

Experience with Using Self-Audit Handbook for SMEs in Process and Power Industry

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In 1995 the European Commission decided to help owners of small and medium-sized enterprises by providing a tool to aid the evaluation and decision-making in the fields of safety of health at work. When the Self-Audit Handbook for SMEs (European commission, 1995) was published, almost nobody anticipated such effectiveness of self-assessment practices.

In 1995, almost 6,000,000 workers in European Union were affected by workplace incidents and accidents or work-related ailments; as a result 6,229 of them died. In 2010, more than 3,000,000 workers were affected by workplace accidents; 4,395 of them died.

Despite the recorded decrease it is foreseeable that in future the number of occupational injuries will be considerable, in both human and economic terms, and also more questions will arise regarding the risks in process and power industry. Today, almost twenty years after the foundation of Self-Audit initiative in the European Union, we can look back at a range of audits and evaluate the experience.

This article is intended to describe the most significant experience with using the Self-Audit Handbook for SMEs in process and power industry. Designed to permit the identification and evaluation of shortcomings and accident risks, the Self-audit Handbook still should help to improve safety in small and medium-sized enterprises.

1. Industrial safety

Organizations often perceive the reasons for the implementation of safety management in the field of ethics; their aim is to prevent the occurrence of accidents and fatalities. However, it is important to realize that safety management significantly affects the economic aspects of business, including profits. Establishing the system of safety management leads to an improved perception of the organization both by employees and also in terms of public opinion (Saracinoa, A., et al., 2012).

Many large organizations in Europe certify the system of management of health and safety at work (e.g. according to OHSAS 18001) to internally and externally demonstrate that these organizations systematically reduce the involved risks.

However, for small and medium-sized enterprises, a significant change in the safety management system is expensive and time-consuming. Some organizations are first willing to independently determine the level of safety, or their customers do not require the certification of safety management system. Moreover, based on the experience (Sparey, 2010), in some industries the certification of safety management system does not have a substantial effect, e.g. in the chemical industry, the power industry or the oil and gas industry (as you can see in Figure 1). The horizontal axis in the figure 1 represents different areas of activity. The vertical axis represents benefits derived from use of the standard in these areas for users and assessors.

Therefore, there is a possibility that the company will conduct its own independent safety audit, which will map the state of safety and propose measures for improvement.

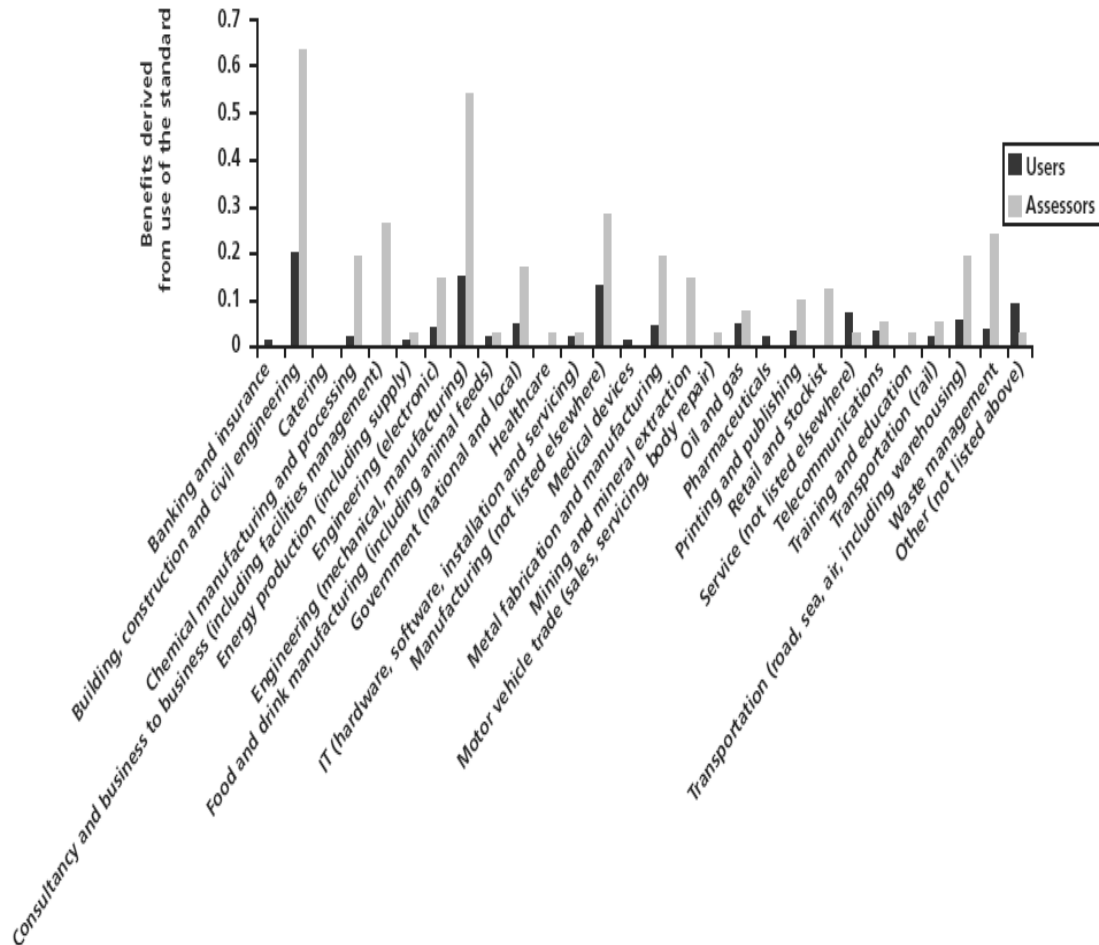


Figure 1: Benefits derived from use of standards

2. Safety audit

A safety audit is a very effective tool for monitoring the state of safety in the organization with the aim to reveal strengths and weaknesses. Revealed weaknesses can become the basis for improvements in safety; nevertheless it is also important to note the strengths and by internal benchmarking to find the elements and approaches that can be used to strengthen weak points.

The audit usually represents a systematic, independent and documented process for obtaining the audit evidence and for evaluating it objectively to determine the extent to which the audit criteria are fulfilled (ISO 19011).

For the organization which does not require certification, it is important that only the organization itself voluntarily sets, implements and maintains a program of audit and procedures of audit on a regular basis. The company carries out an internal safety audit to determine whether the safety management system complies with legislation that is set for safety, the state of science and technology and the demands on the level of safety in the company.

The company itself draws its own procedure for the conduct of audits. This approach should be consistent with the standard that should include:

- Subject and scope of the audit,
- Methodology of audit conduct, responsibility for audit program and competences, ensuring the audit in terms of management as well as the obligations and requirements relating to the audit conduct,
- Auditing process itself,
- Requirements and specifications of the individual safety requirements,
- Method of audit evaluation.

3. Self-Audit Handbook for SMEs

Guidelines entitled "Self-Audit Handbook for Small and Medium-sized Enterprises (SAH)" (European Commission, 1995) were prepared by the European Commission in Brussels based on the experience and needs of small and medium-sized enterprises in the European Union in 1995.

SAH was proposed by the European Commission to allow the identification of deficiencies and potential risks associated with the level of safety in the enterprise.

This handbook is designed for small and medium-sized enterprises. While large companies routinely carry out safety audits (and it is a condition for their success in the market), small and medium-sized enterprises are engaged in audits only very rarely. The reason is that for small and medium-sized enterprises, the safety audit is too expensive, complicated and confusing. Therefore the European Commission decided to help these enterprises and create for them a tool that they can easily use themselves. This manual is intended to serve only as a starting point for managers and employees in their task of establishing good safety practices. Modules examined by the Self-Audit Handbook for SMEs are listed in table 1. There are 14 modules; each one contains a certain number of questions.

Table 1: Modules of Self-Audit Handbook for SMEs

No.	Module	Number of questions
1	Ability to control the risks	12
2	Prevention policy	8
3	Traffic, horizontal risks and vertical risks	12
4	Machinery safeguarding	4
5	Noise and vibration	10
6	Air temperature and air renewal	6
7	Lighting	8
8	Fire, explosion and electrical risks	17
9	Dangerous materials: safety and health risks	12
10	Collective and personal protection	9
11	Transport of heavy loads	7
12	Maintenance work	5
13	Organization of first aid	6
14	Worker participation	3

4. Advantages and disadvantages of audit by SAH

Advantages of audit by SAH are:

- Very complex and deeply sophisticated system created especially for the requirements of the European Union legislation.
- The organization may carry out its own audits in accordance with this handbook, which is cost-effective and flexible.
- The handbook leads the auditor step by step through the whole area of safety issues, so the auditor does not neglect any of the important questions.
- The entire comprehensive handbook is very well graphically processed and easy to understand.
- There is a strong emphasis on the examination of the following modules: Hazardous materials, Noise, Vibration, and Vertical approach.
- The handbook offers a very well-developed five-step evaluation.
- The outcomes of the audit are clear and provide concise information about the strengths and weaknesses of safety at work in the organization.
- An audit conducted in accordance with this handbook has been found very strict, and the company that successfully passes the audit possesses at the moment of the audit a very well-adjusted safety management system.
- The methodology is available in nine languages of the European Union.

Disadvantages of audit by SAH are:

- The company that conducted the audit according to this handbook does not obtain any certificate or other document that would help this company in a competitive environment.
- Lack of questions about near misses.
- It does not take into account some of the new trends in the field of safety.

5. Methodology of Self-Audit Handbook for SMEs

SAH contains 119 questions divided into 14 modules; each question is evaluated by the auditor in the range of 0-5 points on the base of the audit findings (Figure 2). For each question a limit number of points are set that the organization must exceed to comply with the respective question (Equation (1) and Table 2). Some questions are further divided into sub-questions, which, to a certain extent, offer opportunities to examine the specific risks and guide the auditors to similar areas.

(33) Quality of machinery safeguarding.
Do the following systems exist in your company?

	Yes	No	Not applicable
- Emergency shutdown buttons on machines	○	○	○
- A system to prevent accidental start-up of machines (e.g. security keys, dual control)	○	○	○
- A system to prevent machines operating when unprotected (e.g. power cutout if guards are not in place)	○	○	○
- Are all moving parts of machines protected (e.g. by guards, grills, light beams)?	○	○	○

Evaluate the quality of machinery safeguarding by reference to the most unfavourable situation.

0	1	2	3	4	5
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Not applicable:

Figure 2: Example of question from SAH

$$k = \frac{\text{score of question}}{\text{limit number of points for question}} \quad (1)$$

Table 2: Significance of coefficient of questions fulfilment k

k	Significance
<1	Question was not fulfilled
>1	Question was fulfilled

The evaluation of strengths and weaknesses can be generally considered as follows: strengths are all the areas where points over the required minimum were achieved. On the other hand, weaknesses could be seen in the areas where the point score of responses was less than or equal to the value required by the set minimum score. The ranking of strengths and weaknesses is set according to the share of results achieved for each module (Equation (2) and Table 3).

$$Ka = \frac{\sum_0^n k_n (> 1)}{\text{limit number of points for area}} \quad (2)$$

Table 3: Significance of coefficient of area fulfilment Ka

Ka	Significance
<1	Area was not fulfilled - weakness
>1	Area was fulfilled - strength

Furthermore, this methodology provides a procedure for the evaluation of the four basic safety parameters: Personnel, Equipment, Organization, and Environment. Each of the 119 questions examined in the previous section is related to one of the four above-mentioned groups.

The criterion "personnel" refers to how the company takes into account the safety of the individual employees, visitors, temporary workers, newly hired employees, etc. Management of the company should always take all these options into account in order to properly assess the state of occupational safety and health at work. The criterion of "equipment" includes questions related to the purchase and installation of machinery and equipment. The criterion of "organization" refers to the state of allocation of responsibility and communication. The criterion of "environment" includes questions focused on both the environment outside the company and the working environment within the company.

Calculation of the coefficient of parameter fulfillment will be:

$$Kp = \frac{\sum_0^m k_m(> 1)}{\text{limit number of points for parameter}} \cdot 100 \quad (3)$$

This procedure provides a numeric value for each module, which should be compared with the value in table 4.

Table 4: Significance of coefficient of module fulfillment Kp

Kp	Significance
75 - 100 %	Good state of safety of the module parameter
50 - 75 %	Average state of safety of the module parameter
25 - 50 %	Critical state of safety of the module parameter
0 - 25 %	Insufficient state of safety of the module parameter

The final score for each of the four parameters is the basis for an action plan. The results that will be obtained on the basis of the audit will help identify the strengths and also the weaknesses that limit the company in its growth. The handbook also points out that it is not possible to improve too many deficiencies at once. Such efforts would not bring the desired results.

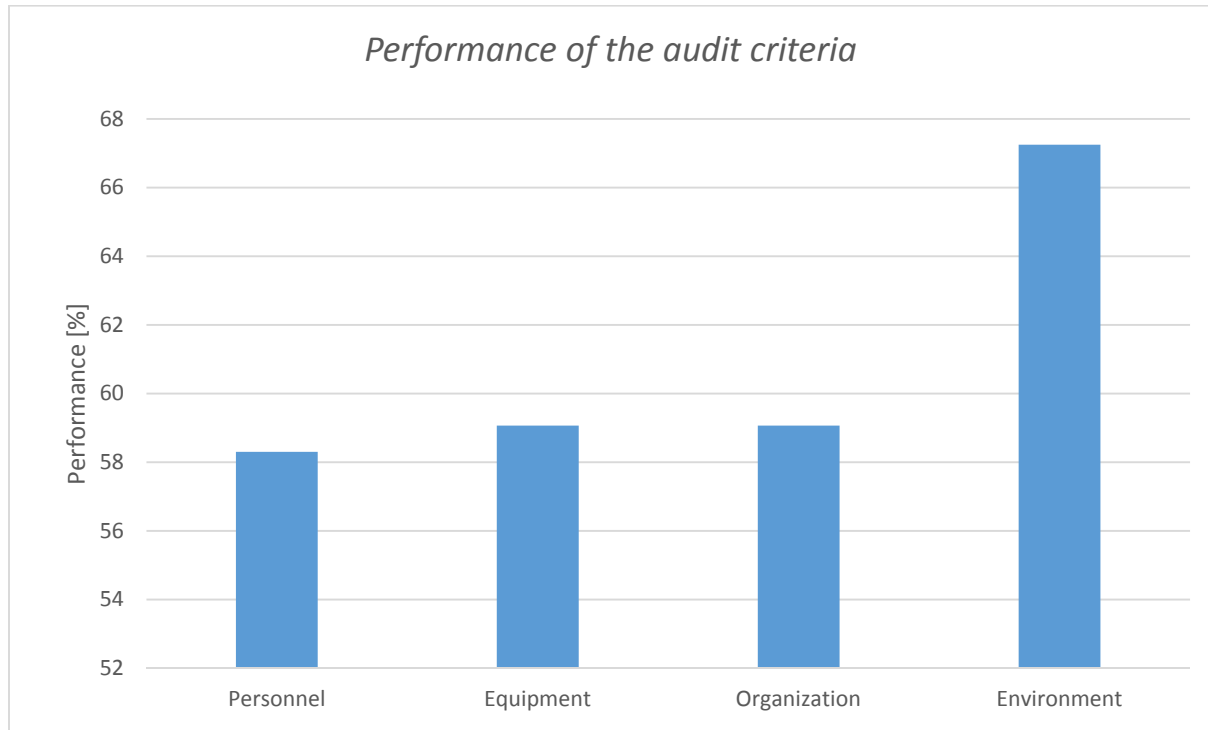


Figure 3: Performance of the audit criteria

6. Conclusions

From time to time the accident occurred because a well-established safety procedures and requirements were ignored. The investigation often shows that the root causes of the accident were outdated work practices that have not changed since their implementation.

Safety audits are an instrument for direct prevention of accidents and fatalities, as they immediately generate positive actions across the whole business activity. Based on the results of the audit the companies can easily build an action plan that will help in filling the gaps in safety.

In the last two years we have applied a described method several times in the industrial companies. In total, six audits were carried out. The enterprises, in which the methodology was used, are mainly active in the fields of power engineering, chemical and process engineering; the companies involved are both Czech and also international companies (with owners in Germany and the Netherlands).

The results of these six audits were compared and Figure 3 shows the performance of the audit criteria in Czech companies where the audit was conducted.

The audit shows that the worst-treated area in the audited companies is safety of personnel. Some risks were not covered in the rated companies and sufficient measures were not taken to mitigate the consequences of accidents. A top-rated area of the companies is environment; there is a very strict European legislation that covers most of the risks that are assessed in SAH.

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References

- Saracinoa, A., Spadoni, G., Curcurutob, M., Guglielmib, D., Boccic, V., Cimarellid, M., Dottorie, E., Violantef, F., 2012. A New Model for Evaluating Occupational Health and Safety Management Systems (OHSMS). *Chemical Engineering Transactions*, 26, 519-524, DOI: 10.3303/CET1226087.
- European commission, 1995. *Self-audit Handbook for SMEs: Safety and Health at Work: Office for Official Publications of the European Communities*. ISBN 92-826-9366-X.
- Sparey, T., 2010. Does BS OHSAS 18001 work?, p.12. BSI www.bsigroup.ae/upload/press-releases/18001%20Whitepaper.pdf, Accessed: 19.11.2013.
- British standards institute. (2007). *BS OHSAS 18001:2007. Occupational health and safety management systems. Requirements*. London: BSI Standards.
- International Organization for Standardization. (2011) *ISO 19011:2011. Guidelines for auditing management systems*. Geneva: ISO.