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CRITICAL COMPARISON ON SAFETY MANAGEMENT SYSTEMS, IDENTIFYING OPPORTUNITIES FOR COMPANIES MANUFACTURING AND USING HAZARDOUS SUBSTANCES

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ABSTRACT

In the life of companies operating with hazardous substances, the daily task is to maintain the safety on a high level and to introduce actions to increase safety performance. The companies covered by the Disaster Prevention Act have a special task, to operate a safety management system that also satisfies industrial safety aspects. To make this as efficient as possible, good practices from other safety management systems can be built into the currently used management system at the company. Perhaps the most frequently operated safety management systems for organizations producing and processing hazardous substances are the Occupational Health and Safety Management according to the ISO 45001 standard and the Process Safety Management systems. A comparison of the latter with what is required by law points to several points that may designate areas for improvement in the certified safety management system. In this way, they provide a basis for the development of a new system, that complying with the prescribed requirements, helps to maintain a high level of safety, to prevent the occurrence of accidents, and to work with safety-conscious employees and suppliers.

KEY WORDS

industrial safety, OHSM, PSM, safety management system

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INTRODUCTION

Appropriately designed and operated management systems can provide a framework for the activities of enterprises operating with dangerous substances. In practice, businesses develop their own operating scheme according to the requirements of a safety management system. According to the relevant standard and legal provisions, the safety management systems formulate the operational requirements and focus on the given system elements differently, but the primary goal of all of them is the safe operation and the reduction of safety risks. It is important to examine and compare these management systems so that the applied safety management system can be improved with effective and good practices used by other systems.

The term of 'safety' as 'an ability for a system to perform its intended purpose, whilst preventing harm to persons'. Safety, or the lack of safety, is an emergent property of an operational system. Thus, safety can be thought of as the combined result of the decisions and action of all persons with an ability to interact with the operational system. 'Safety management' is a label that we use to describe practices that can direct, monitor and intervene in core operations for the purpose of generating or maintaining safety. 'Risk' is a term that is linked to safety and we use it to refer to the level of uncertainty that the operational system will generate safety as an emergent property, and the severity of the potential consequences to people of a lack of safety. Finally, the term 'safety professional' is used to describe roles within an organization that exist with the primary purpose of safety management, and that does not have a core operational purpose for the organization [1]. An integral part of safety management is communication, which must be managed by business organizations on an appropriate platform. Data security and their preservation are just as important as the operation of dangerous technologies, which can be provided with various smart solutions and cloud-based data management. The cloud technology in information and communication technology (ICT) is a young and cutting-edge area. This is due to the fact that from the individual mobile to a full realization of virtual data centers it is possible to provide service over the network [2].

SAFETY RISK REDUCTION SYSTEMS

In the following sections, it is presented the three best-known systems by which companies operating with hazardous substances can increase safety.

OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEM BASED ON ISO 45001: 2018

ISO 45001: 2018 standard [3] was first issued in March 2018 replacing OHSAS 18001standard [4]. The purpose of applying the *Occupational Health and Safety* (OHS) *Management System* is to enable the organization to provide safe and healthy workplaces, to prevent work-related injury and damage to health, and to continually improve its OHS performance. The standard is applicable to any organization that intends to develop, implement, and maintain an OHS Management System (OHSMS) to improve occupational health and safety, eliminate hazards, and minimize OHS risks [3].

The main elements of OHSMS during the operation with hazardous substances

First of all, it is necessary to define the range of stakeholders and to identify the external and internal factors affecting the organization [3]. This is a basic requirement of all management systems and a condition for developing well-functioning processes. When defining an organization's environment, it is especially important to reveal the relationship between each factor and the activity with hazardous sustances. If we do this with sufficient thoroughness, it will be, so to speak, carried out *risk assessments*. In this way, the organization can explore

hazards, establish procedures, and *define responsibilities*. By operating with hazardous substances, it is important to provide the public with the opportunity to be consulted, and to emphasize awareness and the pursuit of safe operation. In connection with notifications made by the population, a thorough investigation must always be carried out and the notifier must be informed of the outcome and the method of the process in an official way. As an internal factor in terms of organizational structure and responsibilities, it can be thorough if it is created appropriate regulations (e.g., organizational and operational regulation) and always be recorded changes in them.

It is necessary to emphasize the *role of the top management*, the *leadership commitment* in the case of everyday activities as well. Good opportunities for this are the forums with employees and consultations with the individual departments. Careful consideration of the employee responsibilities and tasks as defined by the top management is also important. Responsibilities may need to be reviewed and modified when investigating incidents and technological problems that occur during the activity. In connection with hazardous substances, the risk assessment and handling is a fundamental task of the organization. The safety data sheets of substances and preparations must be used in compiling the documentation. Workers should also have access to these safety data sheets. In order to describe each activity (technological and operational instructions), it is important to consult the individual organizational units. The Organization for Health, Safety and the Environment (HSE) has a key role to play in this, as it usually collects the information (accidents, incidents, occupational diseases, quasi-accidents) on the basis of which development aims can be defined. At the same time, top management and human resource management must by now play a role in communicating these aims and the achieved results.

Training is one of the basic pillar of the safe operation of an organization dealing with hazardous substances. Besides of the entry-level training specified in the Hungarian Occupational Safety and Health Act [5], trainings related to hazardous substances, changes and experience of events must be repeated regularly. With proper internal communication, employees' confidence can be strengthened, their interest can be sustained and their professional development can be successful. In addition to negative events (accident, incident, off-spec quality product), it is advisable to communicate the positives (economic progress, development results, successful audits) also.

An organization dealing with hazardous substances should communicate with external stakeholders (population, authority, business partners) by a person with sufficient competence. The top management of an organization must be committed to the management system it operates. During the management review, top management should see opportunities for directions to the improvement.

The approach applied to the OHS management system in the ISO 45001: 2018 standard which is based on the PDCA (Plan-Do-Check-Act) concept. The PDCA concept is a repetitive process with feedback applied by the organization to achieve continuous improvement. One way to pursue technological safety is to use technologies that are automated or achieved by automating existing technological elements. This should be the part of the continuous improvement and thus reduce the problems generated by human omissions. Automated systems generate and transmit data. This communication must be properly designed, as it can potentially control or inhibit different processes of hazardous technologies. Access to these must also be precisely regulated. Technological data must be analyzed and stored so that they can be used during any technological event to determine causes and take preventive actions. Cloud technologies may be suitable for this in the future, provided, of course, that they meet all the important requirements of the company regulations.

The analysis of cloud building technologies shows that the most important characteristics of the cloud include reliability, component variability, flexibility and the measurability of the services. Among the components, the following must be defined: Client Infrastructure, Application, Service, Runtime Cloud, Storage, Infrastructure, Management, Security, and Internet. The technical requirements of the components can be grouped according to the following topics: availability (existence), virtualization of necessary resources (structural and energy knowledge), virtualization of implemented services (validation), flexibility (control and change management) [2].

PROCESS SAFETY MANAGEMENT SYSTEM

Process safety management (PSM) is the proactive identification, evaluation and mitigation or prevention of chemical releases that could occur as a result of failures in processes, procedures, or equipment. The Process Safety Management Guidelines for Compliance [6] targets hazardous chemicals that can cause a catastrophic incident. The purpose of the guideline as a whole is to assist employers in their efforts to prevent or reduce chemical releases that could lead to disaster in the workplace and possibly in the sorrounding community.

As PSM is specifically used in connection with operations related to hazardous substances, it is already different from OHSMS in that it is also used for non-hazardous technological activities. It is important to emphasize that in this system it becomes even clearer that the automation of the technological processes and the exploration of non-process-controlled system components – which require manual control – is needed to be monitored, thus increasing the role of the technological safety and the role of human resources in monitoring, data processing and data transmission. This virtual communication can be implemented with various smart solutions that are sufficiently reliable.

The main elements of Process Safety Management

Employers should compile written process safety information that identifies the hazards of extremely hazardous chemicals in progress, process technology, and information on ongoing equipment. By providing these information, it is possible to design the elements and the entire process of PSM, Figure 1. The compilation of the process safety information provides the basis for identifying and understanding the process hazards that are required to develop a process hazard analysis, change management, and event investigation [7].

The guideline places great emphasis on involving employees in developing and executing the PSM programs, especially in the area of hazard identification and assessment [8].

The process hazard analysis shall use as many methods as possible, which shall cover the hazards of the process, the identification of any previous incidents that may have catastrophic consequences in the workplace, engineering and administrative controls applicable to the hazards and their interrelationships, inadequate controls or the consequences of the lack of controls, the location of the facility, human factors, possible safety and health effects on workers [7].

Employers should develop a written action plan to implement the employee participation required by the PSM and prepare and execute written operational procedures that should include process safety information. Steps for each operational phase: initial start-up, normal operation, temporary operations, emergency shutdown, including conditions for the need for an emergency shutdown, and assignment of shutdown responsibility to qualified operators to ensure that the emergency shutdown occurs safely and in a timely manner. It is also important to correctly define the operating limit values, which can be used to ensure the analysis of the consequences of the deviations, as well as the definition of the steps necessary to correct or avoid the deviation. Operating procedures should be easily accessible to employees working on or maintaining the

Figure 1. The 15 main elements of the PSM.

process. Operating procedures should be reviewed as often as possible to ensure that they reflect current operating practices, including changes in chemicals, technology, equipment and facilities. They must be certified annually to ensure that they are up-to-date and accurate. It is also important to involve employees in the preparation of process risk analyzes [7].

Employers should provide basic training for all employees, including contractors, who are currently involved in the operation of a process or a newly assigned process by reviewing the process and operating procedures. This should be repeated at least every three years or more often if necessary so that employees understand and follow the current operating procedures of the process [8].

Specific provisions of the PSM include training for contractors and their employees who are at or near a particular process. When selecting a contractor, the employer must obtain and evaluate the contractor's security performance and program. It is the employer's responsibility to ensure that employees are trained and aware of the hazards of potential release of flammable, explosive or toxic substances, as well as the emergency plan, to comply with the safety rules of the facility, to know the specific hazards of their work [7].

PSM requires the employer to perform a pre-start-up safety review before new facilities and modified facilities starting operation. The safety review should confirm that the construction and equipment are in accordance with the design specifications, safety, operational, maintenance and emergency procedures are in place and appropriate, the process hazard analysis has been carried out for new facilities, and the training of all employees involved in the operation of the process has been completed [7].

The employer must establish and implement a written procedure while maintaining the continuing integrity of the technological equipment. The frequency of inspection and testing of process equipment shall be in accordance with the manufacturers' recommendations and good engineering practice. They should be performed more frequently if deemed necessary based on previous operational experience. All inspections and tests of process equipment must be documented [7].

Employers should provide and implement written mechanical integrity procedures and programs to perform appropriate maintenance and equipment inspections and tests at appropriate frequencies to detect equipment deficiencies before they fail. Employees involved in maintaining the integrity of process equipment should be trained in the procedures relevant to their job responsibilities [8].

A permit shall be issued for flammable activities, documenting that the fire prevention and protection requirements of OSHA (1910.252 (a)) [9] have been met prior to the commencement of fire protection work, indicating the date (s) permitted and identifying the equipment on which the flammable activity is carried out [7].

A key part of the process safety management program is to thoroughly investigate incidents by identifying a chain of incidents and causes so that corrective actions can be developed and implemented. Accordingly, the PSM requires the investigation of all cases that have resulted or could have resulted in the catastrophic release of an extremely hazardous chemical in the workplace. An investigation into such an incident should begin as soon as possible. The investigation should be carried out by a team involving a person familiar with the process, if necessary an expert, as well as other persons with appropriate knowledge and experience in order to thoroughly investigate and analyze the case [7].

If an incident occurs despite the best planning, it is essential that workers are able to take appropriate action. For this reason, a plant-wide emergency action plan must be developed and implemented in accordance with the provisions of other OSHA regulations (29 CFR 1910.38 (a)) [10]. In addition, the emergency action plan should include procedures for dealing with small releases of hazardous chemicals [7].

To ensure effective management of process safety, employers must demonstrate that compliance with the provisions of the PSM has been assessed at least every three years as part of an audit. This demonstrates that the procedures and practices developed in accordance with the standard are properly followed. The conformity check must be performed by at least one person familiar with the process and must report on the findings of the check and the correction of deficiencies. Planning is essential to the success of the audit process. The selection of members of an effective audit team is critical to the success of the program. Team members should be selected based on their experience, knowledge, and qualifications, and should be familiar with processes and control techniques, practices, and procedures. The size of the team depends on the size and complexity of the process under study. Effective control includes review of relevant documentation and process safety information, inspection of facilities, and interviews with all levels of plant personnel. The audit team should document, through systematic analysis, areas where corrective action is required and where the process safety management system is effective. It provides a record of audit procedures and findings and serves as a basis for operational data for future audits. It will help identify changes or trends in future audits. The employer shall ensure that any identified deficiencies are remedied, record the corrective actions to be taken, and properly document the responsible audit person or team. To monitor the process of corrective action, the employer should consider using a tracking system [6].

Once the hazards have been identified and assessed, controls (physical and behavioral) are also introduced to manage the hazards to an acceptable level of risk. These controls are often reflected in technical changes to systems and equipment, management systems and procedures. Non-physical controls, such as procedures and business processes, are documented by security management systems, supplemented by training programs [1].

Employers should make available all information necessary to comply with the PSM, even if it contains any trade secrets. However, the provisions of the PSM do not prevent an employer from entering into confidentiality agreements [7].

SAFETY MANAGEMENT SYSTEM REQUIRED BY HUNGARIAN DISASTER MANAGEMENT LEGISLATION

The purpose of the operation of the Safety Management System (SMS) is to implement the operator's safety policy for the prevention of major accidents and the reduction of risks. The SMS is a "quality management" system based on the fulfillment of a legal obligation, by the operation of which adequate safety against major accidents can be achieved and maintained [11].

For the operators of plants dealing with hazardous substances (hereinafter: plants), the IVth Chapter of the Hungarian Act CXXVIII of 2011 on Disaster Protection and Amendments to Certain Related Acts [12] requires the operation of a safety management system (SMS) or a management system (MS), depending on the status of the plant. This safety management system shall in all cases follow the SEVESO III [13] principles, including the required risk analysis, should be prepared with this in mind. In many cases, the development trends of automation and communication in smart cities can be included as an improvement factor in the management of risks, for example when it comes to the investigation of the terrorist threat. The risks to the safe operation of a chemical manufacturing and processing organisation must be excluded or minimized. These risks can be managed with secure communication solutions, secure data storage and movement, and a high degree of automation of production processes.

The main elements of the Safety Management System

The operator must define the exact responsibilities and roles of the personnel at all levels of risk management, set out the ability and competence requirements for the personnel, define the roles, responsibilities, tasks, competencies and interdependencies of the managing and executive personnel. "Security management" is responsible for constantly updating the system documentation, keeping it up to date, something about the organizational management of the safety management system [14].

The operator must establish and apply procedures for identifying and assessing hazards arising from the activity and from the handling and processing of hazardous substances and preparations. It is also necessary to define accident prevention and reduction measures. The assessment of the theoretical knowledge and practical experience required to design and implement the above procedures should be part of the management system. Hazard identification and assessment shall cover hazards during design, installation, commissioning, operation, development, hazards in normal and abnormal modes, accidents and potential hazards, external events, human factors and safety management. System failures, decommissioning, modifications and shutdowns, hazards of preventive activities, natural hazards, transportation, material handling activities, effects of surrounding activities, intentional or unauthorized actions. The hazard identification and assessment should also include the identification and assessment of major-accident hazards arising from activities carried out in the subcontracting system. Information on the results of hazard identification and assessment procedures, operational hazards and management shall be kept up to date and made available.

The operator must develop the standards of the safety management system, technological descriptions and instructions for safe operation with the involvement of the executive staff. The system of standards must also take into account normal operating technologies, shutdowns, start-ups, equipment maintenance and technological hazards, as well as possible malfunctions. The instructions must be given to the staff partially or completely involved and periodically ascertained as to their implementation, up-to-dateness and applicability [14].

Best practice should be included in the safety objectives. It is essential to monitor and control the condition of critical equipment. For this, it is necessary to develop a strategy and methodology in order to ensure safety against serious accidents involving dangerous substances. The operator must pay due attention to follow-up measures and any countermeasures that may be necessary. Practical implementation options include setting technical safety sustainability objectives and designating related procedures to regulate activities related to the periodic inspection, technical safety review, calibration and maintenance of physical equipment, and providing the necessary resources to perform these tasks [11].

The operator must pay attention to changes in equipment, storage facilities and production. The safety aspects of these changes must be taken into account in advance when planning and implementing the changes. In managing changes, particular attention should be paid to the definition of responsibilities and tasks, the documentation of the proposed change, the determination of the security implications of the proposed change, the definition and application of additional post-change review procedures [14].

The operator must draw up a protection plan to deal with the assessed hazards. The procedures necessary for the preparation, implementation, application, review, exercise, control and updating of the security plan shall be laid down and shall be included in the safety management system. The operator must ensure that those involved, including subcontractors, are familiar with the content of the plan and receive appropriate training and preparation on the relevant tasks [14].

The operator must develop methods to continuously monitor the achievement of the objectives set for the prevention of major accidents involving dangerous substances. The implementation of the tasks related to the objectives should be continuously evaluated. An information report on major accidents or incidents involving dangerous substances shall be provided, in particular on factors which indicate a failure of the safety system. An assessment should be made of the deficiencies identified, conclusions drawn and action taken on the basis of these to address the tasks required for prevention or remediation. The operator must operate monitoring systems to continuously assess the achievement of the safety objectives set. This includes, on the one hand, monitoring the implementation of plans and objectives and the implementation of risk management measures before the accident occurs (active monitoring), and, on the other hand, reporting and investigating failures in the event of a breakdown or accident (reactive monitoring). Compliance with the safety management system can be verified by conducting audits. The audit must be carried out by a person independent of the plant concerned. Based on the audit results, the need for improvements in the elements of the safety management system can be determined. A review of management can be used to determine whether the operator is achieving the objectives he has set with the safety management system [14].

In relation to compliance with SEVESO III, the operator shall introduce the indicators used in the safety performance assessment procedures and incorporate the changes identified as necessary during the inspection. In order to implement the new regulatory elements in practice, the PDCA cycle will play a particularly important role. The application of the PDCA cycle ensures, among other things, that measures identified as a result of management reviews, internal audits are implemented, and that lessons learned from unforeseen events are incorporated by operators into the operational SMS [11].

In order to maintain and continuously improve the safety level of the plant, it is essential to apply a systematic management system that guides the operator step by step throughout the development cycle, involving each element of the SMS in the process in the appropriate order and time. The PDCA cycle is based on four main elements: Plan, Do, Check, and Act. The application process of the four elements as a self-recurring loop allows for the continuous improvement of the tested system throughout the entire life cycle of the plant [11].

The application and implementation of the SMS can be simplified if it is based on a professionally high-level, sufficiently thorough safety report. In addition, in Hungary, companies subject to the SEVESO Decree also operate a certified OHSMS system, which also includes the provisions of the SMS.

COMPARISON OF THE THREE MANAGEMENT SYSTEMS – METHODS TO INCREASE EFFICIENCY

Critical comparisons are prepared for the three described management systems, namely OHS, PSM and SMS management systems, Table 1. The aspects of the comparisons are as listed.

Basic features of operation

It takes into account the environment and organization of the enterprise, as well as the basic information necessary for operation – management commitment, employee responsibility: an economic organization, especially when operating with hazardous substances, must declare that safe operation is important for managers and that all resources are provided for this. Employees must be aware of the dangers of their activities, their effects and all the responsibilities that affect them.

Planned activities to increase operational safety

The start and execution of technological activities must be preceded by a well-prepared planning process in which all possible risks are assessed and operated with these in mind.

Documents for operational safety

The precise course of hazardous technological processes is set out in instructions in which all tasks and responsibilities are clarified, not least the control points to which special attention must be paid.

Operation different from normal and normal conditions

In addition to the normal operating processes recorded in the procedures and instructions, the company must be prepared for changes in the process, possible accidents and their management.

Evaluation of operation, identification of deficiencies

Operation can be best measured with performance indicators, which focus on those elements of operation that provide information on the safety and continuity of the process. Based on these, deficiencies can be identified that are not perceptible at a given moment, but with their help it is also possible to take preventive measures.

Continuous improvement with risk assessment

A basic requirement of any management system, in which the assessment of risks related to processes and activities can help. Based on these, new development directions in terms of security can also be determined.

Data management

Although the PSM system most clearly highlights business secrets, the protection and secure management of data is an important aspect of any management system, for which the abovementioned smart solutions are also available, so the exact scope and authority can be determined.

Smart solutions

Management systems, safe operation can be improved by using them, so the pursuit of smart communication and automated methods should be emphasized.

Table 1. Comparison of safety systems.

	ISO 45001:2018 (OHS)	**Process Safety Management System (PSM)**	**Safety Management System /by law/ (SMS)**
Basic features of operation	organization's environment	Process safety information	Organization and personnel
Leadership commitment, employee responsibility	Leadership and employee participation	Leadership commitment Employee training Employee participation	
Planned activities to increase operational safety	Planning	Process hazard analysis Pre-startup safety review Critical process equipment	Identification and assessment of major-accident hazards
Documents for operational safety	Support	Operating procedures	Operational control
Normal and abnormal operation	Operation	Contractors (subcontractors) Flammable activity Emergency Response Incident investigation	Protection planning
Evaluation of operation, identification of deficiencies	Performance evaluation, Audits, Management review	Audits and controls	Performance monitoring, audit
Continuous improvement with risk assessment	Development Management of change	Management of change	Management of change
Methodology	Application of PDCA		SMS operating according to the PDCA cycle
Data Management		Trade secret	
Smart solutions	In the case of a security management system, it is not emphasized, but the methods used by different smart cities (automation, cloud-based data management) are possible for development.		

When comparing the three systems (Table 1), the following can be stated:

- each system seeks to avoid and prevent disasters such as those at Flixborough (United Kingdom, 1974), Seveso (Italy, 1976) and Bhopal (India, 1984);

- the PSM e.g. in the USA, SMS /by law/ in Hungary is a legal obligation under the Disaster Management Act, while OHSMS may be expected from external stakeholders;
- PSM and SMS aim at the prevention of disasters related to the avoidance and improper handling of hazardous substances, OHSMS focuses on hazards that can lead to health problems [15];
- OHSMS formulates in general terms that it can be applied to all activities, the PSM mainly gives directions to organizations operating with hydrocarbons, the SMS gives the system of activities with hazardous substances (harmful to human health, environment, flammable, explosive);
- all three systems can significantly reduce the likelihood of accidental events. To prevent accidental events, it is essential to know how control systems work. Effective management systems reduce the dangers of employees not performing their activities at the same level, and ensure that important tasks are performed. Management systems should be as simple and efficient as possible and should not involve unnecessary tasks, as cumbersome systems encourage employees to circumvent the rules;
- in the case of all three systems, it is important to determine the causes of malfunctions and to investigate the events that have taken place. An emphasized and detailed description of the range of events to be investigated has been made in the PSM standard and the guidelines related to the SMS. It is important to note, however, that none of the systems emphasizes those cases, technological events that do not have serious consequences, the release of hazardous substances, but it is important to consider and, if necessary, to investigate them. Such an event is, for example, an increase in the operating parameter in a technological equipment to an extent that is not yet critical, but has caused the shutdown of certain technological elements. If the possible causes are discovered in these cases as well, we can exclude these points as possible sources of danger later with preventive measures.

For any sector where hazardous substances are used, manufactured (chemical, pharmaceutical, cosmetics) it can be useful to improve the various elements of the safety management systems used, to increase efficiency, to start emergencies, to bit normal operation, focusing on new elements and methods.

AN EFFICIENCY-ENHANCING METHOD

An important element of any system is the traceability of the measures and the follow-up of the measures taken. If a workflow is not effective, it is necessary to consider what steps need to be taken to improve the workflow or improve the management system. In order for the measures taken to be actually carried out, the Direction, Competence, Opportunity, Motivation (DCOM) model [16] can be introduced for the development of the system.

The DCOM model examines what management needs to do for management systems to work effectively. It focuses on:

- *Direction*: norms, expectations, roles.

  In the field of direction, the audit examines the elements of the safety management system that: (i) includes written procedures that ensure the consistency of the tasks to be performed, reflect safe practices already in place, are available at all times, and provide appropriate guidance to employees and management on expectations; (ii) clearly defines who has what everyone's task and who is responsible for what; (iii) comply with legal requirements and operate as originally planned, and (iv) reflect management's clear expectations through the involvement of management in various operational and control activities.

- *Competence*: education, understanding of processes.

  This part of the study assesses how well employees perform their work, how aware they are of the dangers of the activity they are doing, and the requirements for bit-safe of safe work.

- *Opportunity*: the time, tools and resources needed to do the job well.

  When examining the possibilities, they check whether sufficient time and resources have been provided for the long-term support and development of management systems.

- *Motivation*: measurement, control and feedback processes that monitor the efficiency of the system, examination and evaluation of employee performance.

  The test protocol should be designed to incorporate the aforementioned principles of DCOM. During the assessment of motivation, it is necessary to establish whether the employees and the management are sufficiently motivated for the high-quality implementation, operation and continuous development of the management system. It must be checked whether (i) the effectiveness of the systems is monitored with measurements and other feedback on management systems; ii. the quality and efficiency of management systems and related support processes are periodically checked; iii. are there tracking systems in place to monitor the performance of tasks; (iv) whether the activities and behavior of employees have predetermined consequences.

FOCUSING ON IMPORTANT SYSTEM COMPONENTS

Proper handling of and compliance with statutory documents during activities with hazardous materials can significantly increase a company's performance. By following the operating and technological instructions and educating them properly, safe work can be ensured. The safe operation of machinery and equipment can be achieved if an appropriate maintenance plan is prepared and the maintenance is carried out on time. By thoroughly investigating unexpected events, the number of critical points can be continuously reduced through corrective and more preventive activities.

WHERE and WHAT is the danger: We need to define the basic characteristics of the operation, what activity, what hazards.

WHO AND WHY RESPONSIBLE: The importance of senior management commitment should be emphasized, as well as the definition of the responsibilities of each employee related to the activity, it is necessary to evaluate the performance of individual units (eg as the bonus system)

WHAT TO DO AND WHEN: Planning is needed, so a process hazard analysis needs to be performed, how safety reviews need to be defined, major accident hazards need to be identified, the range of documents that contribute to operational safety needs to be defined, ~~and~~ as well as the main elements of the documents.

HOW TO DEVELOP: Incident investigation, that is, the investigation of events that are not normal operation. Ongoing evaluation is also needed in this area. Without continuous improvement, the safety of operation cannot be increased. In connection with individual development proposals, appropriations and actions must be formulated depending on the danger of the organization's activities.

WHAT METHOD WE APPLY: Effective application of PDCA is an important element of all 3 systems, a methodology that can be applied to all systems, can be used for all components. Guidance should be given on the depth and documentation environment in which each organization should perform its tasks. By definition, the more hazardous substances there are, the more hazardous activities there are, the more thorough and detailed regulation is needed.

SOME ASPECTS OF SYSTEM DEVELOPMENT AND OPERATION

1) The impact of leadership behavior on the organization.
   All leaders need to be aware that the leadership style, attitude, ethical values, and willingness to take risks that they choose and certify will determine their organizational culture. Based

on practical experience, it is not always the focus because it can be taken for granted. If leadership commitment is not emphasized and there are no verifiable action processes behind it, none of the systems can be operated effectively and improved.

2) No design without planning.
   An essential condition for achieving the goals is sound planning, coupled with an appropriate performance appraisal system. This creates an opportunity to involve employees already in the definition of goals, which lays the foundation for easier identification with goals, motivation of employees to contribute to the achievement of goals.

3) Each objective / task must be assigned to a responsible person and a deadline.
   In the absence of a definition of the person responsible for implementing the objectives and the deadline for implementation, the achievement of the objectives is left to chance. It is important that the responsible person is provided with all the authority and resources necessary to achieve the goals. It is important to highlight this point because it is clear that all tasks are performed by someone, but one must also be aware of the responsibilities involved, so the selection of responsible persons plays a major role in the continuity of operation and development.

4) Responsibility of the delegation.
   It is important to keep in mind that when delegating tasks, responsibility is only partially transferred. The ultimate responsibility and accountability for the adequacy of the delegation, for the performance of the task remains. Therefore, in each case, it should be considered whether the delegated person / entity has the appropriate competence to perform the task. The delegate is also responsible for monitoring and controlling the fulfillment of the delegated tasks.

5) Find a balance between management and micro management.
   Careful consideration needs to be given to how the performance of a particular task can be managed in a way that does not require interference in processes to an extent that already hinders work and impairs efficiency, while providing an acceptable level of certainty to achieve goals. By incorporating or refocusing the above aspects, as well as the principles of DCOM, in the processes, we will focus more on assessing the participation of managers and accountability, so that our colleagues can focus even more on the factors that guarantee the sustainability of the management system.

Figure 2 follows the PDCA principle of management systems in production practice, but the implementation aspects and the implementation of DCOM principles further emphasize the possibility of creating continuous production and technological safety. These focuses should be emphasized in the regulation of operations, which should be made clear to all internal and external stakeholders.

OTHER ASPECTS THAT DESERVE MORE EMPHASIS

By placing even greater emphasis on the following aspects in the operated safety management system, the safety performance of the company can be further enhanced. These, although present, do not receive adequate attention in our applied systems.

1) Vulnerability analysis

   The vulnerability of each sub-area can be determined in different ways.
   In the case of organizations and individuals, existing documents should be reviewed, and personal interviews should be used to ascertain how well employees know the regulations, and the current level of employee safety awareness should be assessed.

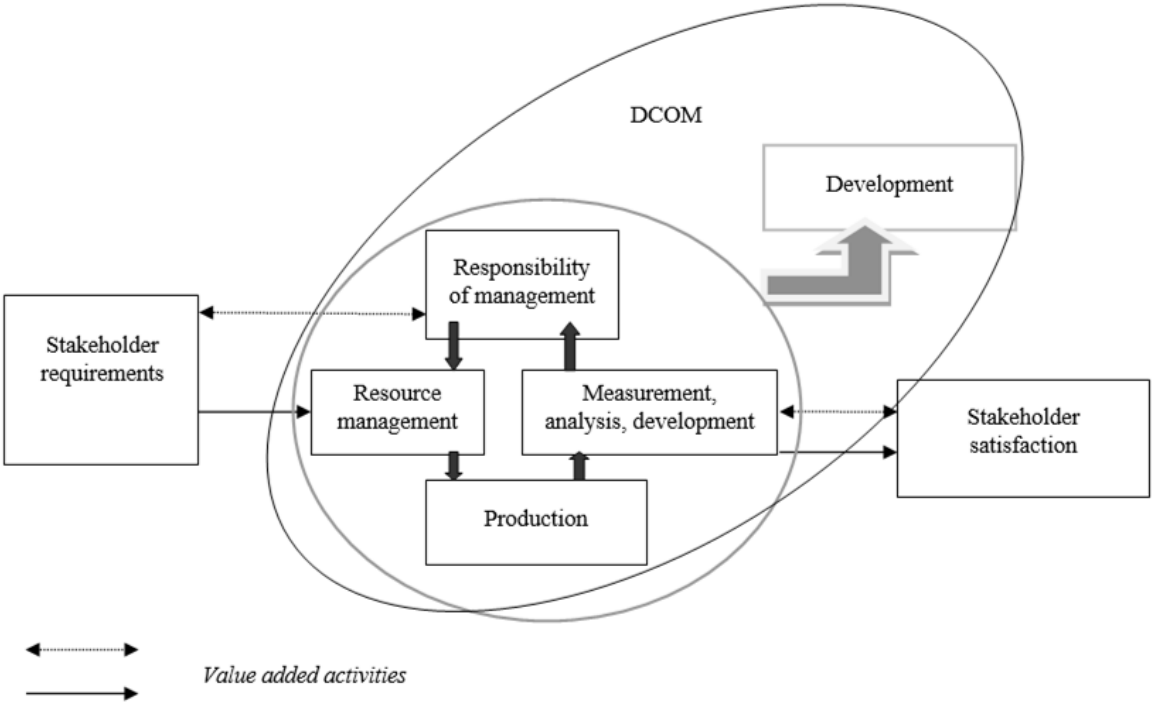

Figure 2. Management system in new focus.

Vulnerabilities are considered to be:

- the missing documents,
- existing rules but not implemented in practice,
- rules of inadequate quality,
- any rules for the implementation of which there are no personal conditions, and
- any case of conflict between the instruction to be executed and the responsible person assigned.

2) Development of a measuring and indicator system

The day-to-day operations of an organization dealing with hazardous substances cannot be completed without reporting. A production process requires a number of measuring devices, by examining the information and data provided by them, energy savings, quality improvement and a higher degree of safety can be achieved. Controls on processes and individual departments are also a factor in increasing safety, as non-conformities detected during audits can in many cases result in not only corrective but also preventive action.

The need for measurement stems comes from the consideration that if an organization does not define indicators of its safety performance, it cannot observe changes in them, so it does not know when and in what direction to intervene to achieve its goals. When designing a measurement system, as each area is different, measurement and indicator numbers must be defined for each area. The organization's measurement system should be designed so that measurements can be repeated and the results obtained are comparable. A prerequisite for the development of a measurement system is that the organization defines the goals and measurement methods with which safe operation can be monitored. Knowing these, you will already be able to measure your processes, the efficiency and effectiveness of your activities.

Basics of a general measurement system with a focus on safety:

- Deficiencies revealed during official inspections and audits
- Implementation of the improvements indicated in the development plan

- Number, type, severity of security incidents
- The number of technological incidents in which liability needs to be investigated, can have any technology safety implications, their likelihood, their potential severity to the technology
- Complaints

3) Psychosocial hazards

Most of the applied management systems do not pay enough attention to psychosocial hazards, even though this is one of the most common problems nowadays, as it is known that economic and technological development worldwide has changed the pressures on workers and the workplace requirements.

Traditionally, occupational safety and health has focused mainly on physical and chemical hazards in the workplace It has become increasingly clear that not all hazards are physical in nature. Psychosocial factors, i.e., psychological, economic, and social impacts on workers, have an impact on both physical and mental health and well-being. It is important to recognize that workplace psychosocial factors can significantly affect the health and well-being of workers. These factors related to the planning, organization, and management of work processes can lead to increased work-related stress and deterioration in work performance and physical and mental health. Research over the past few decades has identified working conditions ("psychosocial risk factors") that can cause stress to workers, regardless of their individual characteristics, job, or cultural background [17].

The Hungarian Occupational Safety and Health Act names psychosocial risk and provides for its management. The Ordinance on Medical Examination of Suitability specifies the pathogenic factors and certain groups of workers exposed to such effects. The latter list does not fully correspond to the definitions in the standards. The Hungarian legal system also allows for the reporting of occupational diseases caused by psychosocial factors. However, justifying exposure is often a significant challenge.

4) Incident investigation, startup of technologies, conditions of safe operation

At several companies engaged in hazardous activities, the important system elements – named by the PSM system or is mentioned in the SMS guidelines – are often not sufficiently focused on. Although the guidelines for the application of the standards may cover these, the practical experience and the circumstances of the occurrence of an accident show that it is worth dealing with this separately. For a large company, these are clear, but in the case of many small and medium-sized enterprises, their application can be problematic due to the compliance burden on them. Such named elements include incident investigation and effective use of its results, pre-startup review of the technology or technological component, the handling of contractors, and mechanical integrity. Enterprises engaged in hazardous activities are well aware of the importance of these elements from their operational practice, therefore sufficient emphasis must be placed on them in the construction, operation and development of the safety management system.

CONCLUSION

By comparing of the Occupational Health and Safety Management System, the Process Safety Management System and the Safety Management System – prescibed by law – important focal points can be can be identified. The emphasis on the proposed focal points in safety management systems operated by hazardous companies, highlights and takes over the elements that are part of all three systems. Important parts become visible, according to which new aspects can be added to the operated safety management system. As a result, the efficiency gains and the shaping of a safer workplace atmosphere become more achievable. With the

introduction of the new focused system, the documentation system will become more uniform and transparent, it can be an economic advantage for companies, as the continuity of operation will become more accessible by ensuring technological security. Monitoring would become more uniform, and responsibilities and authorities could be clarified. Parallels, overlaps, repetitive tasks will be reduced, thus reducing the administrative burden, thus giving attention to an area that may not have received enough attention so far.

By tailoring these focal points, the DCOM method and the solutions used by the different smart cities, a management system can be developed that is free of any over-regulation, focuses on the elements responsible for operational safety and continuity and uses the elements of all three management systems that the specific characteristics of the given activity and corporate structure. This, of course, requires staff familiar with all three systems, who will make development suggestions with local experts after assessing the processes. These can be well applied, effectively operated and reviewed if everyone is aware of the results available, has the leadership commitment that is highlighted in each forum and provides the necessary tools.

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