

# **Topic № 1.1 «The foundations of safety science. Conception and main definitions»**

Lecture for 2d gr. students

# **Items:**

- 1. Safety science as an object of scientific investigation/ The main challenges of safety science.**
- 2. The conception of «safety» and «danger».**
- 3. Taxonomy of menaces.**
- 4. The conception of «acceptable risk».**
- 5. Systems analysis of “safety”.**
- 6. The role of safety science in medical field.**

**1. Safety science as an object of scientific investigation. The main challenges of safety science.**

1. Humans are living and working under the permanent risk of danger. The activity of mankind apparently causes a potential menace.
2. **Menaces (hazards).** All that can endanger the safety of humans, society and commonwealth in general.
3. Protection of menaces is a priority problem of our society. **Because there is no any absolute safety.** Always we should take into account **a remaining risk.** Under the term “safety” we understand such level of danger we can accept.
4. Menaces:
  - presumable
  - potential
  - permanent
  - total

## **The definition of safety science.**

### **Table 1**

So, to understand the scope of safety science we must first understand the definition of safety science

Table 1 shows that many safety researchers have conducted extensive and in-depth discussions on the definitions of safety science

Viewpoint proponent	Brief description
Liu 1994	Safety science is a science that studies the essentials as well as its transformation and the conditions that guarantee it
Zhao and Luo (1995)	Safety science is a multidisciplinary subcategory law of movement between safety and danger caused by the application of technology, adopts countermeasures to control technological hazards within the allowable limits, promotes the sustainable and stable development of production, and achieves the goal of protecting the physical and mental health and safety of personnel, avoiding material property losses and protecting the environment
Zhang et al. (2007)	Safety science is a kind of comprehensive interdisciplinary field that studies the law at human safety activities and its application
Aven (2014)	Safety science can be understood as the totality of safety education programmes, researchers, research groups, journals, papers, etc
Hollnagel (2014)	Safety science can be viewed as “a conceptual umbrella term that is common to other scientific disciplines” instead of replacing any of them
Fu (2015)	Safety science is a comprehensive system of knowledge about “the occurrence and development rule or accident and means of preventing accidents”
Stoan et al. (2017)	Safety science is an integral part of science, defined as a



**Safety science** - is a science about comfortable and clear of danger interaction between human and habitat form. Safety science is a part of government measures with the aim to protect people and their property from big accidents, crashes, disasters and etc.

The main goal for safety science is to decline the risk of emergency situations, especially human-caused disasters (situations through human's fault)

# **Challenges of safety science**



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graph TD; A([Challenges of safety science]) --> B([Identification of menaces]); A --> C([Prophylaxis of these menaces]); A --> D([Emergency action]);
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**Identification of  
menaces**

**Prophylaxis of these  
menaces**

**Emergency action**



## 2. The conception of «safety» and «danger»





**Danger (risk)** – is a situation or event where something of human value (including human themselves) is at stake and where the outcome is uncertain

**Safety** — is a condition of being safe for some complex system, the absence of internal and external negative factors for this specific system according with current requirements and knowledges





**Identification of menaces** — recognition and parametric representation of menaces

**Hazard to life** — quantitative rating of menaces. Define like a frequency of emergence any event depending on the another event (in the range of 0...1)

**Damage to health** — some injury or trauma which can cause fatal outcome.

**Homosphere** — human working space.

**Knoxosphere** — space or area with permanent existence of menaces.

### **3. Taxonomy of menaces.**



**Огюстен Пирам  
Декандоль (1778–1841)**



**According to genesis:** natural, technogenic, anthropogenic.

**According to the damage source:** mechanical, physical, chemical, biological, psychophysiological.

**According to harm manifestation:** impulsive, cumulative

**According to localization:** related with lithosphere, hydrosphere, atmosphere and space.

**According to consequences:** fatigue, diseases, traumas. crashes, disasters and etc.

**According to the nature of harm:** social, industrial, ecological, economical

**Scopes of danger emergence:** domestic, sports, transport, manufacturing, military

**According to structure of menaces:** simple and derivative.

**According to realizable energy:** active and passive



## **4. The conception of «acceptable risk»**

**Acceptable risk** — potential hazard which doesn't influence on economic indexes of any industry or enterprise or commonwealth in general.  
This is a compromise between safety and possibility of it reaching.



**The priority challenge of the theoretical part of safety science is increasing level of safety.**

1. Enhancement technical systems;
2. Training of staff;
3. Institutional arrangements;
4. Using individual and technical protection equipment;
5. Economic methods (compensation, insurance and etc.)

## **Sequence of hazard research**

**Stage I** — preliminary hazard analysis.

**Step 1. identify hazard source (e.g. fire, explosion)**

**Step 2. identify the part of system that can cause this hazards**

**Step 3. eliminate other threats (limit the analysis)**

**Stage II** — find entire hazard sequence.

**Stage III** — analyze consequences (poisoning, nuclear pollution, destruction of buildings etc.)



# Systems analysis of “safety”.

**Systems analysis.** The aim of systems analysis of safety — to identify the reasons which entailed unwanted consequences (such as crashes, fires, explosions and etc.) and to decrease the probability of their occurrence.

## **6. The role of safety science in medical field.**

**Occupational health and safety (OHS)**



# Medical workers are exposed to a variety of health and safety hazards each day.

These hazards include:

- **physical hazards**
- **chemical hazards**
- **biological hazards**
- **ergonomic and psychosocial hazards**
- **electrical hazards.**

The contemporary approach that is used in studies of occupational health and safety (OHS) involves identifying the health and safety hazards in workplaces and providing a safe working environment

Needlestick injuries are the most common source of occupational exposure to blood and the primary cause of blood-borne infections among health care workers



## **The most common factors which influence on emergence and growth work-related illnesses among medical workers:**

- **physical** - (noise, vibration, ultra-violet radiation, unfavorable artificial lightning, dust, sharp devices);
- **chemical** - toxic agents (e.g. mercury, disinfection agents, anesthetic gases, cytotoxic agents, disinfectants, detergents, and solvents ) and allergenes (antibiotics, gypsum etc);
- **biological** - viral hepatitis, human immunodeficiency virus, influenza, and tuberculosis ;
- **psychosocial** - (emotional stress, shiftwork, heavy lifting, violence, static pose, eye strain and etc).



# **Conclusion**

**Human life and health are the main values of our contemporary society. During the interaction between humans and their habitation these values can meet with unfavorable events.**

**So, safety science is necessary and required science, and it has few important challenges: identification of menaces, prophylaxis and action in case of hazard.**

**The contemporary approach that is used in studies of occupational health and safety (OHS) involves identifying the health and safety hazards in workplaces and providing a safe working environment. To accomplish this goal, medical staff must be trained in both health sciences and industrial hygiene, and OHS should be included early in the medical educational programs of universities**

**Thank you for your attention!**