanisms.

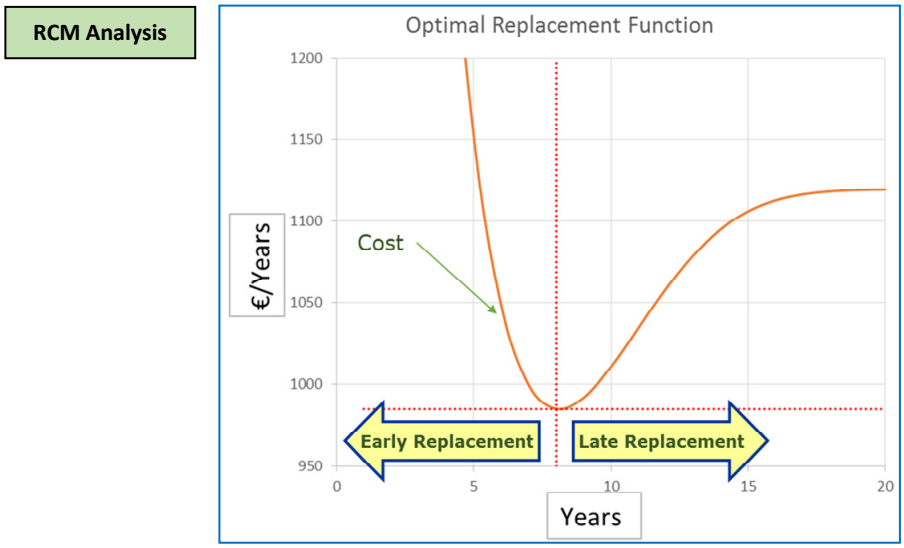
The selection of a particular damage mechanisms on the P&ID leads to:

- A description of the damage mechanism
- Affected units and equipment
- Appearance and morphology of the damage
- Prevention and mitigation measures
- Inspection and monitoring recommendations

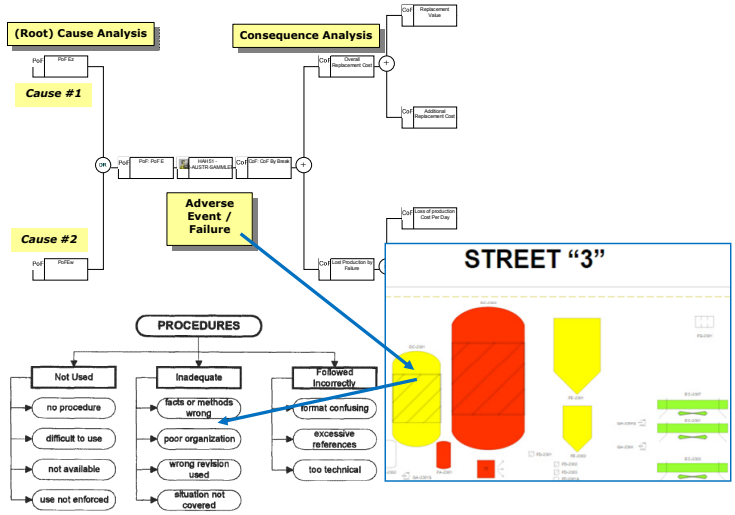
RCM:

RCM (Reliability-centered maintenance module) covers all the aspects of the classical RCM approach.

Furthermore, the RCM module allows for the calculation and determination of optimal intervention/replacement times for rotating equipment, based on equipment initial cost, discount rates and planned (maintenance/replacement) or unplanned (failure-related) outage costs.



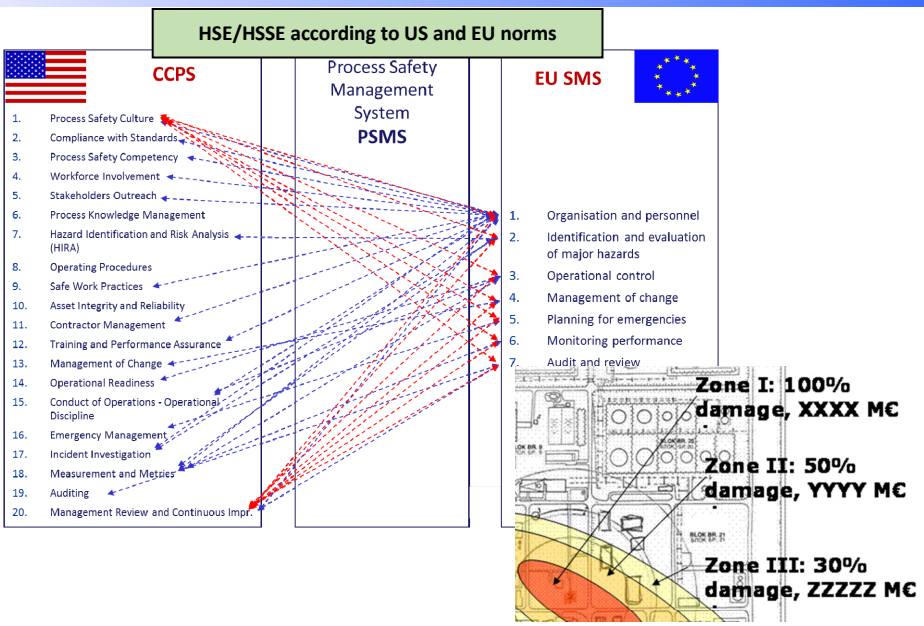
RCFA:



RCFA identifies most significant annual losses in an organization and supplies knowledge needed to identify the causes and possibly eliminate their recurrence in the plant in the future. RCFA relies on the comprehensive and effective data collection which is absolutely needed in order to manage the knowledge about failures and their (root) causes.

RCFA provides better insight both in what could go wrong and in what has gone wrong, using Basic Failure Modes & Effects Analysis (FMEA) and Opportunity Analysis. The end result is the analyses build a business case for which events are the best candidates for Root Cause Analysis based on the Return-On-Investment.

HSE:



HSE/HSSE is the concerned with protecting the safety, health, security, environment and welfare of the employees, organizations, and others affected by the work they undertake (such as customers, suppliers, and members of the public). The **HSE Module** in iRiS-Power is based on current European and American standards in the area (i.e. Seveso II, ATEX, EPA requirements), and is designed as a checklist against the requirements in order to identify critical equipment and show compliance with protection/mitigation measures.

Implementation and maintenance of the system

In order to simplify the data collection, data analysis and data presentation, as well as to reduce maintenance of the modules to the minimum, the following implementation scheme is foreseen:

- One central data/application server running MS SQL Server, Oracle or other database system for data collection, processing and presentation is foreseen
- One central web server, based on MS IIS, with support for MS .Net applications
- Web-browser based clients
- Reports and other data presentation tasks have web-based interface (Offline data presentation/browsing capabilities are also available)
- The implementation architecture provides the following benefits primarily in terms of reduced maintenance costs and reliability and simplicity of the maintenance/updating procedure:
  - Data stored at one place and available for all authorized persons trough web-based interface
  - Data collection is also done trough web-based interface, which allows interaction with data without any client software, apart from standard web browser
  - The maintenance and further development of this part of the system is done on the central web- and data/applications servers only

Deliverables

Typical results of introduction of iRiS are

- satisfying legal requirements,
- improving overall business practice and
- savings due to, e.g., loss prevention, improved used of resources or reduced insurance costs.

Typical deliverables are

- risk management system implemented,
- database providing overview of all risk/relevant factors and
- "risk maps" and risk & safety reports.

The form of R-Tech solution spans from small, ad-hoc consulting actions for on-going activities and pilot-projects, to large projects covering large nets of plants or whole countries. They include on-the-job and academic training and certification, if so desired by the client.

Contact

Steinbeis Advanced Risk Technologies R-Tech,
Haus der Wirtschaft, Willi-Bleicher-Straße 19, 70174 Stuttgart, Germany
Tel: +49-172 635 9190; +49-711 4100 4129; Fax: +49-711 4100 4124
E-Mail: info@risk-technologies.com / info@risk-technologies.eu
www: www.risk-technologies.com / www.risk-technologies.eu; www.stw.de