American Journal Of Applied Science And Technology
(ISSN – 2771-2745)
VOLUME 03 ISSUE 02 Pages: 82-92
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 7.063)
OCLC – 1121105677
Crossref doi Google Scholar WorldCat MENDELEY
Publisher: Oscar Publishing Services

Journal Website: https://theusajournals.com/index.php/ajast

Research Article

THE AXIOM OF POTENTIAL DANGER. RISK AS A MEASURE OF DAMAGE IN TRANSPORT COMPANIES

Submission Date: February 18, 2023, Accepted Date: February 23, 2023,
Published Date: February 28, 2023
Crossref doi: https://doi.org/10.37547/ajast/Volume03Issue02-09

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ABSTRACT

This article addresses the question of the Axiom of Potential danger, which provides for a quantitative assessment of the negative impact, which is assessed by the risk of damage to the health and life of the employee.

A quantitative measure of the danger (possible danger) of an adverse event or the state of the technological process that led to a violation of the requirements for labor protection or safety.

KEYWORDS

Danger, потential danger, professionalrisk, andindividual risk, collective riskк, acceptable risk,social risk.оциальный риск.

INTRODUCTION

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Danger – situations, operations, actions, etc. manifest as events that can lead to accidents and / oroccupational diseases.

Axiom of potential danger- Potential danger lies in the hidden, implicit nature of the manifestation of dangers.

The axiom of potential danger provides for a quantitative assessment of the negative impact, which is assessed by the risk of damage to the health and life of the employee.

Occupational risk-a combination of the probability of damage to the health and life of an employee in the course of work and the severity of this damage. Occupational risk assessment is a procedure that allows you to determine the quantitative or qualitative value of a risk indicator.

The probability of health damage resulting from the performance of work duties is called an occupational risk. They exist in almost any profession, and the following occupational factors can cause damage to health:

- physical— noise, vibration, temperature changes, exposure to ionizing and non-ionizing radiation, etc.
- chemical— interaction with harmful substances.
- biological— interaction with plants, animals, and microorganisms.
- the severity of the labor process— everything related to physical exertion and the position of the body in space during work;
- the intensity of the labor processis a load on the organs of perception.

The occurrence of colds can be attributed to occupational risks. However, this is not comparable to occupational risks leading to disability or death. Therefore, it is logical to distinguish risk levels.

A lowlevel of risk implies the likelihood of a short-term health disorder.

A significantlevel of risk is considered to be the level at which moderate to light damage to health can be caused. If the health can be caused, including serious harm, this level of risk is calledhigh. The highest level is lethal[2].

The complex of measures for assessing occupational health and safety risks includes: identification of occupational risks, assessment and reduction of their level.

To identify and assess occupational risks, you must:

- production control;
- state sanitary and epidemiological supervision;
- sanitary and epidemiological assessment of means of production;

Each of these activities includes:

1. Workplace inspection,which allows you to identify harmful factors in the production environment (existing or possible), as well as the types of work during which employees may be exposed to these factors.

2. Collect datato compare it with current regulations.

3. Assessment of the possibility of completely eliminating or reducing the hazardto the minimum acceptable level.

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Thus, to assess professional risks, it will be necessary to attract specialists of engineering and scientific orientation. Methodological manuals, specialized tables, databases, and software are also needed to determine risk levels.

It should be taken into account that in addition to working conditions, important risk factors are the competence of the employer and employee in matters of industrial safety. Competence management includes training, including targeted instruction (for example, before mass events), moral and material incentives, and disciplinary actions. If an employee has been absent from the workplace for more than a year (for example, on maternity leave), an extraordinary check of their knowledge is required after returning to work знаний .

Actions that reduce and manage risks:

1. Eliminate a hazard or risk. Measures that include modification of equipment and technological processes. For example, the introduction of technical devices to protect employees from electric shock.

2. Replacing one risk with another. Measures aimed at using materials, substances, and processes that perform the same functions, but are less dangerous.

3. Technical measuresare aimed at isolating people from danger. A classic example is protective screens, curtains, and screens for X-ray room staff.

4. Administrative measures. Continuous administrative control, checking equipment, informing employees about the rules and working conditions at the workplace.

5. Use of personal protective equipment (PPE) . It is necessary not only to organize the issuance of protective equipment according to standard industry standards, but also to monitor their use and maintenance.

6. Behavioral security audit. Measures aimed at consolidating the results obtained and reducing dangerous actions that occur due to the human factor. For example, employees may incorrectly use protective equipment, forget to turn on additional lighting or heaters, create drafts, or create traumatic situations. All this can be identified and corrected as a result of a behavioral audit.

These measures and actions are carried out in accordance with the plan drawn up by occupational health and safety specialists and approved by the company's management. The plan is a list of works and deadlines for their implementation, indicating the responsible persons.

Risk is a combination of the probability of occurrence of a dangerous event in the course of work and the severity of injury or other damage to human health caused by this event.

Such factors of industrial risks entail several groups of adverse consequences.

- explosions.
- fires.
- failure of mechanisms and equipment;
- injuries, occupational diseases, or death of an employee.
- causing damage to the environment;
- causing harm to third parties;

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The main methods of quantitative risk assessment includeметод анализа чувthe sensitivity analysis method, thestatistical testingmethod (Monte Carlo method), and the modeling method. The sensitivity analysis method is one of the main methods of quantitative risk analysis.

Risk assessment can be carriedout by a specialist in labor protection or the labor protection service, but it is more effective to create a commission of three to seven people. The composition of the commission is determined depending on the number of employees and the scope of the organization's activities.

Risk management methods and tools

1. refusal to engage in excessively risky activities (refusal method),

2. prevention or diversification (reduction method),

3. outsourcing or insurance of costly risk functions (transfer method),

4. formation of reserves or reserves (acceptance method).

The risk management process consists of three stages:

- identification (identification) of hazards;
- assessment of risk levels;
- development of measures to reduce or control risk levels.

The procedure for risk assessment is not spelled out in the legislation.

To identify, identify and assess risks, you can hire a third-party expert organization or conduct the procedure yourself. If the organization has decided to conduct a risk assessment on its own, then you can develop your own algorithm for the procedure or usea four-step algorithm.

In practice, the most commonly used methods are:

Faina-Kinneyis a risk assessment based on the product of three components: the degree of exposure of an employee to a workplace hazard, the possibility of a workplace threat, and the severity of the consequences for employees if the threat occurs.

Positive:	Easy calculations
	You can get a quantitative assessment of the level of risk
	Visibility
Disadvantages:	Subjectivity in the assessment process

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Matrixapproach – based on calculating the probability of occurrence of dangerous situations and the level of severity of consequences for the employee's safety and health.

Positive:	Visibility
	Simplicity
	You can easily rank risks
and disadvantages:	Low objectivity
	You need to set the scale criteria in the matrix

Система Elmery system- the method is based on observations. These observations cover all the most important components of occupational safety, such as the use of protective equipment, workplace order, safety when working with machinery, occupational health and ergonomics.

Positive:	Ease of calculation
	and flexibility in application
	Suitable for small businesses
	Planning of actions to eliminate the identified nonconformity
Disadvantages:	One workplace hazard may be critical, but the risk factor will be low

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	Factors affecting occupational safety are assumed to be equivalent

Checklist-represents a list of risks that are evaluated yes/no.

Positive:	Application at any stage of work execution
	Flexibility in application
	It can be used by a manager of any level, not just an expert
	Suitable for small businesses
Cons:	You can miss important points
	Used for already known hazards
	Assessment frequency
	There may be a formal approach: put a check mark

Cause tree- allows you to identify the root cause of a hazard and reduce the risk. To do this, ask at least five questions "Why did this happen?".

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Positive:	The primary cause is identified, not the superficial
one. Cons:	It is necessary for the danger to arise and cause harm

Table. Comparison of risk assessment methods

Method	Complexity	Ability to rank risks	Visibility	Ability to identify factors that caused increased risk	Need to combine with other methods for ranking	Scores
Fine – Kinney scores	2	2	2	2	2	10
Matrix	2	2	2	2	2	10
Система Elmery system	2	1	1	1	1	6
Checklist	1	1	1	1	1	5
Reason tree	1	1	2	2	11	7

The more points assigned to the method, the more accurate and complete the risk assessment can be.

Difficulty: 1-easy, 2-medium.

Ability to rank risk: 1-no, 2-yes.

Visibility: 1-no, 2-yes.

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Ability to identify factors that have caused an increased risk: 1 – no, 2-no.

Need to combine with other methods for ranking: 1-yes, 2-no.

Step 4. Adjust your risk assessment.

The final stage of risk assessment is registrationof the hazard registerand adjustment.

Based on the results of the risk assessment, make a list of them, depending on the level of each risk.

In order to reduce the risks, eliminate or reduce the risk factors. To do this, take measures to reduce the risk level:

- exclude dangerous or harmful work, procedure, process, raw materials, materials, equipment, etc.
- replacedangerous or harmfulwork, procedure, process, raw materials, supplies, equipment, etc.
- implement technical methods to limit the risk of exposure to hazards for employees;
- implement administrative methods to limit the risk of exposure to hazards for employees.
- providePPE workers.

Make a risk management and control plan. All assessed risks are subject to management, regardless of their level.

After reducing the risk levels, re-evaluate the risks

Based on the results of the repeated risk assessment, determine the level of risks, and develop measures to control the level so that it remains at an acceptable or acceptable level for the employer.

Occupational risk assessment is carried out independently of a special assessment of working conditions. The employer has the right to use the results of the SAIT to identify hazards in the workplace, but this is not necessary. You can use any information in your organization that will help you identify hazards.

A quantitative measure of the danger (possible danger) of an adverse event or the state of a technological process that led to a violation of labor protection or safety requirements is the risk R-a combination (product) of the probability (or frequency) of damage and the severity of this damage [3]:

$$R = \sum_{i=1}^{n} P_i U_i ,$$

where pii – is the probability (frequency) of the i-th adverse event for a certain period of time.

Ui – severity of damage caused by the i-th adverse event or condition over a certain period of time.

n is the number of adverse events over a certain period of time.

In the course of work, the employee may be affected by the following main types of hazards caused by:

- professional activityof the employee;
- production activities of the organization;
- not related to the professional activity of the employee and the production activities of the organization;

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- the specific type of work performed.

Each of the identified hazards (a manifestation of the hazard) the damage associated with its manifestation is put in line.

In general, when assessing risk in the workplace , an N-level scale of damage can be used, each level of which is assigned a certain weighting coefficient by expert assessment (Table 1).

Table 1

Example of a three-level scale of damage severity

Severity of damage	Weight ratio	Verbal description of the damage
Small	5	The injured employee does not require medical treatment; in the worst case, 3-day absence from work
Average	10	The injured employee is taken to a health organization or needs to be visited; absence from work for up to 30 days; development of a chronic disease
Large	15	An accident causes serious (incurable) health damage; requires hospital treatment; absence from work for more than 30 days; permanent disability or death

When choosingthe level of severity of damage, you can use the classes of working conditions established based on the results of a special assessment of working conditions.

Quantitative risk indicators allow you to assess potential hazards and even compare hazards of different nature. In relation to the problem of life safety and industrial safety, such an event can be a deterioration of health or death of a person, an accident or catastrophe of a technical system or device, pollution or destruction of an ecological system, the death of a group of people or an increase in population mortality. For the industrial sphere of activity, the study of the ratios of risk objects and undesirable events makes it possible to distinguish between professional, individual, collective, environmental, social and economic risks. Each type of risk is determined by its specific sources and factors.

Individual risk – a characteristic of the implementation of the danger of a certain type of activity for a particular employee. The indicators of occupational injuries and morbidity used in our country, such as the frequency of accidents and occupational diseases, are an expression of individual occupational risk.

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Individual risk is the probability of undesirable consequences for an individual arising from certain hazards at a particular point in space. The risk value is determined by the probability R

$$R = \frac{n}{N} \times \frac{t}{T},$$

wherenis the number of undesirable consequences for the observation period (usually one year);*N*is the number of maximum possible consequences;*t* isthe time period of the hazard existence; *T*is the observation time.

For example, if an average of 10,000 people die from road accidents every year in a country with a total population of 10 million, then the individual risk of road accidents is equal to

$$R = \frac{10^4}{10^7} = 10^{-3}.$$

If you have to visit this country for 1 month, then the individual risk of dying in an accident is

$$R = \frac{10^4}{10^7} \times \frac{1}{12} = 8 \cdot 10^{-5}.$$

Collective risk-a characteristic of the realization of the danger of a certain type of activity for a group of employees.

Occupational risk is a dimensionless value determined for a specific period of time, most often for a year. Occupational risk is accepted as a criterion for the safety of production equipment and technological processes. Due to the impossibility of achieving absolute safety of production, there is a concept of acceptable (acceptable) and expected(predicted) risk.

Acceptable risk$_{доп}$RR is the minimum amount of risk that is achievable in terms of technical, technological, and economic capabilities. It represents a compromise between the level of security and the ability to achieve it. The amount of acceptable risk depends on the industry of production, the employee's profession, and the type of negative factor that determines it.

The maximum acceptable level of total risk of human death in many countries of the world is assumed $R_{\text{to be}}$ $_{RR}$ = 10-6^{-6} per year, and the average occupational (acceptable) risk is 2.5·10-6^{-6} per year.

For comparison, the estimated value of the risk of death of an employee in production in Russia as a whole is 1.5·10-4^{-4}, and in railway transport it is 0.9·10-4^{-4}.

The realization of a danger in the form of an injury or illness is possible only if three conditions are met simultaneously: the presence of a source of danger, the presence of a person in the "risk zone", and the absence of protective equipment.

For risk analysis, a number of methods, techniques and software tools are used to comprehensively study hazards and assess the risk of an emergency situation, the source of which is an industrial facility. Terminology

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and methodology for analyzing the risk of violations of labor protection requirements are given in GOSTa R Uz.

In addition, the concept of "risk level" ***R is used***, i.e. the probability of an undesirable event occurring, taking into account the amount of possible damage from the event. The degree of risk isthe mathematical expectation of the amount of damage caused by an adverse event or condition:

$$R(m) = p_i m_i,$$

where p_i is the probability of occurrence of an adverse event or condition related to damage.
m_i – random value of damage caused to the economy, health, etc.

Social risk-reflects the dependence of the number of people killed on the frequency of eventsthat cause the death of these people.

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