Performance and reliability of human factor: case of a plasma welding workplace

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Every kind of human activity is associated with a certain risk. The man is the least reliable and vulnerable part of the working system "man – machine – environment". Human factor failure can bring along the material damage but also the human losses. Although valid values are difficult to obtain, estimates agree that errors committed by man are responsible for 60–90 % of the accidents; the remainder of accidents are attributable to technical deficiencies (Griffith, 2011) (HSE, 2005). Authors assess the reliability of human factor – employees in engineering sector with a special focus on plasma cutting. responsibilities.

Methods

It was used For quantitative analysis MIPS (Method of identification of failure causes). Methodology is based on a controlled conversation (questions) with a selected worker of appropriate profession. The questions are formulated in such a way that each of them would allow to reveal subsequently the possible cause of worker failure. Final step of analysis consisted in elaboration of protocol on investigation. This protocol contained the calculated values (Fp)k and (Pp)k and possible reasons of effect of human factor on the analysed work activity.

Assessment of probability of determination of human failure cause Pp by the values of factor of human element failure F_p

F_p	P_p	Probability of correct determination	Qualitative assessment
0 – 0.20	< 10 %	very low	Neither human failure, nor effect on other causes is supposed.
0.21 – 0.30	10 – 30 %	low	Human failure is not supposed, however the identified cause might affect the acting of other causes belonging to another group.
0.31 – 0.40	30 – 50 %	moderate	Cause acting might result in human failure at participation of causes belonging to another group
0.41 – 0.54	50 – 80 %	high	Acting of cause in appropriate group might result in human failure and/or significantly participate in it.
0.55 – 1.00	> 80 %	very high	Acting of cause in appropriate group caused the human failure and/or its effect on occurrence was decisive.

Comparison of estimation probability for the effect of human factor $(P_p)_k$

k	Group name	Equipment operator	Shift foreman	Head of organisational unit
1	Training	< 10 %	< 10 %	< 10 %
2	Tasks and duties	> 80 %	50 – 80 %	50 – 80 %
3	Decision making and control of processes	10 – 30 %	30 – 50 %	< 10 %
4	Operations and manipulation	10 – 30 %	< 10 %	< 10 %
5	Work group	10 – 30 %	< 10 %	< 10 %
6	Attendance and supervision	< 10 %	10 – 30 %	< 10 %
7	Control and management	30 – 50 %	10 – 30 %	10 – 30 %
8	Personal features	30 – 50 %	30 – 50 %	< 10 %
9	Risk factors of work environment	< 10 %	< 10 %	< 10 %
10	Workplace	< 10 %	< 10 %	< 10 %
11	Stress factors	< 10 %	< 10 %	< 10 %

Conclusion

The method MIPS was suitable for the certain working process. It revealed weaknesses in the management of the work and working procedures.

The results from analysis by MIPS method have shown that the human failure factor on the workplace for plasma cutting of materials Fp varies in average from 0.17 to 0.30.

In quantitative assessment it means that though human failure is not supposed, the identified cause might affect the behaviour of worker.

In spite of the fact that the risk of human factor failure is rather low, the analysis has revealed several weak points actually in each of analysed fields.

References

Griffith, C.D. & Mahadevan, S, 2011. *Inclusion of fatigue effects in human reliability analysis*. Reliability Engineering & System Safety, 96 (11), 1437–1447.

HSE. INSPECTORS TOOLKIT, 2005. Human factors in the management of major accident hazards http://www.hse.gov.uk/humanfactors/topics/index.htm