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Successful Avoiding of Risk in Doing Explosion Risk Assessment

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The performance of explosion risk assessments and the maintenance of their currency are pivotal activities within the safety management of the process industry. The most commonly utilised tools for the documentation of risk assessments within the industry are word processing software and homemade spreadsheets. Given the intricate nature of the installations, the high rate of modifications, the considerable number of personnel involved, and the frequent staff changes, ensuring the currency of these documents is of paramount importance, yet also a significant challenge. It is difficult to guarantee the complete transparency of the history and version numbers of such assessments with the tools currently in use. Furthermore, there is often no systematic management of these documents, which can result in their loss, particularly when personnel change jobs or retire. The potential consequences of this unsatisfactory situation can be catastrophic for on-site employees, leading to losses of installation, interruption of production/loss of customers as well as environmental damage. Liability issues may arise for both the operating company and the involved consultants.

This paper presents the newly developed software, FERA (Fire***Ex*** Risk Assessment), created by Fire***Ex*** Consultant GmbH. The software supports a systematic analysis of explosion risks and ensures proper documentation.

* 1. Introduction

It is of paramount importance that industries engaged in the handling of explosible dust and gases undertake comprehensive Explosion Risk Assessments in order to ensure the safety and operational continuity of their activities according to the requirements of ATEX Directive 2014/34/EU , ATEX Directive 1999/92/EC , EN 1127-1:2019. The findings of the explosion risk assessment serve as the foundation for the creation of the Explosion Protection Document (EPD), which is a mandatory requirement set forth by the relevant authorities.

The generation of an explosion risk assessment is beset with numerous challenges, listed in Table 1.



Figure 1: Conventional approach

Table 1: Challenges in generating an Explosion Risk Assessment

|  |  |
| --- | --- |
| **Challenge:** | **Major question:** |
| Complexity of the installation  | How does the installation work?  |
| Modifications of the installations  | Are the existing drawings up to date? |
| Description and certification of the installed components  | Are all necessary certificates available?  |
| Process and products  | Is there an up to date process description? Is it clear which products can be handled with the installation (defined intended use)?  |
| Basis of safety  | Is the documentation of the safety concept up to date and valid for the current process and products?  |
| Project team  | Are all relevant persons part of the project team? How is the interaction of the team members?  |
| Project team member changes | How is verified that the safety knowledge is passed from one person to the next?  |
| Recognizing mistakes  | How is it verified that mistakes inside the risk assessment are detected and eliminated? |
| Liability  | What happens if an accident happens? Who’s liable?  |
| Be in line with the valid standards and laws (including regional differences)  | Who is it ensured that the involved employees are aware of changing standards?  |

The conventional approach as described in Figure 1 relies on fundamental templates prepared with word processing software and spreadsheets, for the creation and manual signing of documentation.

While there are numerous advantages to this approach, there are also major disadvantages that cannot be overlooked (see Table 2).

Table 2: Pro’s and Con’s of the conventional approach

|  |  |
| --- | --- |
| **Pro’s** | **Con’s** |
| * Cheap software tools
* Everybody can handle the software
* Document can be easily adapted by any user
* Looks simple
 | * No automatically logged traceability of the activities inside the document
* Difficult to find and eliminate mistakes
* The structure of the document looks different from consultant to consultant
* Expensive as existing know how is not used
* Difficult manage the document by the operating companies
 |

Nevertheless, the task of doing a risk assessment presents considerable challenges, particularly as plant systems become increasingly complex and the frequency of modifications increases. It is of the utmost importance to ensure the systematic and up-to-date documentation of processes and procedures in order to prevent catastrophic incidents and maintain legal compliance.

In addition it has been observed by Fire***Ex*** Consultant GmbH and other experts that many operating companies encounter difficulties in maintaining the currency of their explosion risk assessments and ensuring that employees receive adequate training to uphold safety standards. In the event of an explosion resulting in unexpected damage or personal injury, the plant manager is likely to be held liable due to the following factors:

* The explosion risk assessments and explosion protection documentation are outdated and do not reflect the current installations and processes.
* Inadequate or absent explosion protection measures that are not properly implemented or maintained.

It is evident, even to those without expertise in the field, that relying on standard software templates alone is inadequate for ensuring the safety and reliability of both small and large plants. The use of professional software tools is essential for achieving this.

It is pertinent to inquire as to why professional software tools for risk assessments have not yet been widely adopted within the industry. Notwithstanding the existence of well-established multinational clients in the field of explosion risk assessment, the implementation of standardised tools remains limited within the industry. Typically, these assessments are conducted by small to medium-sized consulting firms, often relying on highly experienced individual consultants. These professionals frequently prefer their personal methodologies, which can be easily adapted in all directions, and perceive little incentive to share knowledge or standardise practices within their teams or organisations. Additionally, company leadership may hesitate to enforce standardised procedures out of concern for employee resistance. Furthermore, developing specialised professional software solutions requires significant time and financial investment, which is often prohibitive for most consulting firms.

* 1. Requirements to an Explosion Risk Assessment Software

Deriving from the current challenges, the following requirements, listed in Table 3, results:

Table 3: Requirement to an Explosion Risk Assessment software

|  |  |
| --- | --- |
| **Challenge** | **Requirements** |
| Complexity of the installation | All installations must be displayed in an easy way (upload of drawings). |
| Modifications of the installations  | Modifications of an installation must be easy and clearly marked. |
| Description and certification of the installed components  | The installed components must be well defined including the available certification. |
| Process and handled products  | The assessed processed products must be described The handled products must be defined, and the corresponding safety data must be stored (upload of product test reports). |
| Basis of safety  | The basis of safety must visible. |
| Project team | All project team member must be mentioned. The access rights to the software must be managed by the project leader. |
| Project team member changes  | Information must flow easily from processor to successor without negative impact on the plant safety. |
| Recognizing mistakes | Systematic mistakes must be impossible. The standard procedure of the software must lead to minimize mistakes with a safety impact. |
| Liability | Clear access rights.Log file of any modification.Standardized approving process. |

A review of the aforementioned requirements leads to the conclusion that the generation of software capable of fulfilling these requirements is a relatively straightforward process.

* 1. Introduction to FERA Software



Figure 2: New FERA approach

The selected procedure applied in FERA is a semi-quantitative, intuitive risk assessment solution pertaining to all aspects of fire and explosion protection (analogous as described in VDI2263, ESCIS, ISSA , EU Project No: SMT4-CT97-2169).

The software has been developed with the specific target audience of consultants, equipment manufacturers, plant operating companies and even supervisory authorities in mind. The software offers distinct benefits to each group, facilitating enhanced workflows (as displayed in Figure 2), and greater effectiveness in risk assessment and management.

**For consultants**, the software offers notable advantages, including increased efficiency, a streamlined process for involving system operators in risk assessments, and a significant reduction in the error rate. Furthermore, the system is furnished with an extensive knowledge base, thereby facilitating connections with plant operating companies even after project completion, thus ensuring continuity and support.

The software offers **equipment manufacturers** the ability to create simplified explosion risk assessments for their standard equipment, which can then be adapted to customer-specific requirements. Subsequently, the customer is able to integrate the explosion risk assessment into their explosion protection document.

**Plant operators** stand to gain from the streamlined administration of their explosion risk assessments. The software's design permits the modification of risk assessments created using the software, such as those performed with FERA, to reflect any system changes, thereby facilitating flexibility and adaptability.

The software is equipped with a number of features that serve to enhance both its usability and effectiveness:

* **Intuitive entry masks**, which facilitate data input for users.
* **Flexible authorisation management** system permits the selective integration of the plant operator during data acquisition, thereby facilitating controlled collaboration.
* **Report preview** function and a **flexible approval process for finalising reports** facilitate the efficient review and approval of documents by all relevant stakeholders.
* Capacity to generate both draft and final **reports in PDF format** is conducive to fulfilling documentation requirements.
* Ability to manage **versions of reports** allows users to monitor alterations and retain a record of document iterations.
* **Plant section library**, thereby facilitating the creation of structured and consistent documentation.
* **Task system** is available to facilitate project management and task allocation.

In order to utilise the software, it is necessary to have an internet connection, which enables users to access the platform from any location, thereby facilitating remote and on-site operations in an uninterrupted manner. The software, in conjunction with its associated database, is installed on a dedicated web server. The configuration of this setup is conducted in accordance with the customer's preferences, thereby ensuring a tailored and secure deployment that is aligned with individual needs and operational specifications.

The following Table 4 represents a summary of the key views of FERA.

Table 4: Key views of FERA

|  |  |
| --- | --- |
| Customer system list: | Hazard identification (13 possible ignition sources according to EN 1127-1): |
|  |  |

|  |  |
| --- | --- |
| Risk profile grid with tooltips: | PDF final report with title page & table of contents  |
|  |  |
| Comprehensive system plant section library: | Integrated task system: |
|  |  |

* 1. Methodology of Risk Assessment with FERA

The FERA procedure is based as outlined in VDI2263, ESCIS, ISSA , EU Project No: SMT4-CT97-2169 considering the experience of experts. The structure of the explosion risk assessment is aligned with the software menus, as illustrated in the following Table 5:

Table 5: FERA menus for an explosion risk assessment project

|  |  |  |  |
| --- | --- | --- | --- |
| General menu: | Analysis menu: | Risk Estimation menu: | Report menu: |
|  |  |  |  |

Once the overarching project parameters have been established under general, the plant and the process can be delineated in the subsequent analysis phase. Subsequently, the risk estimation is conducted along the same trajectory, without incorporating the measures that have already been implemented. Secondly, the risk estimation is conducted by considering the measures that are currently in place and incorporating additional measures that are to be implemented with the objective of achieving the requisite level of safety.

The finalisation process is concluded with the online signing of the report by the consultant and the customer, thereby ensuring accountability. Once the report has been finalised, the customer is granted full access to the document, which may be modified in the event of any modifications being made to the plant. It is strongly recommended that the further approval of the adapted report be conducted by an expert, whether internal or external.

* 1. Limitations of FERA

The FERA method can be readily applied to projects of varying scale. The most challenging aspect for the consultant is determining the optimal level of detail. The software offers a plethora of options, yet does not allow the consultant to become mired in minutiae. Furthermore, it should be noted that FERA is not an expert system, but rather a framework. It is therefore evident that the expertise of the consultant leading the explosion risk assessment is of paramount importance in ensuring the safety of the plant.

During the implementation of FERA at a consulting company, it is crucial for the new user to avoid becoming overwhelmed by the software and to instead focus on leveraging its full potential to benefit the customer, the project team, and the individual consultant. Many discussions are often required to establish shared principles and procedures, which should be conducted anyhow independently of any software.

* 1. Case study: Application in a multi-national industrial company

An illustrative case study of FERA implementation can be found in the context of a multinational industrial company. The company has a substantial number of facilities distributed across multiple locations, utilising comparable equipment configurations and exhibiting a notable depth of expertise within its internal ranks regarding explosion protection. As is the case in many large companies, the internal experts have disparate objectives that are not aligned in numerous instances. External consultants have been engaged to assist in the development of a comprehensive master explosion risk assessment for the most prevalent plant configuration, utilising FERA methodology.

One of the most significant benefits of utilising FERA is the ability to streamline the roll-out process across diverse operational sites. The master risk assessment can be replicated and tailored to the specific circumstances of the local site. Any modifications to the master risk assessment must be justified and are displayed in a highly transparent manner. Furthermore, the explosion risk assessment is stored in a way that allows the headquarters also to access the documents. The transparency facilitates the sharing of knowledge and supports the local plants in achieving the corporate safety goals. Additionally, significant costs can be saved by avoiding the unnecessary duplication of efforts at different locations.

* 1. Conclusions and future development of FERA

FERA signifies a substantial advancement in the domain of explosion risk assessment, offering a structured, systematic, and forgery-proof platform for documentation. The software's design facilitates continuous updates, thorough analysis and robust reporting, thereby contributing to safer and more compliant industrial operations.

It is anticipated that future updates to FERA will incorporate predictive analytics and AI-driven insights, thereby further supporting proactive risk management. These features have the potential to make FERA an even more comprehensive tool for explosion risk assessment across all industries. FERA has the potential to assist various industries in optimising their procedures and enhancing the comprehension of all pertinent parties, including regulatory authorities.

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