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Labour and processes safety

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CONTENTS

1. INTRODUCTION TO THE PROBLEMS OF SAFETY AND RELIABILITY, DEFINITION OF THE CONCEPTS OF QUALITY, RELIABILITY AND SAFETY

1.1. Introduction to the problems of safety and reliability

Implementing the basic elements of risk management in a clear and reliable manner in any scope and context. Each industry or method of risk management application has individual needs. The risk management process must be an integral part of the organization's management, it must be anchored in the organization's culture and practice, and it must be adapted to its processes. The risk management consists of:

- Communication and consultation,
- Definition of the connections,
- Risk assessment (includes identification, analysis and risk assessment),
- Risk management,
- Risk monitoring and process verification.

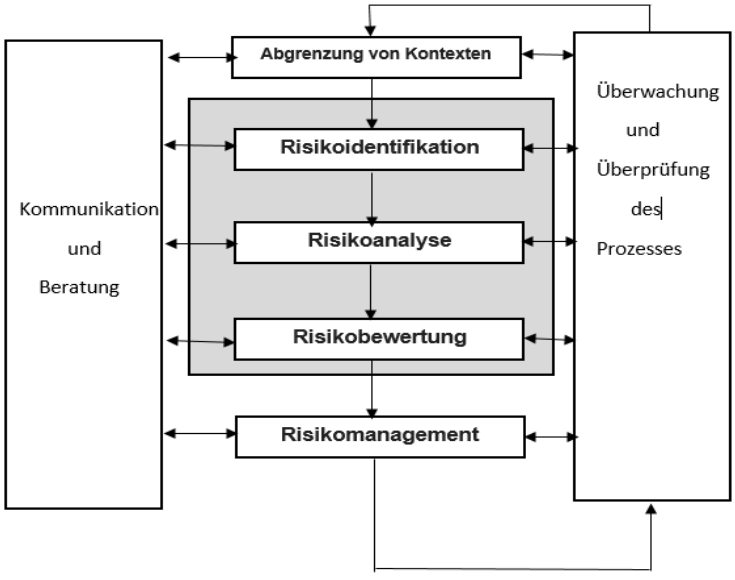

Figure 1 - Risk management process
Source: ČSN ISO 31000:2010

The main objective is to increase security processes and all levels. The introduction of security measures includes a process or measure to minimise risk. Risk reduction can come thanks to:

- reducing the vulnerability of the asset
- Eliminate threats
- reducing the likelihood of an emergency
- reducing the severity of the effects of an emergency

The importance of the impact depends in individual cases on loss, which includes the cost of taking back and the cost of the consequences of the damage.

1.2. Basic concepts

Safety - the state in which the risk of danger or the occurrence of damage is eliminated or reduced to an acceptable level

Target value - a detailed, concrete and well-defined requirement, as far as possible, concerning the organisation, arising from the objectives and which must be met in order to achieve the declared objectives

Factor - the component, the criterion of the working conditions, of which the quantity exists, which is used for the evaluation of work, workplaces etc.

Risk assessment - a comprehensive process for determining risk size based on the analysis of possible consequences of a deliberated/expected exceptional event and its probability of occurrence; part of risk assessment is the decision whether to accept the risk or to limit it to an acceptable level (a complex process for determining risk size and deciding whether the risk is acceptable or not).
This term covers the whole process of hazard identification, risk assessment and risk mitigation or risk management measures.

Identification of hazards - the process of identifying hazards, their size, nature and location.
Exceptional event - an unplanned event caused by human activities, natural influences and also an accident resulting in injury or other damage to human health or property or damage to the environment.

The hazard - source or situation with the potential to cause harm, such as personal injury or illness, property damage, environmental damage or a combination thereof, such as the possibility of machinery, machine systems, technologies, work systems, materials, raw

materials, etc., which may cause harm to human health or property (hazard is a source of risk).

The accident - an undesirable event leading to injury, illness, damage or other loss.

Disagreement - any deviation from labour standards, practices, procedures, regulations, management system compliance, etc. that may directly or indirectly result in injury or illness, property damage, damage to the working environment or a combination thereof

2. THE LEGISLATURE IN SAFETY AND HEALTH PROTECTION

Law. 262/2006 Coll., Labour Code, as amended, which regulates:

- The procedure before the employment relationship.
  - Covering of medical examination.

- Employment, employment contract and employment relationship.
  - Information on the content of the employment relationship.
  - Introduction to legal and other regulations to ensure health and safety at work and other regulations.

- Changes in the employment relationship
  - Transfer to another job.

- Contracts for work outside the employment relationship.
  - Contract for the performance of an activity, Contract for the performance of an activity

- Working hours and rest periods. 4
  - Weekly working hours.

- Classification of working time
  - Equal or uneven division of working time, flexible division of working time.

- Work break and safety break.
  - Uninterrupted rest between two shifts, uninterrupted rest in the week.
  - Overtime, night work, standby duty.

Act No. 309/2006 Coll., which regulates further requirements for health and safety at work in industrial relations and for safety and health protection in activities or services outside the employment relationship, as amended, which regulates:

- Additional health and safety requirements at work in employment relationships
  - Requirements for the workplace and the working environment.
  - Requirements for the workplace and the working environment on the construction site.
  - Requirements for production and work equipment and equipment.
  - Requirements for the organisation of work and procedures.
  - Safety signs, signs and signals.

- Avoidance of food and health hazards.
    - Risk factors of working conditions and controlled zones.
    - Prohibition to carry out certain tasks.

- Professional competence and special professional competence.

- Ensuring health and safety at work or providing services outside employment.

- Other tasks of the contracting authority, its contractor or the natural person involved in the construction and the occupational safety and health coordinator.

Act 258/2000 Coll. on the Protection of Public Health and on Amendments to Certain Related Acts, as amended, regulating the following:

- concern for living and working conditions.
    - Hygiene requirements for water.
    - Swimming pools and saunas.
    - Hygiene requirements for the premises and traffic of schools.
    - Internal environment of buildings.
    - Protection against noise, vibration and radiation that does not ionize.
    - Use of biological factors and asbestos.
    - Treatment of hazardous chemical materials and mixtures.
    - And more.

- The advance of the emergence and spread of infectious diseases
    - Cure of infectious diseases.
    - Preventive measure against the spread of infectious diseases by physical persons secreting pathogenic germs.
    - Protective disinfection, disinfection, deratization.
    - And others.

- Further obligations of persons in public health protection.

- State administration in public health protection.

Decree No. 361/2007 Coll. determining the conditions for health protection at work, as amended, which regulates:

- This regulation deals with the corresponding regulations of the European Union and addresses with regard to directly usable regulations of the European Union.
    - Risk factors of working conditions, their divisions, methods and detection methods, hygienic limits.
    - Evaluation methods of the risk factors in relation to the health protection of the employee.

- The minimum scope of health protection measures of employees.
- More detailed conditions of delivery of protective drinks.
- More detailed hygienic requirements for the workplace and working environment.
- More detailed requirements on the way of work and work procedure organization in case of heat or cold load, work with chemical substances, mixtures, chemical dust, lead, asbestos, biological factors and physical load.
- More detailed requirements for working with display units and others.

- Work performed at a workplace that is not or only partially protected from external effects.

Decree No. 79/2013 Coll. on the implementation of certain provisions of Act No. 373/2011 Coll. on specific health services (Decree on medical employment services and certain types of trust-based care), which provides:

- Assessment of the state of health of employees or persons applying for employment.
  - Determination of the influence of work activity, working environment and working conditions on their state of health.
  - Evaluation of the results of the monitoring of the strain of the employees' organism by the effect of the work environment risk factors.
  - The processing of the analyses of the occurrence of the accidents at work and their causes, analyses of the employment sickness occurrence or threats of them, or the sickness occurrence related to the employment.
  - Evaluation of data on the influence of work activity, work environment and working conditions on the health of employees and related sick leave, and others.

- Consulting activities.
  - In the field of ergonomics including work physiology, psychology, regime and rest, definition of performance norms.
  - Planning, construction and reconstruction of workplaces and other employer regulations.
  - In the introduction of new technologies, materials and processes with regard to their influence on working conditions and health of employees.
  - In the preparation of workplaces, including workplaces for employees with health disabilities.
  - In the selection of technical, technological and organizational measures and in the selection of personal protective work measures.
  - In the issue of drinking plan and provision of protective drinks, and others.

- Supervision security.
    - Regular monitoring of workplaces and work performance in order to identify and evaluate risk factors.
    - Supervision of company catering and other employer's facilities.
    - Risk assessment using information on exposure measures of risk factors during work, results of analysis of occupational illnesses, accidents at work and illnesses related to employment.
    - Cooperation in elaboration of proposals for employers for removal of established obstacles.

3.RIGHTS AND OBLIGATIONS OF THE EMPLOYEE AND THE EMPLOYER

3.1. Obligations of the employer

An employer:

- does not allow the employees to do any forbidden works and works, their difficulty would not correspond to the ability and the state of health of the employee.
- informs the employee about the category to which his work belongs.
- replaces possible loss of earnings for the employee who undergoes a preventive examination, examination or vaccination, in the amount of the average salary.
- Should be safety and health protection (safety and health protection) of employees at work, taking into account the risks of possible health threats affecting the execution of work.
- The maintenance of safety and health protection provided by the employer is an inseparable and equal part of the work duties of the heads of employment at all levels of management within the scope of the position they occupy.
- The employer's obligations to ensure safety and health protection extend to all natural persons who remain in the workplace with this awareness (i.e. also to any clients in the company).
- The costs connected with the health and safety grant are paid by the employer and may not be transferred directly or indirectly to the employees.
- shall systematically search for and evaluate risks, take measures to eliminate risks.
- allows employees not to do forbidden work (pregnant women, young people).
- provides entrance and preventive examinations for the employees, or first aid.
- Do not use any kind of work rewards leading to increased risks of Gesungeit damage.
- ensures compliance with the smoking ban in the workplace.
- provides rooms for pregnant nursing mothers and mothers who became mothers 9 months ago.

3.2. Obligations of the employee

Every employee is obliged to take care of his or her own safety, health and also the health of other natural persons who are directly affected by his or her actions (or omission from work) to the best of his or her ability. Knowledge of the basic obligations to ensure safety and health protection at work resulting from the employer's legal and other regulations and requirements is an inseparable and permanent part of the employee's qualification requirement. The basic duties of employees are determined by the Act § 106 of the Labour

Code, and every employee is obliged to comply with them:

- to participate in employer-supplied training courses focused on safety and health protection, including examinations of their knowledge.
- to undergo official examinations or vaccinations determined by special regulations.
- To comply with the employer's legal and other regulations and instructions to ensure safety and health protection at work about which he is lawfully known, and to act in accordance with the principles of safe conduct at work and employer's information.
- to work in accordance with the established working procedures, to use established work equipment, means of transport, personal protective work equipment and protective devices, and not to change them or put them out of operation without authorization.
- not to consume alcoholic beverages, not to abuse other addictive substances at the employer's workplace and during working hours outside these workplaces, not to enter the employer's workplace under their influence and not to smoke in other workplaces and rooms where other non-smokers are also exposed to the effects of smoking.
- to acquaint its superior manager with the deficiencies and complications in the workplace which threaten or could directly threaten the safety or health of employees at work, in particular with the imminent occurrence of the special event or the organisational shortcomings, defects or malfunctions of technical equipment or protective systems designed to prevent them.
- to take part in the elimination of defects found by the organs during the inspection, with regard to the nature of its work performed; these organs include the performance of the inspection according to special regulations.
- to immediately inform his superior about his accident at work, if it is possible for them to do so, and to inform him about the accident at work of another employee or natural person he has witnessed, and to cooperate in explaining its causes.
- to submit to the determination whether he is not under the influence of alcohol or other addictive substances, on the instruction of the authorized manager of the employee authorized in writing by the employer.

3.3. Rights of the employee

- The employee has the right to cover the safety and health protection at work, information about the risks of his work and information about the measures before their effect, information must be understandable for the employees,

- The employer pays the costs connected with the coverage of safety and health protection, these costs may not be transferred neither directly nor indirectly to the employees.

- The employee has the right to refuse to perform the work about which he reasonably believes that it directly and seriously threatens his life or health.

3.4. Employee training

Training of the employee in the area of safety and health protection should always be carried out before entering employment and proportionally when changing the workplace and work classification, also when introducing new technologies and in such cases which could have an influence on safety and health protection (occupational accident).

The period of training is specified by the employer according to the type of work (the law does not specify neither the periodicity nor the content of the training, but stipulates the performance of "safety and health examinations" at all workplaces at least once a year in cooperation with the trade union organisation or the employee representative).

- Training and risk prevention are determined according to the size of the company. Whether the employer employs (Act 309/2006 Coll.)
- Not more than 25 employees, he can secure tasks of risk prevention himself, if he has the necessary knowledge.
- 26-500 employees, he can secure tasks of risk prevention himself, if he is professionally capable to do so.
- More than 500 employees, he always secures risk prevention tasks with one or more professionally competent persons.

Types of training

- entry trainings
- Periodic training
- special trainings

The training shall be conducted by a person who is technically competent to do so. The professional competence of the persons is given at least by higher education with the Abitur and professional practical course min. 3 years, at the conclusion of the technical school min. 2 years, at universities min. 1 year with the proof of successfully passed examination of professional competence.

4. PERSONAL PROTECTIVE EQUIPMENT

Every employer is obliged by law to protect his employees against accidents and occupational diseases. This safety provides with the help of suitable processing technology, suitable and in the event that the employer is unable to eliminate risks or take such necessary measures that lead to work safety, the worker is obliged to provide personal protective equipment.

Personal protective equipment = these are the means which must protect employees from risks. They must not threaten their health. They should choose not to inhibit work performance and certain conditions should comply with special regulations.

In cases when PS is subject to extraordinary wear and tear or dirt, or when it performs a protective function, the employer instructs the employee to wear work clothes or shoes.

4.1. Instructions PS is subject to:

- § 104 Act 262/2006 Coll., Labour Code, as amended
- Government Decree N.495/2001 Sb., with which determines the scope and more detailed conditions PS, detergents, cleaners and disinfectants
- In the case of activities of epidemiological importance (e.g. food service, food industry), in addition to the above-mentioned ordinance, Act No. 258/2000 Coll., Ordinance 137/2004 Coll., on hygiene regulations governs food service and on personnel principles and industrial hygiene.
- Regulation No. 21/2003 Coll. of the Government Ordinance, which sets technical requirements for PS.

The allocation of the PS must respond to the working conditions and the character of the performed activity. PS are based on certain risks of the competent organization. The time/duration after which PS is used with the employee must be taken into account.

- If it is impossible to eliminate the risks or to limit sufficient collective protective means or with measures in the area of work organization, the employer is obliged to provide PS to the employee.
- The employer is obliged to keep PS in the applicable state and control its use.

- Employees shall be provided with detergents, disinfectants and cleaners based on skin and clothing contamination; in workplaces with inappropriate microclimatic conditions, including protective drinks (drinking water is not a protective drink).

- Employees should inform about the use of protective means. (they confirm this with their signature)
- PS, detergents, disinfectants and cleaners are provided by the employer of the employee compared to her signature (registration card PS)

- PS, detergents, disinfectants, cleaning agents and protective drinks are provided free of charge by the employer according to his own list, processed on the basis of risk assessment and specific working conditions.

- The employer may not replace PS benefit with financial fulfillment.

4.2. Assessing the risks for the selection and use of PS

In the course of using PS, they are always the property of the Company. When assessing the risks for the selection and use of PS, the procedure was primarily based on Annex No. 1 of Government Regulation No. 495/2001 Coll. which assesses the risks:

- endangered body parts
    - Head (skull, hearing, eye, whole head, face),
    - upper extremities (hands, arms, and their parts),
    - lower extremities
    - skin
    - fuselage
    - belly
    - whole body

Types of hazards:

- **physiological**
    - Mechanical hazards (fall from height, impact, shock, smashing, stab wounds or cuts, slipping, vibration)
    - Thermal hazards (fire, heat, cold)
        - electricity
    - Radiation (ionizing, non-ionizing)
        - din

- **chemical**
    - Aerosols (dust, thread, smoke, fog)
    - solids
    - liquids
    - Gases and vapours

- **biological**
    - Bacteria,
    - Viruses,
    - Parasites,
    - Mould,

When personal protective detergents, disinfectants and cleaning agents were assigned, they were primarily classified according to Annexes No. 2 and 3 of Government Regulation No. 495/2001 Coll. With individual PS, PS are classified according to this Annex for protection:

- The head,
- Hearing
- Eyes and face,
- Respiratory tract,
- Hands and arms,
- Legs,
- Body and belly,
- For the protection of the whole body.

PS the employer extends the employee free of charge. It does not work at all, replace it with financial compensation.

PS must meet the following requirements:

- On useful life they must be effective against risks.
- It should not represent any further risk for a worker.
- They should be adjusted for individual employees.
- They should respect ergonomic requirements and health of employees.

5. SAFETY AND RELIABILITY OF LOGISTIC CHAINS AND SYSTEMS

Process is a general term for the gradual flow of actions, states, activities or works. In the real world there are more types of processes, so the term process is used in practice in different ways.

5.1. Operational processes and their reliability

The reliability of processes differs by its very nature from the problems of reliability of technical systems. Reliability of technical systems, production equipment, devices, and the like. The solution of the reliability problems of the processes actually systematically covers the process control of organizations.

Current requirements for process reliability

A complex approach to the problem of reliability of operational processes and only process control from the point of view of reliability management is the way out. It demands a new position. Reliability is a sign for the quality of the process and a quality feature for products. Reliability of the process points to its stability and reliability assessment is an important part in assessing its capability. Improvement of operational processes is related to increasing their reliability. It is therefore necessary to analyse the processes and their improvement in the organisation.

The procedure can be divided into four basic steps:

- Analysis of operational processes
- Evaluation of the reliability of operational processes
- Analysis of the causes of the unreliability of operational processes
- Improvement of the reliability of operating processes

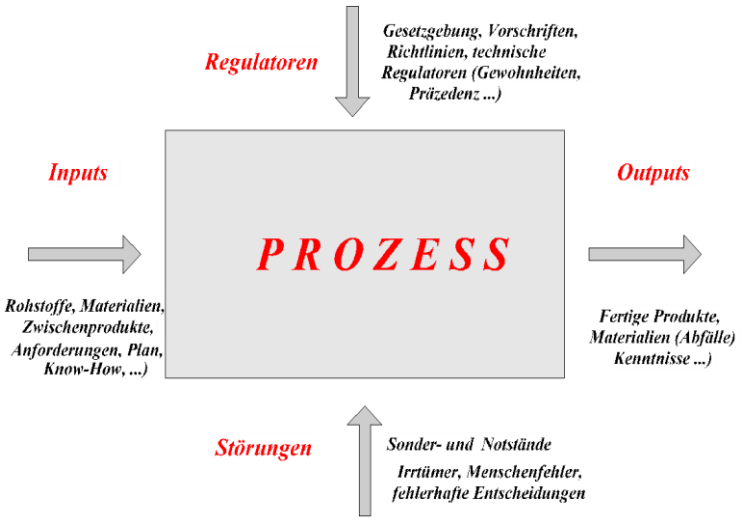

Fig. 1 - Process

There are three basic positions for controlling **the activities and processes in an organization**.

- functional position
- process position
- project position

We can understand operational processes as the consequence of operations that can run sequentially in parallel and whose occurrences have a fundamental influence on the customer. It is necessary to accept that the process offers certain "services" for internal or external customers. So, we can understand the reliability of the process also as the reliability of the service and further we can subdivide it respectively into the readiness of the process and continuity of the process. From a certain point of view, the integrity of the process can be included in the reliability of the process in a broader sense.

- The readiness of the process. We can consider the readiness of the process as the ability to provide services, which is to perform certain operations in required quality and under given conditions (activity), if the services are required by the internal or external customer. The process is triggered by a request (signal) to implement it. Standby depends on the properties of the objects through which the process (service) is realized.

- Continuity of the process. - We consider the continuity of the process to be the ability to realize the process that has already been opened, under given conditions, at a fixed time, which is that it does not lead to the failure of the process.

- Integrity of the process - Represents the ability to realize operations without special worsening, that is in constant quality.

5.2. Evaluation of process reliability

Assessment of the reliability of processes depends on their character. Understandable influences on evaluation also have conditions under which the realization of the process takes place. From this point of view, processes can be divided into three basic categories:

- Continuous processes
- Repeated processes
- Unique processes

5.3. Assessment of the reliability of continuous processes

In the field of continuous process it is possible to take advantage of the theory of reliability, which we use when evaluating the reliability of technical systems. We approach the assessment of reliability of continuous processes in the same way as we approach the reliability of renewal objects.

5.4. Evaluation of reliability of repeated processes

We can also apply the apparatus of reliability theory, as we know it from the evaluation of technical systems, to the evaluation of processes that repeat themselves regularly or irregularly. Because there is a situation here where the process realization changes with the process idle state period, when the process is not realized, the most suitable indicators for assessing the reliability of these processes are, first of all, readiness and operational readiness indicators. Reliability and sustainability indicators may also be used where appropriate in view of the nature of the processes.

5.5. Evaluation of the reliability of unique processes

The reliability of one-time (not repeated) processes can be estimated in such a case that it is a question of complicated processes, which have e.g.: the character of the project. In order to evaluate the reliability of these processes, it is possible to divide disruptions into critical processes and less significant processes. A critical failure of a certain operation can put the whole process out of operation for a long time. Less significant errors can lead to cost increases and delays in the implementation of the process. To evaluate the reliability of the process with respect to critical errors, we can use a reliability block diagram method when trying to predict the failure probability of suboperations to determine the failure probability of the entire process.

6.FAULTS

Disturbance = a state consisting in the completion of the ability of object to perform the function for which it is intended. The object that has the fault is in the fault state.

Error state = a state when object does not fulfil its function. Exception makes a planned maintenance or a moment when the object does not work due to external constraints (e.g. lack of energy, fuel).

Lifetime= the ability of an object to perform the required functions to reach the limit values for certain system prescribed maintenance and repair; the limit values of the object is a state in which the next object use must stop; criteria of limit values for the object establishes technical communication.

Safety = property of the object does not endanger human health or the environment by fulfilling the prescribed function at the specified time and under specified conditions.

6.1. Sorts of disturbances

We can sort disturbances:

According to the cause of the occurrence:

- Constructive disturbance-is prepared with the wrong project
- Production disruption - is caused by inconsistencies of production execution or certain production methods with object design.
- Fault caused by aging - depends on time factor. Their probability increases with the aging of the object.
- Malfunction from incorrect use - this malfunction is more analogous to the malfunction caused by aging.
- Malfunction from wrong treatment.
- Systematic malfunction - the malfunction, the clearly prepared/caused certain cause and it is possible to eliminate it only with the change of the project or construction application, with the change of the process, with the change of the documentation or with other factors connected with it.

After dependence of one failure on another

- **independent fault** - this fault of the object is not prepared with the fault condition of another object
- **dependent** - this fault is caused (directly or indirectly) by the fault state of another object

According to the time course of the object characteristic:

- **sudden disturbance** - the disturbance that was unexpected
- **linear disturbance** - is prepared with linear changes of certain characteristics of given object in time.

From a degradation point of view

- The operability of the object:
  - **Complete malfunction** - a malfunction that does not cause the object to be fully functional. The given object is not able to perform functions for which it is intended.
  - **Partial fault** - a fault that causes no object to be able to perform certain functions in the fault state. (but not all).

With the combination of points of view are defined:

- **Full failure** - expresses as sudden and complete.
- **Degradation disorder** - this disorder is linear and partial

This picture shows these disturbances:

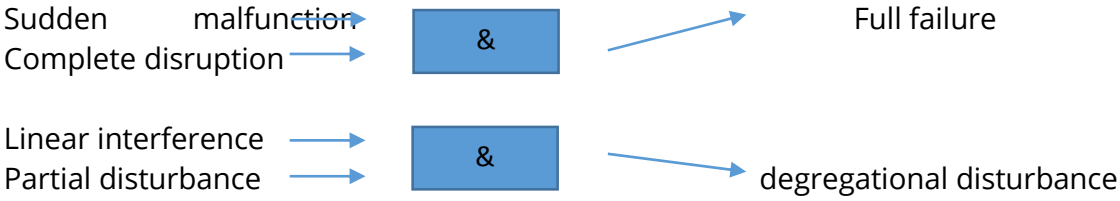

Fig. 3 - Degradation and breakdown fault
Source: (HELEBRANT, HRABEC, & BLATA, 2013) – the author prepared

Operating time to first failure -The total time of the object operation until the first introduction
In usable condition until failure.

Operating time to failure - The total time of object operation from first introduction
In usable condition until failure or from renewal until the next failure.

Operating time under failure - The total time between two failures set under failure object

Operating time until renewal - the period during which the object is in invulnerable condition from internal causes as a reason of failure (LEGÁT V. a., 2013).

6.2. Types of damage

Partial surface of the individual parts prepares each other with mechanical forces, chemical, thermal, electric. Forces and impacts developed on individual machine elements also prepare for operational loading, changes in internal tension, surrounding environment, lubricant, dirt and other substances that may occur on the surface of the plant in the process. The combination of the above mentioned factors leads to various types of damage to machine oils, e.g:

- Wear,
- Eat it,
- Squeeze,
- Deformation,
- Cracks and fractures,
- Other damage.

Seizure - the use of metallic materials is applicable in relation to its useful behavior such as strength and ductility are and among other things (among others) also very good electrical or thermal conductivity. One of the best known types of corrosion is atmospheric corrosion. Next division can be corrosion according to the area of damage to materials

- Surface corrosion
- Bimetallic corrosion,
- Crevice corrosion,
- Intergranular corrosion,
- Selective corrosion,
- Erosion corrosion and others.

Imprint - is constant undesirable surface change, caused by external forces. The pressure is applied at the time when the real contact pressure exceeds the yield strength of the material of the covering.

Deformation - it involves changing the or geometric shape or changing the dimension or body volume. Stress leads to deformation can occur from an element point of view with external or internal forces.

Cracks and fractures - Cracks are damage to the uniformity of the material in the cross-sectional part, fracture is damage to the uniformity in the entire cross-sectional part.

Other damages - this group includes material ageing. Material ageing is caused by alternating stress, often temperature changes, metallurgical processes. These phenomena occur in the course of time without regard to whether it is material, product or plant/machine being used.

7. TECHNOLOGY OF MAINTENANCE AND REPAIR OF MACHINERY

As long as the machine should have safety signs/safety features, reliability, operability and other characteristics, it is necessary to insure its maintenance. As long as sufficient maintenance is provided, which is considered as systematic, then we can talk about assurance of operational reliability. If there is no operational reliability insurance, it goes/leads to frequent malfunctions.

Operational reliability is the most significant and important stage of the technical life of the object because of the machine becoming means of production, i.e. it brings coefficients.

7.1. Under general requirements on maintenance one manages:

Process access - operability and capability in spending the optimal costs is effective in maintenance procedures as a process

Systemic access yield and effectiveness of maintenance is related to increase and control of mutually related processes.

Maintenance procedure is performance management of maintenance should/must implement and create/educate environment in accordance with the overall strategy and concept of production control.

Maintenance is a combination of all technical, administrative and managerial activities during the professional life cycle of an object aimed at its maintenance or its return to the state in which it can perform the required function.

Each maintenance system shall be effectively based on the principle 3P:

- profilaxe
- proactivity
- productivity

The individual stages of development of the maintenance system can be characterized in more detail:

- Maintenance system after the malfunction
- System, planned preventive repair

- System proportional care
- Diagnostic maintenance system
- System Prognostic Maintenance
- System proactive maintenance
- System automated maintenance

In our own production company internship we usually talk about three basic types of maintenance organization, from which we derive the next, e.g. external, etc.

- Decentralized maintenance is ensured in the whole area by employees of the production part of the company, who are professionally integrated into this unit.
- Centralized maintenance - the entire repair and maintenance activity is performed by a single work unit, it deals only with this activity.
- Combined maintenance - autonomous maintenance (treatment) is provided by regular workers of the product unit, repair and other maintenance activity, workers of the individual work unit deal only with maintenance activity.

The aim is that every control, inspection and revision activity (inspection) is to determine the technical condition of the object. Own control and inspection activity is a habit divided into the following two basic groups - subjective and objective, respectively:

- Performing subjective control with service and technology (shift, decade, etc.). These controls are mainly visual in character.
    - **Shift work** - in case of shift delivery, everyone makes the control of his work department and writes down results in the operating machine book.
    - **Weekly (decade)** - a manager of the company object, or team or craftsman (a locksmith + machine electrician) makes and his result give orally to a technician - machine mechanic.
    - **Technical observations** are made with a technician or with a subject (technician - mechanic, revision technician), usually in a certain month, year, etc.

- Technical investigations are carried out by objective methods (technical diagnostic methods) in the form of monitor operation, cyclic (periodic) tracking of operation or tracking of individual order form.
    - We perform non-destructive methods without installation of technical diagnostics for certain machine recording in time (monthly, yearly, etc.) or on order or according to the legislative necessary instructions.
    - Service operation measurement, which is basically the checking of employment or recruitment of insurance bodies.

7.2. Application four vital badges in the control of maintenance:

BENEFITS

- Product solution of maintenance system in given production company,
- **Subject** - organizational unit of the production company (e.g. a.s., division, plant, workplace, etc.),
- **Demand** - ensuring operational reliability and reasonable level of risk of operational safety of production machines and equipment effectiveness.

EFFECTIVITY

- **Process** - Necessity of understanding maintenance as a process, technical activity, i.e. systematic profess access.
- **Structure** - concept and organizational structure of maintenance in a given production company or company,
- **Source** - Means Safety of maintenance

STABILITY

- backward connections and monitoring - is basically tracking operational reliability of any machine, design node etc. and of course evaluation maintenance effectiveness
- Acceptance - integration of all company employees into the maintenance system

DYNAMICS

- **Forewords Connections** - constant solution of maximization of operational reliability based on evaluation of effectiveness and progressive trends in maintenance leads to change of philosophy and maintenance strategy,
- **Activity of people** - must clearly start from change of thinking and attitudes of company workers, what is possible only under the condition of training and qualification.
- **Forecast formation** - determination of remaining durability of machines and equipment (time to necessary repair) for the purpose of production management, which is to form decision insurance, to improve

8.TECHNICAL DIAGNOSTICS

The task of technical diagnostics is the timely identification of the resulting defect, which enables timely fixed heating planning and execution of repairs in the appropriate period/period. With the application of technical diagnostics, economical-ecological operation is achieved and at the same time high/great safety and machine reliability and thus whole processes are ensured.

DIAGNOSIS - A statement about the technical condition of the diagnostic object, i.e. about its existence or the extent of its failure.

PROGNOSE - A statement about the probable development of the technical condition of the object.

8.1. Diagnostic procedure

Diagnostic procedure is a result of individual projects and measurements.
Diagnostic procedures can be described as simple or fanned out.

Simple diagnostic procedure - actions (measurements) are performed in fixed sequences independent of measured values. At present we use it exclusively for documentation of technical condition, e.g. revision measurement.

Advantages

- Simplicity
- No claim to operation
- Revision security

Disadvantages

- high laboriousness
- time-consuming nature
- inefficiency

Branch diagnostic method - it is convenient to apply to more complicated machine. It is logically fanned out. The next step is based on the evaluation of the previous step.

Advantages

- low average effort - main advantage
- detailed diagnosis only of objects where it is needed

Objects in good technical condition leave the diagnostic system very quickly (corresponding value of the diagnostic signal).

Disadvantages

- Difficulty for operation - Experience with diagnostics and similar objects

8.2. Diagnostic methods

it is a method of measurement and evaluation of measured measurements for the purpose of determining the technical condition of the measured object. The basic distribution of methods is subjective and objective.

Subjective - these methods are based on innate human characteristics. On their senses perceive and distinguish deviations of the given object from/from normal state.

Subjective methods can be used:

- **Hearing** - with hearing you can follow the sound of the object. A technical stethoscope can be an aid.
- **Sight** - with sight one can follow visual expressions of the observation unit, e.g. changes of colors, shapes, surface, breaks or presence of foreign bodies. Auxiliaries : magnifying glass, microscope, binoculars, etc.
- **Touch** - with touch one can follow unevenness on surface, temperature, grip, tremor, humidity.
- **Odour** - with odour it is possible to smell the presence of smelling material, heating of insulations and friction linings.

Objectives - these methods are based on measurement of a selected physical quantity. The measured value can be an indicator of the technical condition of the diagnostic object.

Measurement and analysis can be used for objective diagnosis:

- **Operating machine parameters** - power, fuel consumption, power requirements, revolutions, pressures, speed, etc.
- **Machine vibrations and their parts** - speed, acceleration of vibrations, amplitude, etc.,
- **Products of wear in oil fillings** - quantity and type of operating components and impurities, viscosity change, chemical reaction change
- **Thermal fields of the diagnostic object**
- **Physical quantities** - voltage, current, flow rate, pressure and their torque characteristics.

The contribution of technical diagnosis is that it is necessary for planning and maintenance procedures as/as part of the system production process. Therefore, correct selection and combination of diagnostic methods, procedures and correctly set measurement interval is very important. The following methods are used to determine the real technical condition.

Vibrodiagnostics

Vibrodiagnostics is one of the methods of non-destructive gyroscopic apparatus diagnostics. The vibrodiagnostics uses the vibrations generated by the apparatus in operation as a source of information about the operation of the particular apparatus. Vibrodiagnostics is also an important tool of modern predictive and proactive methods of machine maintenance. For measurement and analysis vibration signal is used speed, acceleration or vibration deviation. It is carried out in on-line and off-line modes.

Thermodiagnostics

The task is to measure and evaluate the surface temperature and temperature figures of a tracked object. For measurement it is possible to use touch thermometers, non-contact thermometers, infrared thermometers or thermal imaging cameras. It concerns without assembly, contactless measurement, which is carried out during the work of the tracked object.

Tribodiagnostics

It is without assembly diagnostic method, which uses lubricant as/how information carrier about changes in lubricating places. Mission is to determine main areas when to detect presence of foreign substances in lubricant and its physical and chemical changes.

Acoustic diagnostics

Certain resemblance to vibrodiagnostics, it is followed by the expression of the defects of the machines with the help of the evaluation of the acoustic signal. It is often followed influence of noise on human organism, machine noise, hygienic-technical point of view.

Electrodiagnostics

It is about technical diagnosis of electrical devices by means of various methods. It is often used for identification of current disturbances, voltage, resistance, etc.

Visual control

They can be performed in different ways, among the most common include endoscopic control, performed borescopes. These are the controls that do not require extensive disassembly of the controlled device. Checks are carried out when the instrument is not in use.

Other methods and procedures

Among them one can refer to various methods and procedures for machine diagnostics, such as for prolonging their life, maintenance, adjustment, adjustment, lubrication, etc.

9. INCREASING SYSTEM RELIABILITY

Requirements on reliability together with requirements on functional properties are to be understood as important, because at users they have a clear influence on operating expenses on expenditure on preventive maintenance and after-failure maintenance during the total useful life, on loss caused by inaccessibility due to stands in case of malfunctions, maintenance etc. At present they express the ability not to threaten life and health, environment etc.

9.1. Factors of process reliability

Many factors have an influence on reliability of operating processes, in which processes related to logistics also belong. Influences on process reliability can be divided into the following categories, which are obtained by asking the following questions:

- **Material** - Whose is it made of?
- **Machines and equipment** - Who do you do it with?
- **Environment of the process** - Where do you do it?
- **Human factor** - Who does it?
- **Process** - How do you do it?
- **Information** - What information do you use?

Not only actual theory, but also experiences of practical operation tell us that without system input it is not possible to successfully solve problems of reliability of the system with heavy structure. The following steps can be applied to increase the reliability of the overall operating process.

- **Decomposing the whole operational process to smaller operational processes.**

- **Categorize these smaller processes according to their function:**
    - Main processes,
    - Support processes,
    - Lead processes.

- **Analyse the consequences and connections of these processes from the point of view:**
    - Input and output of processes
    - Duration (sequences, series and parallel processes).

- **Specify critical processes from the point of view:**
  - the meaning,
  - of time,
  - Replaceability/Restorage

- **Decompose these critical processes to smaller orders:**
  - Machine reliability, setup and equipment
  - human reliability
  - Quality of the entry material,
  - Reliability and quality Information delivery
  - Quality of production processes and documentation,
  - Quality surrounding environment.

- **Determine which of these factors are critical in given processes.**

- **Selecting appropriate methods for the feasibility analysis of increasing the reliability of certain factors.**

- **Plan and realize improvement.**

- **Analyse effectiveness.**

9.2. Process of search optimal strategy

Successful solutions of reliability problems require system input, which can be characterized as/as process of search optimal strategy, mutual accompanying reliability assurance in all stages of life cycle, at the same time secured from the point of view:

- **managerial** (reliability programs, reliability planning - fail-safe, maintainability, programs official verification, programs of increase of fail-safe, sorting with loading, etc.),
- **technical** (application of suitable methods of reliability analysis, procedures of official verification, increase of immunity to interference, sorting with loading, reliability tests, etc.)
- **economic** (life cycle cost program).

If a contract is applied between the customer and the supplier, reliability requirements should form a part of the contract, in which it is important to precisely define a system, a device, assembly, etc., to apply them requirements and criteria, on their basis safety, immunity to interference, maintenance, etc. will be assessed. In specification on reliability should also include a reference to factors that may include costs of providing immunity to interference and preservation (expected shelf life, liquidation or recycling). In order to

provide an object or system on reliability is responsible a manufacturer (supplier) and therefore it is recommended special attention mainly to a form of presentation requirements with measures for maintenance supply and methods that are used for assessment required badges.

Simultaneous understanding of a division of responsibility between a manufacturer (supplier) and a customer in relation to reliability products can be summarized briefly:

- Manufacturers or suppliers (or both) are usually responsible for determining reliability requirements for established conditions and service life, their ,, transport into a proposal or project, further ensuring inherent safety, durability, immunity to interference during work stages and for principle provisions and rules of maintenance and a significant extent for maintenance insurance.

- A customer is responsible mainly for compliance with determined conditions of use, i.e. operating conditions (load, environmental conditions), treatment (service qualification) and preventive maintenance; according to circumstances it divides or assumes responsibility for maintenance after malfunction and for maintenance insurance in organizational conditions.

10. SAFETY MANAGEMENT

The original question is the role of safety management already in operation management and the attention that safety management pays to the whole hierarchy of leading positions to safety processes and factors, mainly these areas:

- The conception of the system of safety management, formulated and famous visions, goals and strategy
- Increasing the reliability of the human factor
- The links of the safety management processes and other components and aspects of the management
- Application of the principle of continuous improvement
- Supervision of behaviour and positions of employees and delivery of the back federation
- Integration of all employees
- Utilization of all effective devices of preparation and motivation to safe behavior
- Guarantee of sources, requirements and conditions technical, human, methodical, information, financial, etc.

Risk prevention activities should be based on:

- Process, system and complex approach
- The systematic analysis of risk based on identification of causes of malfunctions, failure of inconsistencies

10.1. Strategic risk management

The basis of the strategic management of safety are the analyses of the operational processes and their potential risks. The strategy must arise in the association on the operational visions and politicians related to safety.

These processes and progresses are a part of the strategic management of safety:

- The formulation and explanation of the organization's commitment improve the results in the hazard-free area.
- The formulation and explanation of long-term intention to improve the safety culture
- Evaluation of the present state in connection with the analysis of reliability and safety of processes, identification of risks and analysis of strong and weak points
- Formulation of requirements and needs of changes
- Formulation of visions of dangerlessness and politicians in cooperation of management with employees

- The proposal of security goals - in cooperation with organizational structures and teams
- Processing strategic and action plans - progress and milestones to achieve comprehensive monitoring of how plans are implemented and regularly revised
- Communication of visions, policies, goals and strategies with all employees so that they were well understood and accepted to the maximum extent.
- Determination of the criterion, its fulfillment according to the foundation of communication with own entities and teams, then the placement of competent project teams
- Analyses of critical factors of success and risks connected with the given strategy
- Classification of actions to achieve fast and visible contributions
- Continuous evaluation of the characteristics and effects of the safety culture
- Communication about the results with all employees

The safety program must be worked out by the operator on the basis of the carried out analysis and assessment of risks of important accident

- The principles of prevention of major averages
- The structure and system of safety management ensuring the protection of health and human life, economic animals, the environment and property.
- Preventive security measure extending to the possible emergence of dominoes and avalanche effects

The operator of the object or installation, classified in group B (higher quantity of dangerous substances), is obliged to further process the safety message, which must contain information about the object and its management system from the point of view of how to ensure prevention in case of important accidents:

- Progress and results of identification of sources of risk
- The measure for protection and on restriction of impacts of major accidents
- The policy of prevention of major averages

10.2. Methods of risk assessment

The methods of risk assessment can be divided so:

- Quantitative
- Qualitative
- Relative

The qualification methods are mostly used in the field of:

- Financial risk (insurance)
- Technical safety (threat of building constructions)
- The security of information systems

e.g. the method:
The risk
Monte Carlo
The model of Markus
Bayes' analyses, etc.

II. RELATIVE AND QUANTITATIVE METHODS OF RISK ASSESSMENT

II.I. Relative Methods

It deals with methods of relative risk assessment (source of risk) of objects, equipment and processes based on properties of hazardous substances, their quantity, system and technology parameters and also on statistics of events, which allow comparison of technology parts, technology, objects and equipment between each other and risk prioritization at the operator or in a given region.

- IAEA - TECDOC-727 method
- Dow Fire and Explosion Index
- Substance Hazard Index (SHI)
- Material Hazard Index (MHI)
- Chemical Exposure Index (CEI)
- Threshold Planning Quantity Index (TPQ)

IAEA - TECDOC-727 method

is used in areas where there are more sources of risk. In particular, they are large industrial companies. This method is about prioritising social risk sources.

The procedure of the method

- Classification of the type of activity and facility.
- Estimation of the external consequences of a major accident for the population.
- Estimate the probability of a major accident.
- Estimation of the social risk.
- Definition of risk priorities.

One assumes with the consequences:

- 100% mortality in the affected area.
- Outside the affected areas, deaths are not taken into account and the impact on the population is not assessed.
- The mitigating factor is taken into account depending on the nature of the hazardous substance.

Three categories are defined in relation to the type of event:

- Circular symmetrical shape of the affected area
- Semicircular - circular asymmetrical
- Elongated, elliptical

Dow Fire and Explosion Index

This is a systemic risk analysis Fire & Exploration Index. Indicates the relative loss rate of the unit or device from the point of view of fire or explosion. Originally, the R&D index was used to select a fire protection method. The R&D index must be implemented at the same time as the PHA method.

Substance Hazard Index (SHI)

A procedure for hazard classification of substances by comparing the concentration of the toxic substance in the air and the equilibrium concentrations of the substance at normal temperatures.

Material Hazard Index (MHI)

The method determines the permissible limit of the hazardous substance with regard to operational safety.

Chemical Exposure Index (CEI)

Method for assessing the threat of toxic substances.

Threshold Planning Quantity Index (TPQ)

A method that determines the permissible limits of the quantity of the substance, safety measures must be taken when exceeding.

11.2. Qualitative methods of risk assessment

Risk assessment methods must allow for the greatest possible completeness and complexity of activity analysis. Otherwise, the results obtained are limited to practical applicability.

For risk identification, the following methods are used, for example: methods listed below

Fault Tree Analysis (FTA)

Fault Tree Analysis (FTA) is a product reliability analysis based on a top-down approach. It identifies and analyzes the conditions and factors that lead to or contribute to a particular undesirable result and affect performance, safety, economics, and other specified product characteristics.

Procedures:

- First, a particular adverse event is determined and defined (always one).
- The analysis of the event and the process system to which it belongs is made.
- The chains of possible causes are identified backwards.
- Using logical links AND and OR, the fault tree is compiled with the analyzed unwanted event at the top and a marked path to its root initiators.
- The tree diagram is analyzed for possible measures.

Erection tree analysis (Event Tree Analysis -ETA)

The procedure graphically expresses the possible results of the accident resulting from the initiation event. As a result, there are emergency sequences, a number of failures and failures that lead to a crash (the success or failure of the system function is assessed). It is suitable for analysing a complex process involving several types of safety systems.

Safety Rewiew (SR)

Security clearance is one of the oldest methods. It is based on inspection meetings in an existing facility or a design review at design time. This method requires communication and collaboration with the analyst and staff.

Preliminary Hazard Analysis Preliminary Hazard Analysis – PHA

Preliminary Threat Analysis - also quantification of risk sources is the procedure for the search for dangerous situations or emergencies, their causes and effects and their categorization according to given criteria. In industry, it is mainly used in the design of the plant, but it can already be applied to the existing plant.

What-if analysis (What-If Analysis - W-I)

This industry standard method is based on brainstorming, where an experienced team identifies emergency situations by asking questions like "What if ...". The study is conducted in the form of work meetings, all questions are asked in writing, and the team collectively seeks answers to the questions formulated, the consequences of imbalances, and recommends actions.

The method depends directly on the experience of the team because of the lack of systematic approach. For larger processes it is better to divide the whole system into smaller subsystems, separate traffic sections and evaluate them separately. On the other hand, the advantage of the method is low time expenditure, the ability to be used at any stage of the equipment's life.

Hazard and Operability Analysis (HAZOP) Study

A method developed to identify and evaluate process hazards and to identify operational problems. It is mostly used during or after the project phase, it is also successfully used for existing processes.

Failure Mode and Effects Analysis (FMEA)

The method creates a table with causes for errors and their consequences for the system or the company. The FMEA identifies simple errors that can contribute significantly to the crash, but is not suitable for an exhaustive list of errors. It is easy to use when you change and modify the process. It can be performed by one analyst, but should be reviewed by another.

Human Reliability Analysis (Human Realbility Analysis -HRA)

A human reliability analysis is a method of assessing the impact of human factors on the occurrence of natural disasters, accidents, disasters, attacks, etc., or on some of their effects. It is a systematic assessment of factors that affect the work of operators, maintenance personnel, technicians and other company employees. The aim is to identify possible human errors, their causes and consequences.
The principle is to ask questions:

- the physical nature of the process
- the characteristics of the environment
- the skills
- the knowledge and skills of the employees

It includes the approaches of microeconomic (human-machine relationship) and macroeconomic (the "human-technology" relationship). The HRA analysis is closely linked to the current work regulations, especially with regard to occupational safety.

Hazard Analysis and Critical Control Points (HACCP)

This analysis is essential for operators in the production, preparation, storage and marketing of food. It consists of identifying the critical points (technological sections) where there is the greatest risk to food safety. The system is based on the principles of manufacturing practice, hygiene rules and requirements.

12. CRITICAL INFRASTRUCTURE

12.1. Explanation:

The security system is a legally anchored, hierarchical, interdependent system of rights and obligations of state administrative bodies, self-governments, private institutions and citizens, leading to the security of all its components regardless of the nature of the threat and its scope. Security can then be understood, for example, as securing the sovereignty and territorial integrity of the Czech Republic, protecting its democratic foundations and protecting life, health and property values. It follows from the definition that this is a multidisciplinary system with an obvious connection to the role of the state as a whole. In the literature, security problems are very often equated with the concept of security. Security is one of man's fundamental feelings. It can be said that immediately after the fulfilment of basic life and physiological needs, the next most important need is security. The aim of the safety system is to provide safety in order to meet one of the most inner needs - safety.

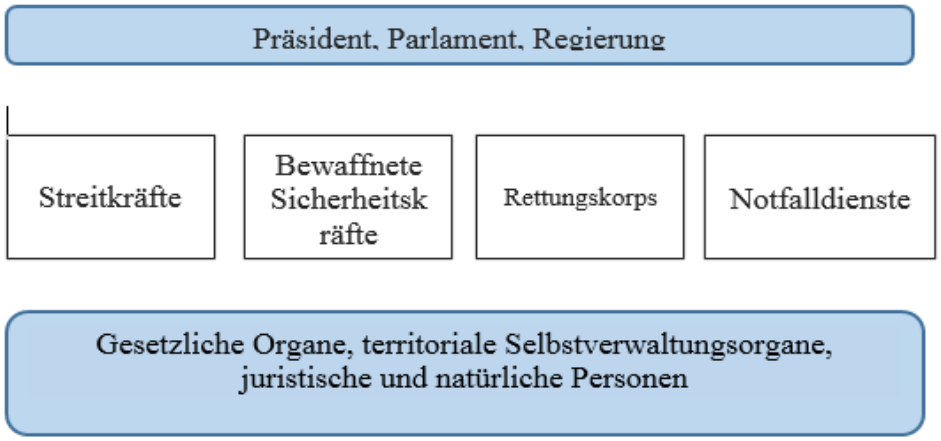

Image 4 -Organisational structure of the critical infrastructure of the Czech Republic
Zdroj: MV-GŘ HZS ČR upravil autor

Crisis management is a summary of the management activities of crisis management bodies to analyse and assess security risks and to plan, organise, implement and control activities related to them:

- **preparation for crisis situations and their resolution**
- **the protection of critical infrastructure**

12.2. The protection of critical infrastructure

- Areas of critical infrastructure in the Czech Republic:
- Energy - electricity, gas, heat, oil
- Water management - drinking water and waste water
- Food - and agriculture - food production, agricultural production
- Health care - medical activity and protection of public health, medical supplies
- Transport - road, rail, air and water transport
- Communication and information systems - telecommunications, satellite communications, Internet
- Banking and financial sector - public finance, banking, insurance, capital markets
- Emergency services - Fire Brigade, Police of the Czech Republic, AČR
- Public administration - justice, penal system, social protection and security

Critical infrastructure - manufacturing and non-production systems and services, their malfunctioning would have serious implications for state security, the economy, public administration and livelihood security. A critical infrastructure can be a critical infrastructure element or a system of elements.

Critical infrastructure for critical infrastructures in Europe on the territory of the Czech Republic, the disruption of which would have serious consequences for another Member State of the European Union,

Critical infrastructure elements are in particular buildings, installations, means or public infrastructure determined by cross-sectoral and sectoral criteria; if an element of critical infrastructure is part of European critical infrastructure, it is considered an element of European critical infrastructure.

Critical infrastructure protection means measures to reduce the risk of disruption to the functioning of critical infrastructure elements.

The critical infrastructure object is the operator of the critical infrastructure element; if the operator is a European component of critical infrastructure, it is considered a European critical infrastructure.

Cross-cutting criteria are a set of criteria for assessing the severity of the impact of a critical infrastructure element, including limits on the extent of life loss, impact on human health, extremely severe economic impacts or public impacts due to a severe reduction in the provision of necessary services or other serious disturbances in everyday life.

12.3. The Plan of Crisis Preparedness of the AI Subject

The Plan of Crisis Preparedness of the AI Subject identifies potential functional threats to the AI Subject and determines its protective measures. The plan is divided into basic, operational and auxiliary parts.

The basic part contains: Limitation of the scope of activities of legal and entrepreneurial natural persons (hereinafter "PaPFO") and the tasks and measures which were the occasion for the preparation of the crisis prevention plan, - the characteristics of crisis management, - the overview and evaluation of possible sources of risk and analyses of threats and their possible impact on the activities of PaPFO, - the list of AI elements, - the identification of possible threats to the function of the AI element.

The operative part contains: the overview of the measures resulting from the contingency plan of the competent crisis management unit and the way to ensure their implementation, - the way to ensure PaPFO's ability to act in order to ensure the implementation of crisis measures and the protection of PaPFO's activities, - the KS solution procedures identified in the threat analysis, - the action plan for

the economic mobilisation of mobilisation suppliers, - the overview of links with competent crisis management bodies, - the overview of the plans processed in accordance with specific legal provisions (eg.B.: according to the Water Act, EMH Act, etc.), which can be used in the solution of KS. The above measures and procedures must be aimed at protecting the function of the CI element (the operational part is supplemented by measures for its protection).

The auxiliary part contains: an overview of the legal provisions or crisis situations that can be used in preparation for a special event and their solutions, - an overview of the contracts concluded to ensure the execution of the measures that were the reason for the preparation of the crisis preparedness plan, - the principles of handling the crisis preparedness plan, - geographical documents, - other documents related to the preparation for MU or KS and their solutions.

12.4. Damage or disruption of the CI

Damage or disruption of the CI have an impact on:

- Economic environment
- Political U.
- Social U.
- Pychological U.
- the environment

Possibilities of threat and dangers of AI:

- Terrorism
- natural disasters
- carelessness of service
- Industrial disasters and accidents
- PC hacks
- Organised crime and criminal offences in general

Harmonogram of the procedure:

- Analysis of the solution state of the problem of AI
- Complex strategy of the Czech Republic for solving AI problems
- Definition of the content structure of the National AI Protection Programme
- the National Programme
- Area protection programs

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