Assessment of the Severity of the Last Accident Based on the Fine-Kinney Method

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Abstract. The analysis of existing methods for assessing professional risk, which are divided into quantitative and qualitative. Presented are often used in the field of occupational safety methods for evaluating occupational risks. The article describes the importance of assessing the severity of the consequences of an accident, as one of the components of occupational risk. For this was used the Fine and Kenny evaluation method. Due to of the study was made last analysis of accidents, incidents and accidents in the organization. Based on the results obtained, the total amount of losses of the enterprise was calculated and the level of consequences was determined - very serious

1. Introduction
Occupational safety and health involve systematic research aimed at protecting workers from harmful working conditions that can be caused by various reasons in the workplace. Today, occupational risk assessment is a mandatory procedure in the field of occupational safety management at work. This is due to the fact that despite great efforts and a long time of work to reduce the level of injuries and occupational diseases of workers, the goal of zero injuries has not been achieved.

Before starting a professional risk assessment, a suitable risk assessment method and procedure must be selected. Rausand combines procedures risk analysis and risk evaluation is called risk assessment [1]. Methods for assessing occupational risks are divided into two groups (Fig. 1) [2]. Currently, various quantitative and qualitative methods are used to assess occupational risks in the field of labor protection: Fault Tree Analysis [3,4], Cause-Consequence Analysis [5], Dynamic Event Tree Analysis [6], Preliminary Risk Analysis [7], What if? Analysis [8], Hazard and Operability Studies [9,10], Failure Modes and Effects Analysis [11,12], human reliability assessment (HRA) techniques [13], decision matrix risk assessment [14,15], Fine Kinney [16,17].

Before implementing one of the risk assessment methods, a business is required to know the following definitions:
Risk: The possibility of loss, injury or any other harmful result caused by a hazard.
Risk assessment: Describing the hazards that exist in the business or might come from outside, grading and analyzing the risks which are caused by hazards and the factors that cause the hazards to turn into risks.
Hazard: The potential that exists in the business or might come from outside, affects, harms employees or cause harm to business [18].
2. Methods
Within the framework of this work, in order to assess the severity of the last accident, the Fine-Kinney method was chosen. The Fine Kinney Method is a quantitative risk assessment method developed by Kinney and Wiruth in 1976 [19]. It considers three parameters for each detected hazard (Likelihood of Hazardous Event, The Exposure factor and possible consequences). The final value of professional risk is obtained by multiplying the obtained variables Eq. (1) [16]. Then it is assessed whether the situation is acceptable or not.

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\text{Risk Score} = \text{Likelihood of Hazardous Event} \times \text{The Exposure Factor} \times \text{Possible Consequence}
\] (1)

Fine-Kinney is a useful quantitative method for assessing risks. According to the author, this method is a quantitative and comprehensive tool for risk analysis and control. [20]. In Fine-Kinney method, Likelihood is the probability of damage occurring over time, while Exposure factor refers to the frequency of hazard exposure. Possible consequences is the amount of harm or damage to people, the workplace and the environment if a hazard occurs [19]. After the identification process, an analysis of accidents, incidents and accidents in the organization is carried out. Experts are appointed to rank the findings. Based on the data obtained, each criterion is assigned a value and an overall risk calculation is made.

The assessment tables for the concepts used to calculate the risk score are shown in Table 1, Table 2, Table 3, and the risk score itself is shown in Table 4

| Table 1. The values for likelihood of hazardous event. |
|-----------------------------------------------------|
| **Possible consequence**                           | **Value** |
| Might well be expected                          | 10        |
| Quite possible                                   | 6         |
| Unusual but possible                             | 3         |
| Only remotely possible                           | 1         |
| Conceivable but very unlikely                    | 0,5       |
| Practically impossible                           | 0,2       |
| Virtually impossible                             | 0,1       |

| Table 2. The values for the exposure factor.      |
|--------------------------------------------------|
| **Possible consequence**                         | **Value** |
| Continuos                                        | 10        |
| Frequent (daily)                                 | 6         |
| Occasional (weekly)                              | 3         |
| Unusual (monthly)                                | 2         |
| Rare (a few per year)                            | 1         |
| Very rare (yearly)                               | 0,5       |
### Table 3. The values for possible consequences.

| Possible consequence                                      | Value |
|-----------------------------------------------------------|-------|
| Catastrophe (many fatalities, or >$10^7 damage)           | 100   |
| Disaster (few fatalities, or >$10^6 damage)               | 40    |
| Very serious (fatality, or >$10^5 damage)                 | 15    |
| Serious (serious injury, or $10^4 damage)                 | 7     |
| Important (disability, or $10^3 damage)                   | 3     |
| Noticeable (minor first aid accident, or >$100 damage)    | 1     |

### Table 4. The risk score definitions.

| Risk score | Risk situation |
|------------|----------------|
| >400       | 100            |
| 200–400    | 40             |
| 70–200     | 15             |
| 20–70      | 7              |
| >20        | 3              |

### 3. Results

Assessment of the severity of the consequences of an accident is one the main elements for calculating the total occupational risk at an enterprise. The severity of the consequences of an accident or accident reflects the consequences of these events, expressed in monetary terms. Therefore, in order to analyze and develop further measures and prevent such cases, it is necessary to conduct a study of the damage received by the organization.

To carry out this study, an analysis was carried out of incidents and accidents that occurred over 3 years at one of the coal mining enterprises. During the research it was revealed that 7 accidents occurred at the enterprise. The consequence of one of them was a fire, where 3 people were seriously injured and 2 minor injuries. At the same time, 13 accidents were identified during the study period. Among them, 5 employees were seriously injured and 16 were injured of mild severity. Also, 1 employee was diagnosed with an occupational disease during a medical examination. Along with this, incidents were identified that contributed to the failure of equipment. To restore process has been expended funds for its repair.

Thus, the analysis promoted calculation of the overall level of severity of the consequences of the accident - $ 17534. Therefore, according to Table 4, this level of severity of accident consequences refers to “Very serious” (fatality, or >$10^5 damage).

Based on the results obtained, an analysis was carried out, and the «weakest» points in the enterprise were identified. Also, measures were recommended to prevent such cases and reduce the level of injuries, as well as to protect workers from harmful working conditions that contribute to the development of an occupational disease.

### 4. Conclusions

As a result of the study, the severity of the consequences of accidents at the enterprise was determined. Carrying out such activities allows you to detect and use information for further monitoring and development of measures to eliminate such incidents and accidents. This work is one of the components for further research on the development of a methodology for evaluating a comprehensive assessment of occupational hazards. This study shows what financial losses contribute to various accidents, incidents and accidents during the execution of the technological process. This information can be used to draw the attention of employers to improve the level of labor protection at the enterprise, which will reduce the damage to the enterprise from various adverse situations.
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