

Assessing (Auditing) the Conformity with Legal and Other Provisions in Terms of Occupational Health and Safety of Critical Power Infrastructures

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Abstract. In order to ensure energy, economic and societal security, the State must ensure access to electricity to all domestic, industrial and vital consumers, which are made through critical power infrastructures. This makes power substations strategic objectives of national and European interest, and the role of OHS (personnel and secure workplaces in an ergonomic and healthy working environment) on them becomes a major objective to ensure the smooth functioning of the national economy. In the current situation, and in many unfortunate cases, OHS activity is subordinate to production or service activity and OHS risk assessments and audits are also made formally by non-specialized personnel, leading to undesirable events with an unstable effect, and the need for assessment (auditing) with legal and other provisions is intended to verify compliance with OHS rules and principles and to limit or stop work accidents. This paper addresses the verification of OHS, by "INCDPM Bucharest method" - Assessment of conformity with legal and other provisions (auditing) - to an European critical infrastructure (power substation), for the purpose of verifying knowledge and conformity with legal and other provisions at the workplace level and assessing the efficiency or failure of the OHS management system of the analyzed economic entity management, and after implementation it will serve as a tool to verify the functioning of the system. The assessment (auditing) of the OHS shows that the critical power infrastructure under consideration has an overall level of safety close to maximum (99,88%) and a low overall risk level, which means that OHS rules are met and the assessment (auditing) has had a positive effect.

1 Description, purpose and necessity of the assessment of conformity with legal and other provisions in terms of OHS - INCDPM Bucharest method

The obligation to establish and maintain a continuous process of assessment of conformity with legal and other provisions in force results from the provisions of the Occupational

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Safety and Health Law 319/2006, as well as from standards SR OHSAS 18001:2008 and SR ISO 45001:2018 (clause 4.5.2) and is thus applicable to any organization, regardless of its option related to the implementation of a management system [1, 2]. The purpose of the conformity assessment is a direct one, namely checking the degree of knowledge and conformity with legal and other provisions at workplace or organization level and an indirect one of assessing the effectiveness of the OHS management system at work [3, 4]. Conformity assessment should be carried out as part of the initial analysis preceding the development and implementation of an OHS management system, in order to ground the management's decisions in this way. After implementation, the conformity assessment is used as a tool to verify the operation of the management system, in order to establish the decisions required for ensuring the continuous improvement of the system. The assessment method used in this paper consists of the following sets of independent sheets:

- **Sheet A - "Employer's obligations";**
- **Sheet B - "Personnel' rights and obligations";**
- **Sheets C - "General requirements";**
- **Sheets D - " Specific requirements".**

The A and B sheets are intended for the assessment of the organization's management against legal provisions and apply only once, throughout the organization. The relevant sheets in sets C and D shall apply for each compartment, workplace or activity which is assessed. For each sheet, the audit criteria represented by the elements of national legislation and by European directives that these legal regulations transpose are indicated, where appropriate. The sheet contains a checklist of indicators formulated in such a way as to be directly related to the provisions of the statutory acts constituting the audit criteria. Each indicator of the sheet shall be assessed on the basis of the verified information collected on-site by the evaluation team and noted by a score, depending on the extent to which this information shows that the requirements to which the indicator refers have been met. The scoring system shall allow each indicator to be assessed as follows:

- **Not-applicable (N/A)** – in the situation where the requirement referred to in the indicator is not applicable to the assessed objective;
- **0 points** – if the requirements described by the indicator is totally unfulfilled;
- **1 point** – if the requirement described by the indicator is partially fulfilled, but in a proportion of maximum 50%;
- **2 points** – if the requirement described by the indicator is partially fulfilled, but in a proportion of over 50%;
- **3 points** – if the requirement described by the indicator is fully fulfilled.

The indicators have weighting coefficients associated, with possible values of 1, 2 or 3, depending on the importance of the requirement referred to by the respective indicator. After assessing the indicators of the sheet, the level of conformity and/or level of security are determined.

The level of conformity expresses the extent to which the requirements forming the audit criteria are met for the objective under consideration, giving equal importance to all requirements. The conformity level (NC) shall be obtained as the ratio of the achieved score (PO) to the maximum score (PM) and expressed as a percentage according to the relationship:

$$NC = \frac{PO}{PM} \cdot 100 \quad [\%] \quad (1)$$

The score obtained (PO) is calculated with the relationship:

$$PO = a + b + c \quad (2)$$

where:

a - is the total of scores for questions having weighting coefficient 3;

b - is the total of scores for questions having weighting coefficient 2;

c - is the total of scores for questions having weighting coefficient 1.

The maximum score (PM) is calculated with the relationship:

$$PM = 3 \cdot (d + e + f) \quad (3)$$

where:

d - the number of questions applicable which have a weighting coefficient 3;

e - the number of questions applicable which have a weighting coefficient 2;

f - the number of questions applicable which have a weighting coefficient 1.

The level of safety expresses the extent to which risks of accident and occupational disease are controlled for the objective under consideration. The security level (NS) shall be calculated with the relationship:

$$NS = \frac{PO}{PM} \cdot 100 \quad [\%] \quad (4)$$

The achieved score (PO) and the maximum score (PM) shall be determined with the following relationships:

$$PO = a \cdot 3 + b \cdot 2 + c \cdot 1 \quad (5)$$

$$PM = 3 \cdot (d \cdot 3 + e \cdot 2 + f \cdot 1) \quad (6)$$

The General Conformity Level (NC_g) is given by the relationship (sheets A and B):

$$NC_g = \frac{PO_A + PO_B}{PM_A + PM_B} \cdot 100 \quad [\%] \quad (7)$$

where:

PO_A and PO_B - are the scores for sheets A and B;

PM_A and PM_B – are the maximum possible scores for sheets A and B.

The **General Conformity Level** (NC_g) is given by the relationship:

$$NC_g = \frac{\sum PO}{\sum PM} \cdot 100 \quad [\%] \quad (8)$$

The General Security Level (NS_g) is given by the relationship:

$$NS_g = \frac{\sum PO}{\sum PM} \cdot 100 \quad [\%] \quad (9)$$

where:

the PO and PM represent the scores obtained, respectively the maximum possible scores determined for the A and B sheets used in the assessment of the organization's management, as well as for the C and D sheets applied directly to the assessed objective.

Determination of the General Risk Level – the level of security is a synthetic conventional indicator, inversely proportional to the level of risk. Thus the level of risk of the work system analysed can be assessed according to the value of the security level based on a correlation which is shown in table 1.

Table 1. Security level/Risk level correspondence

Security level	Risk level
91-100 %	Low risk
81-90 %	Medium risk
71-80 %	High risk
under 71 %	Very high risk

2 Assessment of conformity with legal and other provisions in terms of OHS at a 400/220 kV cross - border - power substation within the National Power Sector - European critical infrastructure

2.1 Program for assessing conformity with legal and other provisions in force

At the level of the National Power Sector , through the national company responsible, it is established the program for assessing the conformity with legal and other provisions in force (auditing) [5, 6, 7] which is set out in table 2 below, and the assessments (audits) have to be carried out by the Internal Prevention and Protection Services (SIPP).

National Power Sector
Responsible National Company

Table 2. Program for assessing the conformity with legal and other provisions (audit)

No.	Compartment / Workplace	Month of deployment												Obs.
		1	2	3	4	5	6	7	8	9	10	11	12	
1.	Company Manager													
2.	Operational Personnel													

SIPP Responsible
(OHS assessor/auditor)

Date:

2.2 Assessment of the organization’s management

For the assessment of the management of the organization, sheets A and B are be used. The sheets completed following the collection of information by the assessing (audit) team are presented below.

2.2.1 The sheets used

A. Employer's obligations

Table 3. Audit criteria, Indicators, Conformity / Security Level – Sheet A

AUDIT CRITERIA	
National legislation	EU legislation
① Occupational Safety and Health Law 319/2006	89/391/EEC Directive
② The methodological norms for applying the	-

provisions of the Occupational Safety and Health Law 319/2006							
Code	INDICATOR	N / A	0	1	2	3	Weight
A.1. – A.56.	56 indicators						
<i>N/A – Not-applicable; 0 – Nothing; 1 - Partially (≤ 50 %); 2 - Partially (> 50 %); 3 – Completely</i>							
Total scores for questions with weight 3		a = 84					
Total scores for questions with weight 2		b = 72					
Total scores for questions with weight 1		c = 12					
Number of questions applicable with weight 3		d = 28					
Number of questions applicable with weight 2		e = 24					
Number of questions applicable with weight 1		f = 4					
CONFORMITY LEVEL							
Score obtained: PO _A = a + b + c = 168		Conformity level: NC _A = PO _A / PM _A × 100 = 100 %					
Maximum score: PM _A = 3×(d + e + f) = 168							
SECURITY LEVEL							
Score obtained: PO _A = a×3 + b×2 + c×1 = 408		Security level: NS _A = PO _A / PM _A × 100 = 100 %					
Maximum score: PM _A = 3×(d×3 + e×2 + f×1) = 408							

B. Personnel's rights and obligations

Table 4. Audit criteria, Indicators, Conformity / Security Level – Sheet B

AUDIT CRITERIA							
National legislation				EU legislation			
① Occupational Safety and Health Law 319/2006				89/391/EEC Directive			
② The methodological norms for applying the provisions of the Occupational Safety and Health Law 319/2006				-			
Code	INDICATOR	N / A	0	1	2	3	Weight
B.1. – B.16.	16 indicators						
<i>N/A – Not-applicable; 0 – Nothing; 1 - Partially (≤ 50 %); 2 - Partially (> 50 %); 3 – Completely</i>							
Total scores for questions with weight 3		a = 20					
Total scores for questions with weight 2		b = 9					
Total scores for questions with weight 1		c = 18					
Number of questions applicable with weight 3		d = 7					
Number of questions applicable with weight 2		e = 3					
Number of questions applicable with weight 1		f = 6					
CONFORMITY LEVEL							
Score obtained: PO _B = a + b + c = 47		Conformity level: NC _B = PO _B / PM _B × 100 = 97,91 %					
Maximum score: PM _B = 3×(d + e + f) = 48							
SECURITY LEVEL							
Score obtained: PO _B = a×3 + b×2 + c×1 = 96		Security level: NS _B = PO _B / PM _B × 100 = 96,96 %					
Maximum score: PM _B = 3×(d×3 + e×2 + f×1) = 99							

2.2.2 General conformity level

Table 5. General conformity level – Company manager

Sheet code	Name	Score		Conformity level
		maximum (PM)	obtained (PO)	
A	Employer's obligations	168	168	100 %
B	Personnel's rights and obligations	48	47	97,91 %
TOTAL				NC_g
		216	215	99,53 %

2.3 Assessment of operational personnel

The work system of the 400/220 kV power substation consists of the following elements:

Means of production:

400 kV Power Substation:

- busbars;
- OHL switchgears;
- 400/220 kV AT switchgears;
- coupling switchgears (transversal / longitudinal / longo-transversal);
- compensating coil switchgears;
- busbar measuring switchgears;
- discharge switchgears, etc.

220 kV Power Substation

- busbars;
- OHL switchgears;
- 220/110 kV AT switchgears;
- coupling switchgears (transversal / longitudinal / longo-transversal);
- compensating coil switchgears;
- busbar measuring switchgears;
- discharge switchgears, etc.

Risk factors specific to the means of production:

- mechanical risk (falling from the same level, slipping or tripping, explosions of equipment with a lifetime exceeded, falling from a height);
- electrical risk (direct contact with electrical installations);
- thermal risk (burns due to electric arc).

Work load:

According to the operating regulations, the duties of the operational staff are as follows:

- performing the handover-receiving operations of the work team;
- supervision activity;
- control activity;
- the activity of executing the electric maneuvers.

Risk factors specific to the work load:

- psychic stress in the 400 kV and 220 kV power substations, when installing short-circuits by hand.

Performer:

The following staff works in the power substation:

- manager (s) of the power substations (electrical engineer);
- shift leaders;
- shift leaders aides.

Risk factors specific to the performer:

- wrong action:
 - incorrect identification of the installation and non-verification of the lack of voltage, when mounting the short-circuits;
 - failure to respect the neighbouring distances with risk of electric shock by direct contact;
 - not checking the lack of voltage before mounting the mobile short-circuits.

- omissions:
 - omissions of operations during manoeuvres, with risk of burns caused by electric arc, when closing grounding knives or mounting the mobile short-circuits without checking the lack of voltage;
 - non-use and/or non-verification of the personal protective equipment provided and/or of the electrical insulating means and devices.

Work environment:

The operating staff carries out the activity in the control room at the external power substations of 400 kV and 220 kV, where the specific nature of the work assignment requires operation and control activities regardless of climatic conditions and as a result the main risk factor specific to the working environment is the air temperature by exposure to high or low temperatures during the performances of the work assignment.

Risk factors specific to the work environment:

- physical risk factors:
 - exposure to adverse weather conditions (low/high temperatures, rain, snow, air currents) during installations' control.

The legislation applicable to the assessed work system shall be composed of:

- Occupational Health and Safety Law 319/2006;
- G.D. No. 1425/2006 for the approval the methodological norms for applying the provisions of the Occupational Safety and Health Law 319/2006;
- G.D. No 1091/16.08.2006 concerning the minimum safety and health requirements for the workplace;
- G.D. No 971/26.07.2006 concerning minimum requirements for safety and/or health signs at work;
- G.D. No 1146/30.08.2006 concerning the minimum safety and health requirements for the use of work equipment by personnel;
- G.D. no. 1028/09.08.2006 concerning the minimum safety and health requirements for the use of display screen equipment;
- G.D. No 1048/09.08.2006 concerning the minimum safety and health requirements for the use of personal protective equipment by personnel at work;
- G.D. No 1051/09.08.2006 concerning the minimum health and safety requirements for the manual handling of masses presenting a risk to personnel, in particular dorsolombaric conditions;
- G.D. No 493/12.04.2006 concerning the minimum health and safety requirements regarding the exposure of personnel to the risks arising from noise;
- G.D. No 1876/22.12.2005 on the minimum health and safety requirements regarding the exposure of personnel to the risks arising from vibration;
- G.D. No 1218/06.09.2006 laying down minimum safety and health requirements at work to ensure the protection of personnel from the risks related to chemical agents;
- G.D. No 1092/16.08.2006 on the protection of personnel from risks related to exposure to biological agents at work;
- G.D. No 1093/16.08.2006 laying down minimum health and safety requirements for the protection of personnel from the risks related to exposure to carcinogens or mutagens at work;
- G.D. No 1875/22.12.2005 on the protection of the health and safety of personnel from the risks arising from exposure to asbestos;
- G.D. No 1058/09.08.2006 on minimum requirements for improving the safety and health protection of personnel likely to be exposed to a potential risk from explosive atmospheres;

- G.D. No 520/28.07.2016 on the minimum health and safety requirements regarding the exposure of personnel to the risks arising from electromagnetic fields;
- G.D. No 300/02.03.2006 concerning the minimum safety and health requirements for temporary or mobile construction sites;
- G.D. No 1007/02.08.2006 concerning the minimum safety and health requirements for medical care on board ships;
- G.D. No 1049/09.08.2006 concerning minimum requirements to ensure the safety and health of personnel in surface or underground mineral-extracting industries;
- G.D. No 1050/09.08.2006 concerning the minimum requirements for ensuring the safety and health of personnel in the mineral-extracting industries through drilling;
- G.D. No 1135/30.08.2006 concerning the minimum safety and health requirements for work on board fishing vessels;
- G.D. nr. 600/13.06.2007 on the protection of young people at work;
- G.D. No 355/11.04.2007 on health surveillance of personnel;
- G.E.O.. no. 99/29.06.2000 on measures to be applied during periods of extreme temperatures for the protection of employed persons; 06.07.2000 methodological standard for the application of the O.U.G. provisions No 99/2000 on measures to protect employed persons during periods of extreme temperatures;
- G.D. No 510/02.06.2010 on the minimum health and safety requirements regarding the exposure of personnel to the risks arising from artificial optical radiation.

To this normative acts are added the following own and specific instructions for OHS:

- Own OHS instruction in operational electrical installations – IPSM – EEI;
- Specific OHS instruction for working under voltage (live work) – ISSM – LST;
- Specific OHS instruction on how to complete the working under voltage (live work) authorization - ISSM – ALST.

In order to complete the method, the following sheets have been drawn up on the basis of the above specific and specific OHS instructions:

- D.1 „Own OHS instruction in operational electrical installations – IPSM – IEE”;
- D.2 „Specific OHS instruction for working under voltage (live work) – ISSM – LST”;
- D.3 „Specific OHS instruction on how to complete the working under voltage (live work) authorization - ISSM – ALST”.

2.3.1 The sheets used

The sheets used for the evaluation of the work of "operational personnel" are the following:

- C.1. Minimum OHS requirements at the workplace;
- C.2. Minimum requirements of security signs or OHS in workplaces;
- C.3. Minimum OHS requirements for the use of work equipment by the personnel;
- C.4. Minimum OHS requirements related to the use of display screen equipment;
- C.5. Minimum OHS requirements for the use of personal protective equipment by personnel at work;
- C.14. Minimum OHS requirements regarding the exposure of personnel to the risks arising from electromagnetic fields;
- C.21. Health surveillance of personnel;
- C.22. Measures that may be applied during periods of extreme temperatures to protect people at work;
- D.1 „Own OHS instruction in operational electrical installations – IPSM – IEE”;

- D.2 „Specific OHS instruction for working under voltage (live work) – ISSM – LST”;
- D.3 „Specific OHS instruction on how to complete the working under voltage (live work) authorization - ISSM – ALST”.

The sheets completed with the scores awarded, corresponding to the findings made in the field, are presented below.

C.1. Minimum OHS requirements for the workplace

Table 6. Audit criteria, Indicators, Conformity / Security Level – Sheet C.1.

AUDIT CRITERIA							
National legislation			EU legislation				
●G.D. 1091/16.08.2006 on the minimum requirements of OHS for the workplace.			1989/654/eec Directive				
Code	INDICATOR	N / A	0	1	2	3	Weight
C.1.1. – C.1.123.	123 indicators						
<i>N/A – Not-applicable; 0 – Nothing; 1 - Partially (<= 50 %); 2 - Partially (> 50 %); 3 – Completely</i>							
Total scores for questions with weight 3		a = 146					
Total scores for questions with weight 2		b = 80					
Total scores for questions with weight 1		c = 74					
Number of questions applicable with weight 3		d = 49					
Number of questions applicable with weight 2		e = 26					
Number of questions applicable with weight 1		f = 25					
CONFORMITY LEVEL							
Score obtained: PO _{C1} = a + b + c = 300		Conformity level:					
Maximum score: PM _{C1} = 3×(d + e + f) = 300		NC _{C1} = PO _{C1} / PM _{C1} × 100 = 100 %					
SECURITY LEVEL							
Score obtained: PO _{C1} = a×3 + b×2 + c×1 = 672		Security level:					
Maximum score: PM _{C1} = 3×(d×3 + e×2 + f×1) = 672		NS _{C1} = PO _{C1} / PM _{C1} × 100 = 100 %					

C.2. Minimum requirements of OHS for security signs at workplace

Table 7. Audit criteria, Indicators, Conformity / Security Level – Sheet C.2.

AUDIT CRITERIA							
National legislation			EU legislation				
●G.D. 971/26.07.2006 on minimum requirements of OHS for security signs at workplace			92/58/EEC Directive				
Code	INDICATOR	N / A	0	1	2	3	Weight
C.2.1. – C.2.30.	30 indicators						
<i>N/A – Not-applicable; 0 – Nothing; 1 - Partially (<= 50 %); 2 - Partially (> 50 %); 3 – Completely</i>							
Total scores for questions with weight 3		a = 69					
Total scores for questions with weight 2		b = 21					
Total scores for questions with weight 1		c = 0					
Number of questions applicable with weight 3		d = 23					

Number of questions applicable with weight 2	e = 7
Number of questions applicable with weight 1	f = 0
CONFORMITY LEVEL	
Score obtained: PO _{C2} = a + b + c = 90	Conformity level: NC _{C2} = PO _{C2} / PM _{C2} × 100 = 100 %
Maximum score: PM _{C2} = 3×(d + e + f) = 90	
SECURITY LEVEL	
Score obtained: PO _{C2} = a×3 + b×2 + c×1 = 249	Security level: NS _{C2} = PO _{C2} / PM _{C2} × 100 = 100 %
Maximum score: PM _{C2} = 3×(d×3 + e×2 + f×1) = 249	

C.3. Minimum OHS requirements for the use of work equipment by personnel

Table 8. Audit criteria, Indicators, Conformity / Security Level – Sheet C.3.

AUDIT CRITERIA								
National legislation			EU legislation					
●G.D. 1146/30.08.2006 on the minimum requirements of OHS for to use of work equipment by personnel.			89/655/EEC Directive; 95/63/EC Directive; 2001/45/EC Directive.					
Code	INDICATOR		N / A	0	1	2	3	Weight
C.3.1. – C.3.40.	40 indicators							
<i>N/A – Not-applicable; 0 – Nothing; 1 - Partially (≤ 50 %); 2 - Partially (> 50 %); 3 – Completely</i>								
Total scores for questions with weight 3			a = 120					
Total scores for questions with weight 2			b = 0					
Total scores for questions with weight 1			c = 0					
Number of questions applicable with weight 3			d = 40					
Number of questions applicable with weight 2			e = 0					
Number of questions applicable with weight 1			f = 0					
CONFORMITY LEVEL								
Score obtained: PO _{C3} = a + b + c = 120			Conformity level: NC _{C3} = PO _{C3} / PM _{C3} × 100 = 100 %					
Maximum score: PM _{C3} = 3×(d + e + f) = 120								
SECURITY LEVEL								
Score obtained: PO _{C3} = a×3 + b×2 + c×1 = 360			Security level: NS _{C3} = PO _{C3} / PM _{C3} × 100 = 100 %					
Maximum score: PM _{C3} = 3×(d×3 + e×2 + f×1) = 360								

C.4. Minimum OHS requirements related to the use of display screen equipment

Table 9. Audit criteria, Indicators, Conformity / Security Level – Sheet C.4.

AUDIT CRITERIA								
National legislation			EU legislation					
●G.D. 1028/09.08.2006 on the minimum requirements of OHS relating to the use of display screen equipment.			1990/270/EEC Directive					
Code	INDICATOR		N / A	0	1	2	3	Weight
C.4.1. – C.4.9.	9 indicators							

<i>N/A – Not-applicable; 0 – Nothing; 1 - Partially (≤ 50 %); 2 - Partially (> 50 %); 3 – Completely</i>	
Total scores for questions with weight 3	a = 6
Total scores for questions with weight 2	b = 21
Total scores for questions with weight 1	c = 0
Number of questions applicable with weight 3	d = 2
Number of questions applicable with weight 2	e = 7
Number of questions applicable with weight 1	f = 0
CONFORMITY LEVEL	
Score obtained: $PO_{C4} = a + b + c = 27$	Conformity level: $NC_{C4} = PO_{C4} / PM_{C4} \times 100 = 100 \%$
Maximum score: $PM_{C4} = 3 \times (d + e + f) = 27$	
SECURITY LEVEL	
Score obtained: $PO_{C4} = a \times 3 + b \times 2 + c \times 1 = 60$	Security level: $NS_{C4} = PO_{C4} / PM_{C4} \times 100 = 100 \%$
Maximum score: $PM_{C4} = 3 \times (d \times 3 + e \times 2 + f \times 1) = 60$	

C.5. Minimum OHS requirements for the use of personal protective equipment by personnel at work

Table 10. Audit criteria, Indicators, Conformity / Security Level – Sheet C.5.

AUDIT CRITERIA								
National legislation			EU legislation					
●G.D. 1048/09.08.2006 on the minimum requirements of OHS for to use of personal protective equipment by personnel at work.			89/656/EEC Directive					
Code	INDICATOR		N / A	0	1	2	3	Weight
C.5.1. – C.5.6.	6 indicators							
<i>N/A – Not-applicable; 0 – Nothing; 1 - Partially (≤ 50 %); 2 - Partially (> 50 %); 3 – Completely</i>								
Total scores for questions with weight 3			a = 18					
Total scores for questions with weight 2			b = 0					
Total scores for questions with weight 1			c = 0					
Number of questions applicable with weight 3			d = 6					
Number of questions applicable with weight 2			e = 0					
Number of questions applicable with weight 1			f = 0					
CONFORMITY LEVEL								
Score obtained: $PO_{C5} = a + b + c = 18$			Conformity level: $NC_{C5} = PO_{C5} / PM_{C5} \times 100 = 100 \%$					
Maximum score: $PM_{C5} = 3 \times (d + e + f) = 18$								
SECURITY LEVEL								
Score obtained: $PO_{C5} = a \times 3 + b \times 2 + c \times 1 = 54$			Security level: $NS_{C5} = PO_{C5} / PM_{C5} \times 100 = 100 \%$					
Maximum score: $PM_{C5} = 3 \times (d \times 3 + e \times 2 + f \times 1) = 54$								

C.14. Minimum OHD requirements regarding the exposure of personnel to the risks arising from electromagnetic fields

Table 11. Audit criteria, Indicators, Conformity / Security Level – Sheet C.14.

AUDIT CRITERIA									
National legislation				EU legislation					
● G.D. 1136/03.08.2006 on the minimum requirements of OHS regarding the exposure of personnel to the risks arising from electromagnetic fields.				2004/40/EC Directive					
Code	INDICATOR			N / A	0	1	2	3	Weight
C.14.1. – C.14.10.	10 indicators								
<i>N/A – Not-applicable; 0 – Nothing; 1 - Partially (≤ 50 %); 2 - Partially (> 50 %); 3 – Completely</i>									
Total scores for questions with weight 3				a = 30					
Total scores for questions with weight 2				b = 0					
Total scores for questions with weight 1				c = 0					
Number of questions applicable with weight 3				d = 10					
Number of questions applicable with weight 2				e = 0					
Number of questions applicable with weight 1				f = 0					
CONFORMITY LEVEL									
Score obtained: $PO_{C14} = a + b + c = 30$				Conformity level: $NC_{C14} = PO_{C14} / PM_{C14} \times 100 = 100 \%$					
Maximum score: $PM_{C14} = 3 \times (d + e + f) = 30$									
SECURITY LEVEL									
Score obtained: $PO_{C14} = a \times 3 + b \times 2 + c \times 1 = 90$				Security level: $NS_{C14} = PO_{C14} / PM_{C14} \times 100 = 100 \%$					
Maximum score: $PM_{C14} = 3 \times (d \times 3 + e \times 2 + f \times 1) = 90$									

C.21. Personnel health surveillance

Table 12. Audit criteria, Indicators, Conformity / Security Level – Sheet C.21.

AUDIT CRITERIA									
National legislation				EU legislation					
● G.D. 355/11.04.2007 on health surveillance of personnel.				-					
Code	INDICATOR			N / A	0	1	2	3	Weight
C.21.1. – C.21.15.	15 indicators								
<i>N/A – Not-applicable; 0 – Nothing; 1 - Partially (≤ 50 %); 2 - Partially (> 50 %); 3 – Completely</i>									
Total scores for questions with weight 3				a = 42					
Total scores for questions with weight 2				b = 3					
Total scores for questions with weight 1				c = 0					
Number of questions applicable with weight 3				d = 14					
Number of questions applicable with weight 2				e = 1					
Number of questions applicable with weight 1				f = 0					
CONFORMITY LEVEL									
Score obtained: $PO_{C21} = a + b + c = 45$				Conformity level: $NC_{C21} = PO_{C21} / PM_{C21} \times 100 = 100 \%$					
Maximum score: $PM_{C21} = 3 \times (d + e + f) = 45$									
SECURITY LEVEL									
Score obtained:				Security level:					

$PO_{C21} = a \times 3 + b \times 2 + c \times 1 = 132$	$NS_{C21} = PO_{C21} / PM_{C21} \times 100 = 100 \%$
Maximum score:	
$PM_{C21} = 3 \times (d \times 3 + e \times 2 + f \times 1) = 132$	

C.22. Measures that may be applied during periods of extreme temperatures to protect people at work

Table 13. Audit criteria, Indicators, Conformity / Security Level – Sheet C.22.

AUDIT CRITERIA							
National legislation			EU legislation				
<p>❶ E.O. No 99 of 29.06.2000 on measures applicable during periods of extreme temperatures for the protection of persons in work;</p> <p>❷ Methodological norm dated 06.07.2000 for the application of the provisions E.O. No 99/2000 on measures applicable during periods of extreme temperatures for the protection of persons at work.</p>			-				
Code	INDICATOR	N / A	0	1	2	3	Weight
C.22.1.–C.22.4.	4 indicators						
<i>N/A – Not-applicable; 0 – Nothing; 1 - Partially ($\leq 50 \%$); 2 - Partially ($> 50 \%$); 3 – Completely</i>							
Total scores for questions with weight 3		a = 12					
Total scores for questions with weight 2		b = 0					
Total scores for questions with weight 1		c = 0					
Number of questions applicable with weight 3		d = 4					
Number of questions applicable with weight 2		e = 0					
Number of questions applicable with weight 1		f = 0					
CONFORMITY LEVEL							
Score obtained: $PO_{C22} = a + b + c = 12$		Conformity level:					
Maximum score: $PM_{C22} = 3 \times (d + e + f) = 12$		$NC_{C22} = PO_{C22} / PM_{C22} \times 100 = 100 \%$					
SECURITY LEVEL							
Score obtained: $PO_{C22} = a \times 3 + b \times 2 + c \times 1 = 36$		Security level:					
Maximum score: $PM_{C22} = 3 \times (d \times 3 + e \times 2 + f \times 1) = 36$		$NS_{C22} = PO_{C22} / PM_{C22} \times 100 = 100 \%$					

D.1. Own OHS instruction in operational electrical installations – IPSM – IEE

Table 14. Audit criteria, Indicators, Conformity / Security Level – Sheet D.1.

AUDIT CRITERIA							
❶ Own OHS instruction in operational electrical installations – IPSM – IEE							
Code	INDICATOR	N / A	0	1	2	3	Weight
D.1.1.– D.1.10.	10 indicators						
<i>N/A – Not-applicable; 0 – Nothing; 1 - Partially ($\leq 50 \%$); 2 - Partially ($> 50 \%$); 3 – Completely</i>							
Total scores for questions with weight 3		a = 30					
Total scores for questions with weight 2		b = 0					
Total scores for questions with weight 1		c = 0					
Number of questions applicable with weight 3		d = 10					
Number of questions applicable with weight 2		e = 0					

Number of questions applicable with weight 1	f = 0
CONFORMITY LEVEL	
Score obtained: PO _{D1} = a + b + c = 30	Conformity level: NC _{D1} = PO _{D1} / PM _{D1} × 100 = 100 %
Maximum score: PM _{D1} = 3 × (d + e + f) = 30	
SECURITY LEVEL	
Score obtained: PO _{D1} = a × 3 + b × 2 + c × 1 = 90	Security level: NS _{D1} = PO _{D1} / PM _{D1} × 100 = 100 %
Maximum score: PM _{D1} = 3 × (d × 3 + e × 2 + f × 1) = 90	

D.2. Specific OHS instruction for working under voltage (live work) – ISSM – LST

Table 15. Audit criteria, Indicators, Conformity / Security Level – Sheet D.2.

AUDIT CRITERIA							
● Specific OHS instruction for working under voltage (live work) – ISSM – LST							
Code	INDICATOR	N / A	0	1	2	3	Weight
D.2.1.– D.2.18.	18 indicators						
<i>N/A – Not-applicable; 0 – Nothing; 1 - Partially (<= 50 %); 2 - Partially (> 50 %); 3 – Completely</i>							
Total scores for questions with weight 3		a = 54					
Total scores for questions with weight 2		b = 0					
Total scores for questions with weight 1		c = 0					
Number of questions applicable with weight 3		d = 18					
Number of questions applicable with weight 2		e = 0					
Number of questions applicable with weight 1		f = 0					
CONFORMITY LEVEL							
Score obtained: PO _{D2} = a + b + c = 54		Conformity level: NC _{D2} = PO _{D2} / PM _{D2} × 100 = 100 %					
Maximum score: PM _{D2} = 3 × (d + e + f) = 54							
SECURITY LEVEL							
Score obtained: PO _{D2} = a × 3 + b × 2 + c × 1 = 162		Security level: NS _{D2} = PO _{D2} / PM _{D2} × 100 = 100 %					
Maximum score: PM _{D2} = 3 × (d × 3 + e × 2 + f × 1) = 162							

D.3. Specific OHS instruction on how to complete the working under voltage (live work) authorization – ISSM – ALST

Table 16. Audit criteria, Indicators, Conformity / Security Level – Sheet D.3.

AUDIT CRITERIA							
● Specific OHS instruction OHS on how to complete the working under voltage (live work) authorization – ISSM – ALST							
Code	INDICATOR	N / A	0	1	2	3	Weight
D.3.1.– D.3.10.	10 indicators						
<i>N/A – Not-applicable; 0 – Nothing; 1 - Partially (<= 50 %); 2 - Partially (> 50 %); 3 – Completely</i>							
Total scores for questions with weight 3		a = 30					
Total scores for questions with weight 2		b = 0					
Total scores for questions with weight 1		c = 0					

Number of questions applicable with weight 3	d = 10
Number of questions applicable with weight 2	e = 0
Number of questions applicable with weight 1	f = 0
CONFORMITY LEVEL	
Score obtained: $PO_{D3} = a + b + c = 30$	Conformity level: $NC_{D3} = PO_{D3} / PM_{D3} \times 100 = 100 \%$
Maximum score: $PM_{D3} = 3 \times (d + e + f) = 30$	
SECURITY LEVEL	
Score obtained: $PO_{D3} = a \times 3 + b \times 2 + c \times 1 = 90$	Security level: $NS_{D3} = PO_{D3} / PM_{D3} \times 100 = 100 \%$
Maximum score: $PM_{D3} = 3 \times (d \times 3 + e \times 2 + f \times 1) = 90$	

2.3.2 General conformity level

Table 17. General conformity level

Sheet code	Name	Score		Conformity level
		maximum (PM)	obtained (PO)	
C. General requirements				
C.1	Minimum OHS requirements for the workplace	300	300	100 %
C.2	Minimum OHS requirements for security signs at workplace	90	90	100 %
C.3	Minimum OHS requirements for the use of work equipment by personnel	120	120	100 %
C.4	Minimum OHS requirements relating to the use of display screen equipment	27	27	100 %
C.5	Minimum OHS requirements for the use of personal protective equipment by personnel at work	18	18	100 %
C.14	Minimum OHS requirements regarding the exposure of personnel to the risks arising from electromagnetic fields	30	30	100 %
C.21	Personnel health surveillance	45	45	100 %
C.22	Measures that may be applied during periods of extreme temperatures to protect people at work	12	12	100 %
D. Specific requirements				
D.1	Own OHS instruction in operational electrical installations – IPSM – IEE	30	30	100 %
D.2	Specific OHS instruction for working under voltage (live work) – ISSM – LST	54	54	100 %
D.3	Specific OHS instruction on how to complete the working under voltage (live work) authorization - ISSM – ALST	30	30	100 %
		TOTAL		NC_g
		756	756	100 %

2.3 General security level for 400/220 kV power substation

Table 18. General security level

Sheet code	Name	Score		Security level	Risk level
		maximum (PM)	obtained (PO)		
A.	Employer's obligations	408	408	100 %	Small
B.	Personnel's rights and obligations	99	96	96,96 %	Small
C. General requirements					
C.1	Minimum OHS requirements for the workplace	672	672	100 %	Small
C.2	Minimum OHS requirements for security signs at workplace	249	249	100 %	Small
C.3	Minimum OHS requirements for the use of work equipment by personnel	360	360	100 %	Small
C.4	Minimum OHS requirements relating to the use of display screen equipment	60	60	100 %	Small
C.5	Minimum OHS requirements for the use of personal protective equipment by personnel at work	54	54	100 %	Small
C.14	Minimum OHS requirements regarding the exposure of personnel to the risks arising from electromagnetic fields	90	90	100 %	Small
C.21	Personnel health surveillance	132	132	100 %	Small
C.22	Measures that may be applied during periods of extreme temperatures to protect people at work	36	36	100 %	Small
D. Specific requirements					
D.1	Own OHS instruction in operational electrical installations – IPSM – IEE	90	90	100 %	Small
D.2	Specific OHS instruction for working under voltage (live work) – ISSM – LST	162	162	100 %	Small
D.3	Specific OHS instruction on how to complete the working under voltage (live work) authorization - ISSM – ALST	90	90	100 %	Small
		TOTAL		NS_g	NR_g
		2502	2499	99,88 %	MIC SMALL

Table 19. Security level / Risk level relationship

SECURITY LEVEL	RISK LEVEL
91-100 %	Low risk
81-90 %	Medium risk
71-80 %	High risk
under 71 %	Very high risk

3 Conclusions

The paper approaches OHS measures by assessing the conformity with legal and other provisions (auditing) in force, for the purpose of checking the knowledge and conformity with the legal and other provisions in force at workplace level and for assessing the effectiveness of the OHS management system.

The assessment (audit) carried out is part of the initial analysis preceding the development and implementation of an OHS management system with a view to supporting management decisions, and after implementation it is used as a tool to verify the operation of the management system in order to determine the decisions required for ensuring the continuous improvement of the system. The assessment of the conformity (audit) of the 400/220 kV power substation highlighted the following:

- General conformity level for Sheet A (Employer's obligations) is 100%;
- General conformity level for Sheet B (Personnel's rights and obligations) is 97,91%;
- **General conformity level for "Management" level, for sheets A and B, is 99,53%;**
- General conformity level for Sheet C (General requirements) is 100%;
- General conformity level for Sheet D (Specific requirements) is 100%;
- **General conformity level for "Operational Personnel" level, for sheets C and D, is 100%;**
- General security level for Sheet A (Employer's obligations) is 100% - Risk level LOW;
- General security level for Sheet B (Personnel's rights and obligations) is 96,96% - Risk level SMALL;
- General security level for Sheet C (General requirements) is 100% - Risk level LOW;
- General security level for Sheet D (Specific requirements) is 100% - Risk level LOW;
- **General security level for 400/220 kV Power Substation is 99,88% - General risk level LOW, table 21 (Security level / Risk level relationship).**

The 400/220 kV power substation is found to have a general conformity level between 99,53 % and 100 % and the general safety level is 99,88 %, corresponding to a low general risk level and no critical conformity points are identified, all the safety requirements being met.

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