Management of Security Risk in the Energy Field

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Abstract: An integrated method for an efficient internal auditing of OHS applicable to the work systems met in hydrotechnical and hydroelectrical operations has been devised as part of the program NUCLEU/2010-2011 – Project PN 07 45 01 12.

This project represents an approach in compliance with the European and national requirments aiming at increasing OHS level for companies involved in water construction works and also provides sustainability to the related environment.

Keywords: Internal auditing, method, compliance, safety risk, vulnerability.

1. GENERAL ISSUES ON OHS AUDITING

Audit is a systematic process which examines an operation, system or item in relation to a number of pre-settled criteria, it delivers an objective evaluation on the fulfilment of these reference criteria. Audit also indicates - as a recommendation – the method in which the analysed object corresponds to the criteria and it is also considered to be a communication process of outcomes (results) for the interested parties [1,2].

Auditing can be made by independent bodies or experts (external auditors) or by persons working in audit companies (internal auditors). Internal auditing is a process, which has been developed after the extern auditing, when audit was nothing else but a method of financial control [3].

In order to gain credibility and efficiency, the organization and the carrying on of an internal auditing must be carried out based on international regulations regarding the organization, behaviour and deontology of internal auditors stipulated in the standards issued by the Institute of Internal Auditors, an international organization from the USA [4,5].

OHS auditing is represented by the activities which offer, to the top management of an economic organisation, a guarantee on the efficiency of keeping the occupational accidents and diseases risks under control, in order not to affect the workers and also provides suggestions for improving the control on these issues.

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Literature talks about two categories of methods that are used for OHS auditing: audit which can be used either for inspection or labour safety analyses or for auditing (questionnaire-type methods, DCT-″Diagnostique des conditions du travail″, DSF-″Diagnosis Safety Form″, NOSA); methods which have been specially devised for expert auditing (Workwell, Alberta, CHASE, OSHA, INCDPM) [6-8].

All these methods rely on the same principle: the analysis of the subject in relation to a series of predetermined criteria and the issuance of a qualitative and quantitative estimation on the observance of these criteria.

OHS auditing has been largely developed in Romania in the last years as more local companies desired to get their conformity with the international specifications on quality, environment and even occupational health and safety at work. This is one main reason which reveals the need for local auditing: internal auditing will reduce the need of external auditing (a direct consequence shall be a diminution of costs). Usually, the Romanian auditing companies use the English standards on quality, suitable for the preventive measures that have to be implemented by Romanian companies [9-11].

2. IMPLEMENTATION OF INTERNAL AUDITING

OHS auditing system specific to water construction and hydro-electrical power generation companies relies on the following arguments [12-15]:

- Prevention represents the need to keep under control accidents and occupational diseases

risks in order to prevent their possibility to affect the workers. OSH auditing must be a suitable measure to be implemented to this purpose;

- In order to have pertinent information about the control of occupational risks on regular basis, the most efficient solution is to have a top management internal auditing department for several advantages:

- the use of external auditors is limited by the financial status of the water construction company which desires an auditing and by the availability of auditors;

- internal auditing displays a strong preventive feature by controlling means that supports the accomplishment of OSH targets and prevents more serious damages, while external auditing determines them and monitors them;

- internal auditors display a double interest to increase the performances of the company in relation to OHS: both as auditors and as employees of the water construction company that have to build OHS policy organized by the top management of the company;

The devised method requires the completion of the following stages [16,17]:

- General information on the object of the auditing specific to the water construction company;

- Detection of working tools;

- Use of checklists to verify specific and general requirements for water construction companies and hydroelectric power generation companies;

- Calculation of quantitative indicators used to evaluate compliance;

- Full estimation of OHS level and/or of OHS risks for the audited entity of the water construction company;

- Summarization of non-compliances;

- The drafting of an auditing report.

This method together with the related procedure can be used both for the entire water construction company, for one component (workshop, department etc) or for one operation:

- both for laying the foundation for the implementation/improvement decision and all through the operation of the OHS managing system as basis for corrective measures in relation to the OHS control;

- as a pre-requisite before taking decisions in relation to major changes in the methods or equipment etc;

- after methods or equipment have been changed.

This method can be used for diagnosis purposes to evaluate the global OHS level and to determine OHS risk. Subsequently, it can give a prognosis on the safety level by estimating how probable is to exceed the value of such a condition.

3. EVALUATION OF SAFETY RISK IN OHS MANAGEMENT AREA, FOR ECONOMIC OPERATORS INVOLVED IN WATER CONSTRUCTION AND HYDROELECTRIC WORKS

For the audit of OHS activities of water construction works there have been used the following tools [18,19]:

- General checklist for a global evaluation of compliance with the OHS management system;

- Technical sheet for identification and analysis of non-compliance;

- Grid with the weighting coefficients to evaluate global compliance level;

Overall, there has been registered a very good OHS management at economic operators involved in water construction works and hydroelectric power generation belonging to SC HIDROCONSTRUCTIA SA Bucharest [20]:

Thereby, the safety risk in OHS management has been determined and estimated based on Gumbel type probability function associated to unsafety conditions; the accuracy of different estimation on risk predictors is given by Kolmogorov-Smirnov test. This test is used to determine the trust interval for the prognosis results according to the following equations:

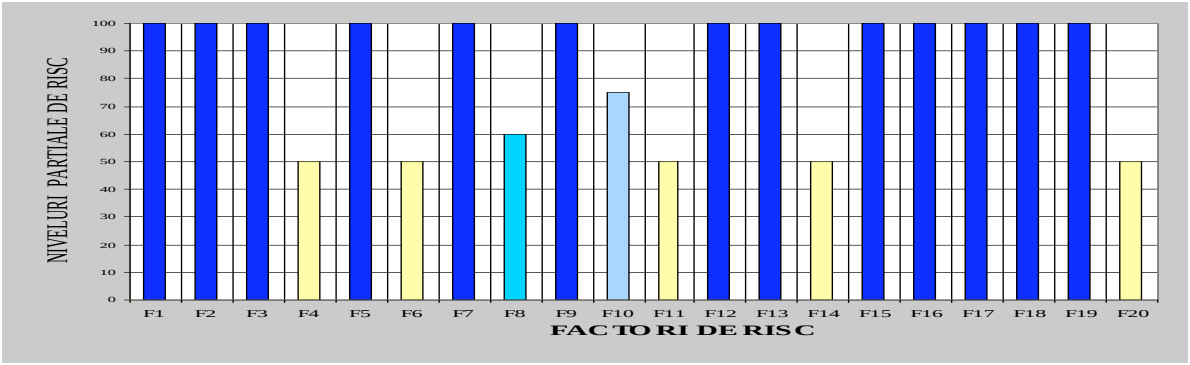
4.1. Statistical parameters and indicators

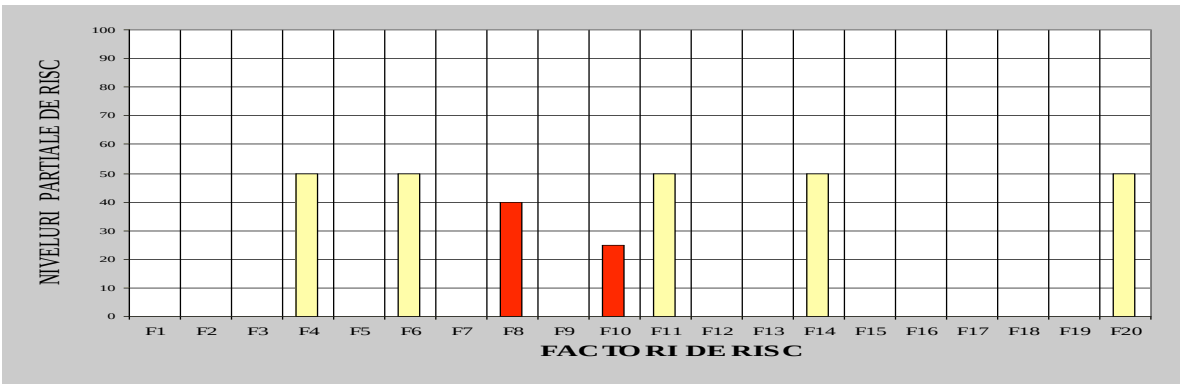
Probability density:

$$f(x) = 0,0565 e^{-\frac{x-5,5477}{17,675}} e^{-e^{-\frac{x-5,5477}{17,675}}}$$

Table 1:

No.	General checklist for the observance of requirements of the OHS managing system	Global/specific level of non-compliance
1	General requirements	0
2	OHSAS [21] policy	0
3	Planning the hazard identification, risk evaluation and establishing control operations	0
4	Legal requirements and other requirements	50
5	Objectives and schedule (programs)	0
6	Implementation and operation of resources, functions, responsibilities and authority	50
7	Competence, training and awareness	0
8	Communication, participation and advisory actions	40
9	Participations and advisory actions	0
10	Documentation	25
11	Control of documents	50
12	Operating control	0
13	Preparation for emergency situations and capability of response	0
14	Verification, measurement and monitoring the performances	50
15	Evaluaation of compliance	0
16	Analysis of incidents, non-compliances, corrective and preventive measures, analysis of incidents	0
17	Non-compliances, corrective and preventive measures	0
18	Control of recordings	0
19	Internal auditing	0
20	Management analysis	50





Repartition function:

$$F(x) = e^{-e^{-\frac{x-5,5477}{17,675}}}$$

Average value:

$$\mu = 15,75$$

Standard deviation:

$$\sigma = 22,66$$

Kolmogorov-Smirnov statistical test (Uncertainty evaluation):

The adjustment of the values sample (associated to uncertainty conditions) to Gumbel distribution is acceptable for the following risk α=0,005 ($K_{MAX}<K_{0,005}(n)$, n=20)

K_{MAX}=0,3681; $K_{0,005}(20)$=0,3776

The equation for the objective average safety risk:

$$\bar{R}(x) = \int x e^{-e^{-\frac{x-5,5477}{17,675}}} dx$$

or

$$\bar{R}(x) = \sum x e^{-e^{-\frac{x-5,5477}{17,675}}}$$

The equation for the objective average vulnerability:

$$\bar{G}(x) = 0,0565 \int x e^{-\frac{x-5,5477}{17,675}} e^{-e^{-\frac{x-5,5477}{17,675}}} dx$$

or

$$\bar{G}(x) = 0,0565 \sum x e^{-\frac{x-5,5477}{17,675}} e^{-e^{-\frac{x-5,5477}{17,675}}}$$

4.2. Different Estimations

The value that shows the exceeding of an insecurity condition for which it corresponds a probability of a certain order (e.g. $p=10^{-1}$)

$x_p = 5,5477 – 17,675 \times \ln(-\ln(1-10^{-1})) = 45,32$

P(x>45,32)=1-F(45,32) =0,89 (a probability of order 10^{-1})

Determination of trust interval at 95 %, according to J. Bernier:

Ex. for p=0,1; n=20; α=0,05; x_p=45,32

T1(0,1;20;0,05)=1,3;$T_1 \times \sigma$=29,458

T2(0,1;20;0,05)=-0,6;$T_2 \times \sigma$=-13,596

$I_{0,95}$=[31,724;74,778]

Probability to overrun a value associated to an insecurity condition (its average value):

$P(x > x_{average}) = 1 - F(15,75) = 1 – 0,570 = 0,43$ (Average safety risk)

Grid for security risk assessment		
0,00 ÷ 0,33 (High)	0,33 ÷ 0,66 (Average)	0,66 ÷ 1,00 (Low)

5. CONCLUSIONS

OHS Audit System specific to hydroelectric power generation companies relies on the following aspects:

- Preventive measures must keep under control occupational diseases and accident risks so that no harmful situation interferes with the workers health and safety; the best guarantee to reach this goal is OHS auditing;
- In order to have pertinent information about the control of occupational risks on regular basis, the most efficient solution is to have a top management internal auditing department for its several advantages.

This method together with the related procedure can be used both for the entire water construction company, for one component (workshop, department etc) or for one operation: both for laying the foundation for the implementation/improvement decision and all through the operation of the OHS managing system as basis for corrective measures in relation to the OHS control; as a prerequisite before taking decisions in relation to major changes in the methods or equipment etc; after methods or equipment have been changed.

Also, estimating OHS safety risk was carried out based on the probability function associated to unsafety conditions, in order to forecast the level of safety conditions based on estimating the probability to exceed the value of such condition.

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