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Ergonomic criteria in the investigation of indirect causes of accidents

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Abstract

Guidelines on ergonomic deficiencies may be derived from accident reports which commonly name employees as being directly at fault (direct causes of accident). The root causes of accidents found of significance for prevention purposes include the misalignment of workstations with the psychophysical capabilities of workers. Such causes lead to the engagement of ergonomists. Accident analysis tools and detailed specifications of direct accident causes have been used to develop a concept of a method for identifying ergonomic deficiencies. The accident investigation methods and tools used to classify accident causes by means of specified criteria make it possible to identify ergonomic deficiencies at each stage of assessment. The author has additionally described a concept of an expert system which supports the investigation of occupational accidents from the ergonomic standpoint. The accident investigation methods identified in this paper are TOL, Job Safety Analysis (JSA), "What if …", FMEA, STEP, OARU (Occupational Accident Research Unit), FTA, the Ishikawa Diagram, the energy transfer method, „4xwhy", MORT, KIK, WAIT (Work Accident Investigation Technique), as well as the ILCI and TRIPOD models. A concept has also been offered for using network methods to establish a hierarchy of ergonomic incompliances.

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Keywords: Ergonomic criteria; Causes of accidents; Investigation of indirect causes of accidents

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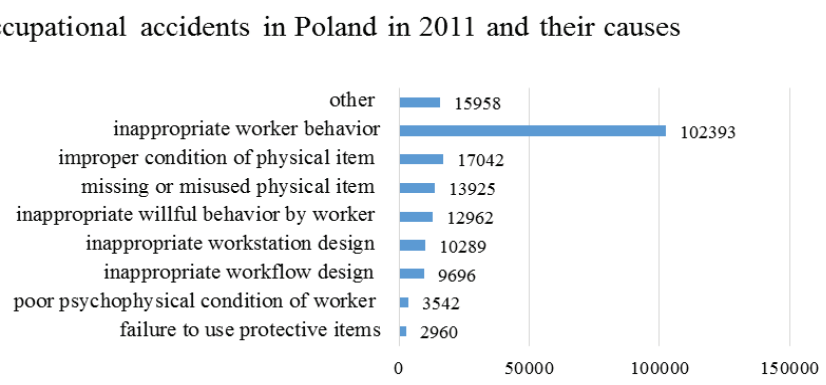

Fig. 1. Top causes of accidents at work in Poland in 2011 [7].

1. Occupational accident investigation requirements applicable in Poland

In the event of accidents at work, the Polish law (art. 234 § 1 of the Labor Code; Regulation of the Council of Ministers of July 1, 2009 on the ascertainment of occupational accident circumstances and causes – Official Journal 105, Item 870 [36]) requires that:

- measures be taken to fully prevent accidents or reduce their impact;
- first aid be provided to any victims;
- accident causes and circumstances be ascertained by the prescribed procedure;
- proper measures be taken to prevent recurrence.

The responsibility for investigating accident circumstances and causes rests with an employer-appointed investigator team comprised of an occupational health and safety officer and a social labor inspector.

Investigation findings are recorded in a "Report on the circumstances and causes of accident at work" (whose template is provided in the Regulation of the Minister of Economy and Labor of September 16, 2004 (Official Journal 227, Item 2298) [37]). A section of the Report has been dedicated to accident causes, some of which may be attributed to the employer. The law stops short of prescribing the methods and instruments to be used in the investigation. This affects investigation thoroughness and results in worker behavior being blamed for accidents [7]. Further investigations go as far as to ascertain the direct causes of accidents without specifying the underlying reasons which indirectly contribute to their occurrence.

The most popular accident investigation methods are [13, 18, 41]:

- the TOL method (determination of technical, organizational and human-related causes),
- Job Safety Analysis (JSA),
- the "what if" method,
- Failure Mode and Effects Analysis (FMEA), also known as Failure Mode and Criticality Analysis (FMCA),
- the STEP method,
- the OARU (Occupational Accident Research Unit) method,
- Failure Tree Analysis (FTA),
- Event Tree Analysis (ETA),
- the Ishikawa diagram,
- deviation analysis,
- the energy transfer method,
- the "4 x why" method,
- the MORT method,
- the KIK method,