

*Ministry of Healthcare of Ukraine*  
*O. O. Bogomolets National Medical University*

**department of hygiene and ecology №2**

# **METHODICAL INSTRUCTIONS**

for individual work of students  
during preparing for practical lesson in the discipline "Occupational  
safety in the health"  
on the topic:

## **OCCUPATIONAL HYGIENE AND SAFETY AT HEALTH CARE FACILITIES**

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**MINISTRY OF HEALTH OF UKRAINE**  
**BOGOMOLETS NATIONAL MEDICAL UNIVERSITY**

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“ \_\_\_\_\_ ” \_\_\_\_\_ 20\_\_ .

**INSTRUCTIONS**  
FOR STUDENTS’ INDEPENDENT STUDIES  
IN PREPARING FOR PRACTICAL WORK

<i>Discipline</i>	Occupational (Labor) hygiene
<i>Module № 1</i>	Occupational health in the field
<i>Module № 2</i>	Occupational health issues in the medical field
<i>Topic</i>	Occupational hygiene and safety
<i>Course</i>	II, III
<i>Faculties</i>	Medical №1-4, FTDAFU, dentistry, medical-psychology.

Kyiv 2018

## 1. Background:

Health care worker occupational hygiene and safety is a matter of both national and regional authorities, managers of health programs, management of every health care facility or company and each employee's health. According to the Constitution of Ukraine and the Law of Ukraine "On Labor Protection" every health care worker has the right to safe work.

In the work environment health care providers may be exposed to the whole complex of harmful agents of different origin. Among all the professions related to the forms of intellectual labor, the work of health care providers is considered one of the most dangerous and requires the development and implementation of effective measures of health improvement and safety regulations that have scientific background. Actually, by solving sanitary, technical, social and economical and other problems in the health care industry, workplace injuries and occupational injuries can be reduced, the efficiency of work can be improved and the health of medical personnel can be preserved.

## 2. Specific objectives:

1. To analyze and evaluate the possible impact of harmful and hazardous environment factors to which health care providers are exposed.
2. To interpret hygienic requirements for design and construction of health care facilities.
3. To explain hygienic requirements and regulations for the protection of medical personnel in the individual structural units of health care settings.
4. To develop and justify measures in order to reduce the adverse impact of occupational hazardous factors on the health care staff according to the current legal system in Ukraine.

## 3. Basic knowledge, skills that are necessary for studying this topic (inter-disciplinary integration)

Title of previous disciplines	Received skills
1.Human anatomy	To analyze information of the structure of the human body, which forms its organs and tissues systems. Determine topographic-anatomical relations between human organs and systems.

2. Microbiology, virology, immunology	To interpret the biological properties of pathogenic and opportunistic pathogenic microorganisms, viruses and patterns of their interaction with the macroorganism, human population, to know the methods of disinfection (physical, chemical, etc.), which are used in ultrasound.
3. General hygiene and ecology of a person	<p>To analyze the state of the environment and the impact of its factors on individual and population health.</p> <p>To demonstrate ownership of the hygienic assessment of the impact of environmental factors on the health of the population.</p> <p>Plan activities for the observance of healthy lifestyle and personal hygiene and implement them in the practice of health care.</p> <p>To interpret the basic laws of hygienic science and the general laws of the connection of health with the factors and conditions of the environment of life.</p>

#### **4. Tasks for the self-study during the preparation for the class**

##### **4.1. List of basic terms, parameters, characteristics, which the student must learn while preparing for the class:**

The term	Definition
Scientific management	The labor management is based on the achievements of science and innovative experience; it is systematically introduced into practice that enables to connect technics and people in a single production process; it increases labor productivity, preserves human health and gradually transforms work into the first vital need. (GOST 19005-74. "Organization of work. Concepts, terms and definitions").
Hospital-acquired infection (HAI)	An infection acquired in hospital by a patient who was admitted for a reason other than that infection. An infection occurring in a patient in a hospital or other health care facility in whom the infection was not present or incubating at the time of admission. This includes infections acquired in the hospital but appearing after discharge, and also occupational infections among staff of the facility (WHO definition).
Medical equipment	Armamentarium that is designed to aid in the

	diagnosis, monitoring or treatment of medical conditions.
Protective gear	Facilities that prevent or reduce the impact of hazardous and harmful production factors on one or more employees.
Personal protective Equipment (PPE)	<p>Special equipment or garments that are designed to reduce employee exposure to hazards.</p> <p><i>Personal protective equipment can be presented by:</i></p> <ul style="list-style-type: none"> <li>• special protective clothing and footwear</li> <li>• equipment that is designed to protect respiratory organs (respirators, self-contained breathing apparatus etc.), hands, head, hearing, eyes and face.</li> </ul> <p>It also includes safety and rescue belts, electrical insulation mats.</p>
General hygiene and human ecology	<p>To analyze the state of the environment and the influence of its factors on the health of different population groups.</p> <p>To demonstrate knowledge of methods of hygienic assessment of the impact of environmental factors on the human health.</p> <p>To plan activities for keeping healthy lifestyle, personal hygiene and introduce them into the health care practice.</p> <p>To interpret basic principles of Hygienic Science and general patterns of interrelations between health state and factors/conditions of the environment.</p>

#### 4.2. Theoretical class questions

1. Hygiene requirements for the design and construction of health care facilities.
2. Safety requirements for the basic medical equipment operation.
3. Scientific management in health care facilities.
4. Hygienic education and health education provided to health professionals.
5. Measures to reduce physical, mental and psychological load of health workers.

6. Measures to reduce the adverse impact of physical factors on the health of workers.
7. Measures to reduce the adverse effects of chemical factors on the health of workers.
8. Measures to prevent harmful effects of biological factors on the health of workers.
9. Sanitary, hygienic and anti-epidemic regime of a hospital.
10. Prevention of nosocomial infections as a part of occupational health and safety in medicine.
11. Medical waste: definition and classification.
12. The requirements for personal protective equipment and work wear of health care providers.

#### **4.3. Practical work (tasks) to be performed in the class:**

##### Task 1.

Write about preventive measures aimed at preventing the negative effects of harmful production factors on the body of surgeons.

##### 2. To solve case tasks:

##### Task 1.

A younger nurse in the X-ray office for all working day continuously helps the radiologist during X-ray examination. Her working day according to the schedule of the clinic lasts 6 hours and 20 min. at five-day working week.

1) Indicate the main safety measures at the work place of the junior nurse's X-ray cabinet;

2) Determine whether the duration of the working week of the junior nurse is in accordance with the standards

The norms of the Resolution of the Cabinet of Ministers of Ukraine dated February 21, 2001, No. 163 (as amended on October 28, 2016) on page No.22.

## **Theme content:**

### **THE IMPROVEMENT OF WORKING CONDITIONS OF HEALTH CARE PROVIDERS**

The main directions of working conditions improvement of health care providers are:

- creation of medical personnel jobs that meet all the requirements of current sanitary laws;
- organization of full preliminary and periodic medical examinations and medical care of health care staff;
- improvement of the professional selection system of the medical personnel;
- development of effective training of medical personnel;
- provision of modern medical equipment;
- compliance of safety regulations;
- computerization of medical records provision of office equipment;
- improvement of work valuation of health care providers, etc.

#### ***Hygiene requirements for the design and construction of health care facilities***

The architectural design and planning are basic conditions of occupational safety and health of the medical personnel; they create optimal conditions for the effective therapeutic process. Health care facilities, such as hospitals, clinics, primary care centers, pharmacies and other service delivery points have to comply with the Sanitary Rules and Regulations 5179-90 “Sanitary rules of design, equipment and operation of hospitals, maternity hospitals and other health care facilities” and with the Building Code 2.08.02-89 “Public Buildings and Facilities” and the “Tutorial guide for designing health care facilities”

Health care facilities must be located in residential, green or suburban areas according to the approved general plan and the detailed project plan of the populated place taking into account its functional zoning.

It is prohibited to build health care facilities on those places that were earlier used as dumps, sewage disposal fields, animal burials, cemeteries, etc. It is strictly prohibited to use territories where soil is polluted by organic, chemical or other factors.

The location of health care centers and maternity hospitals should be removed from railways, airports, highways and other sources of exposure of



physical factors on the basis of calculations made in accordance with existing regulations by taking into account the ensuring of noise levels within the health standards for residential premises and public buildings.

When locating health care settings and maternity hospitals in the residential area one should take into account that medical housings and ward housings should be located no closer than 30 m from the red line of the housing construction and no closer than 30-50 m from residential buildings depending on the height of the health care setting.

The territory on which hospital, maternity hospital or other health care facility is situated should be landscaped and planted. Green area and lawns must be at least 60% of the total area, and the area of garden and parkland – 25 m<sup>2</sup> per person (hospital bed).

Health care setting should be built of materials that are recommended for the hospital construction. Interior design should match its functional purpose. Surface of walls, partitions, ceilings should be smooth, accessible for wet cleaning and disinfection. Much attention should be paid to the correct color selection of the production facilities (walls, floors, equipment). In the health care settings the preference should be given to light beige, pale yellow and yellow tones.

Offices and hospital premises must ensure optimal hygiene and anti-epidemic conditions of patients stay, work and recreation of staff.

The design and planning of the hospital premises must exclude the possibility of the “clean” and “dirty” air flow crossing.

Separate building and sanitary standards and recommendation for the tuberculosis, infectious disease hospitals and departments, departments of radiology, different laboratories, such as clinical laboratories, bacteriological and virology laboratories, laboratories of helminthology, dental laboratories, disinfection, autoclave, boiler stations were worked out.

The physical design of hospital is an essential component of a hospital's infection control strategy, incorporating infection control issues to minimize the risk of infection transmission. The role of infection control in the design of facilities has become increasingly visible as communicable diseases like tuberculosis and multidrug resistant organisms have caught the attention of the media affecting both consumer awareness and regulatory agencies responsible for environmental health and sanitation.

The rational distribution of hospital furniture and medical equipment is very important for the better working conditions of the health care providers.

### ***Safety maintenance and operation of medical equipment***

Safety regulations of health care staff in the operation of medical equipment can be found in the “Safety rules in the operation of medical equipment in health care facilities: General Regulations” They are approved by the Ministry of Health, USSA, August 27, 1984). The requirements of these Regulations are mandatory.

In case of proper equipment use and its periodic inspection the staff constantly maintains a high degree of security and also helps to detect potentially dangerous defects before they may cause harm to patients or staff.

Personnel and patients safety in the operation of medical equipment must be provided by:

- the design of medical equipment that must be safe when used alone or as a part of systems; they have to meet the requirements of standards and other normative and technical documents (medical and technical requirements, specifications, etc.);
- the design of electrical power equipment of the medical devices; they have to meet the requirements of “Regulations for Electrical Installation” and other normative and technical documents;
- the proper competence of the specially trained and authorized personnel that has to be aware of the statements of the operational documentation and safety instructions;
- the system of maintenance and renovation of medical equipment;
- the appropriate premises that satisfy the current building regulations and the rational work organization;
- the work according to the established safety measures and the use of safety equipment.

In medical practice only the equipment that complies with standards, specifications and other technical standards can be used; it must be approved in the prescribed manner.

Only authorized and qualified personnel at least 18 years old with no health problems can use the medical equipment.

Medical staff should have a special higher or specialized secondary education and a document that certifies the successful completion of specialization courses of equipment operation; they should undergo medical examinations and the introductory briefing concerning the safety use of equipment. Then no less than 6 months later the repeat instruction should be conducted according to the GOST 12.0.004-79 “Organization of training of workers safety” and “Instructions on briefing concerning the safe techniques and methods of work in enterprises, institutions and organizations of the USSR Ministry of Health” (annex 5, Order of Ministry of Health No 862, USSR, August 30, 1982).

Heads of the departments are responsible for the organization of the proper operation and maintenance of medical equipment; they are also responsible for the efficiency of the medical devices use; they monitor the implementation of all the requirements of these rules and regulations concerning the safety by the staff.

### *Health education of the medical personnel*

Health education of the medical personnel is a matter of great importance. It includes multifaceted training and educational activities aimed to form a responsible behavior among health care providers in order to preserve health and increase the efficiency of work.

Namely the service of labor protection of the health care setting (according to the Order of Ministry of Health of Ukraine No 268, September 30, 1994 “The service of labor protection of the Ministry of Health of Ukraine”) should provide necessary standards, rules, regulations, instructions and other regulations to the health care providers concerning the occupational safety; this service should conduct propaganda concerning the safe and harmless working conditions by consultations, contests, interviews, lectures, distribution of graphic materials, design of information stands, etc.

## **ACTIVITIES FOR REDUCING HARMFUL AND DANGEROUS PRODUCTION FACTORS TO WHICH HEALTH CARE WORKERS ARE EXPOSED**

### *Measures for reducing emotional stress and for the rationalization of the working process*

In order to improve the working conditions of the health care personnel there should be developed and implemented rational modes of work and rest, regulated breaks during the working day. The qualification of the health care providers should have been constantly upgrading in order to prevent emotional stress associated with the nature of work that is done.

In order to relieve mental and emotional stress, to fight against physical inactivity the medical personnel has to learn self-produced training techniques of psychological relief, gymnastic; the health care personnel has to organize hot food, vitamin and oxygen cocktails consumption in time. For this purpose there must be specially equipped facilities (psychological relief rooms, dining rooms). For fatigue relieving there can be used functional music and light.

For the prevention of negative effects caused by the *forced body position* during the work there must be used rationally engineered industrial furniture according to general principles, ergonomic design and requirements of GOST 12.2.032-78 “Work in sitting position. General ergonomic requirements” and GOST 12.2.033-78 “Work in standing position. General ergonomic requirements”. The desk chair in case of working in sitting position (for example the work of otolaryngologist, ophthalmologist, gynecologist, etc.) should rotate and be able to lift; it should have armrest and backrest according to the configuration of the spine; the seat must be semi-soft, round or rounded. There must be also a special footrest construction.

The mechanization of labor processes should cover all main technical means that ensure the medical and diagnostic process (equipment, tools, and devices) and assistive technical means that help in the service of patients (patient transportation equipment, catering transport equipment, medication trolleys).

The psychological selection of doctors and nurses is very important in those departments where staff works in hazardous conditions. The presence of such diseases as organic CNS disease, mental disorders, neurosis, neurasthenia, as well as the defects of the musculoskeletal system is an absolute contraindication for such work.

It is essential to conduct psychophysiological selection of specialties that deal with some occupational risk factors. The basis of this selection should be based on the ethical, physiological and psychological characteristics of the individual, on the speed and accuracy of visual-motor and acoustic-motor responses, sustained attention, processing speed, etc.

The statements of scientific selection should be implemented into the work process; this approach can help to share clearly the worker’s responsibilities, to organize rationally time and place of work, to improve the provision of information, to contribute to more widely use of office equipment and communications, to improve control performance monitoring, etc.

### ***Measures for reducing the adverse effects of physical factors on the health of workers***

***The microclimate parameters*** of hospitals, maternity hospitals and other health care facilities should be optimal and in accordance with Sanitary Rules and Regulations 5179-90, Building Code 2.08.02-89 and Public Health Standards 3.3.6.042-99 “Sanitary norms of microclimate of industrial premises”.

Conditioners, artificial purge ventilation can be used in order to create comfortable microclimate. Air conditioning should be provided in operating rooms, non-operating rooms for anesthesia, birthing rooms, intensive care units, in

wards where AIDS patients, blood cancer patients and patients with burns are treated, as well as in the neonatal units, wards for newborns, infants, premature infants, traumatized children and in other similar health care premises.

The air intake to the ward must be 80 m<sup>3</sup> per patient.

**Ventilation** of the hospital facilities should be in accordance with sanitary regulations; it must be a natural type of ventilation through windows, window leafs, fanlights, wall air vents or mechanical purge ventilation. In operating rooms the general purge ventilation should provide at least 10 times air exchange per hour. In clean (aseptic) operating and bandaging rooms the air flow should prevail and in purulent surgery units there must be the exhaust ventilation.

Due to the fact that anesthetic gases accumulate in the lower area of the room there should be a local ventilation system with the fresh air flow above the operating room table and the entire operating team. By falling down and rinsing the workers the air reaches the floor and then it should be removed through lower exhaust ventilation channels. The amount of air that is removed from the lower operating zone should be 60 % and from the upper zone – 40 %. In the center of operating room the ventilation rate should reach 60 times per hour. In addition, in order to remove patient's exhaled anesthetic gases there should be arranged special pipeline suction lead out from the operating room.

**The levels of ultraviolet radiation** in the production facilities should meet the requirements of the "Sanitary norms of ultraviolet radiation in industrial premises" No 4557-88.

When working with UV radiation sources the eyes of patients and medical personnel must be protected with special glasses for UV protection; they must be tinted and with lateral protection (leather or rubber rim).

During the breaks in treatment process the UV sources should be closed with sliding doors and in case of their absence black with white lining constructions 40 cm long can be used by putting them on the edges of the irradiator reflector.

**Noise control** in the hospital premises should be achieved by its valuation and implementation of anti-noise measures in the design and maintenance of the hospital premises.

Permissible sound levels in health care facilities must match with the "Sanitary norms of permissible sound levels in public buildings and residential areas" No 3077-84, Sanitary Rules and Regulations 3.3.6.037-99 "Sanitary norms of industrial noise, infrasound and ultrasound" and "Sanitary norms of permissible sound level generated by medical devices in the health care facilities" No 3057-84.

According to Sanitary Norms No 3077-84 the permissible sound level in hospital wards, operating rooms should be no more than 35 dB during daytime (from 7 am till 11 pm) and no more than 25 dB at night; in doctor's offices of different health care facilities the permissible sound level should be no more than 35 dB. When architecturally designing the hospital, the place of building should be located at a proper distance from the main industrial and noise sources. In the ventilation design there can be used sound absorbing wall panels, ducts; fans and motors should be located on the upper technical floor or in the basement; the elevator shaft walls must be double and with air filling between them. Rolled soft flooring can contribute to the acoustic comfort.

In health care facilities there must be double-pane windows.

**Vibration levels** generated by vibration equipment that may jeopardize the personnel and patient's health (dental drill sound, etc.) must not exceed the maximum permissible level that is regulated by Sanitary Rules and Regulations 3.3.6.039-99 "State sanitary norms of the general and local production vibration".

In order to prevent harmful effects of vibration and to maintain high labor productivity the personnel has to do physical exercises, self-massage and to take vitamins.

When working with **ultrasound** equipment one should keep to Sanitary Rules and Regulations 3.3.6.037-99 "Sanitary norms of industrial noise, infrasound and ultrasound". Personal protective equipment such as cotton gloves must be used in case of work using the devices that are intended for ultrasound diagnostics and ultrasound treatment. The medical personnel should have rational mode of work and rest. It is recommended to take breaks at work every 1.5-2 hours for 10-15 minutes; these breaks can be filled with other work that is not related to the action of ultrasound.

Basic premises of health care settings must be equipped with **natural and artificial light sources** according to the Building Code B.2.5-28-2006 "Natural and artificial light"; these types of light must ensure high labor productivity of medical personnel and other health care staff. Insolation duration must be in accordance with hygienic requirements for insolation of public buildings and residential areas. General lighting ceiling lamps should be equipped with special solid lenses. For the wards lighting (except children and psychiatric unit wards) there can be used combined wall lamps (general and local lighting) that are installed above each bed. In each ward there should be night light lamp installed near the door.

The lighting of operating rooms and dental offices can be presented by general lighting and special shadowless lamps that illuminate the field of view.

Operating rooms must be equipped with emergency lighting of the independent power supply. The offices of such health care staff as pediatricians, dermatologists, infectious disease specialists, otolaryngologists should be equipped with luminescent lamps that provide correct color differentiation.

For protection from *ionizing radiation, UHF, SHF, UV electromagnetic radiation* there must be used special methods of physical limiting of radiation power (so called “amount” protection), methods of limiting the exposure time (so called “time” protection) and of course there can be used distance and shielding protection. In case of work with open sources of ionizing radiation medical staff should fulfill the requirements of Radiation Hygiene Regulations.

The “amount” protection against *the ionizing radiation* is regulated by “Radiation Safety Standards in Ukraine” and by “Main sanitary rules concerning the radiation safety in Ukraine”. These documents regulate dose limits for categories A and B, the permissible levels of radionuclides that enter the organism through inspiration and permissible concentrations of radionuclides in the air of working premises for each separate radionuclide, the permissible levels of radionuclides considering the hazard class and permissible levels of radionuclide contamination of work surfaces, clothing and hands of workers.

The “time” protection is achieved by skill training in accuracy and speed manipulation with non-radioactive drugs and devices; and radiologists should keep up the dark adaptation mode before the fluoroscopy procedure. The reduced working hours for this category of health workers belongs also to this type of protection.

The “distance” protection is the most effective, as the radiation dose is reduced in proportion to the square of the distance from the radiation source to the irradiated object; it is achieved by the determination of inaccessible areas for the X-ray and gamma radiation sources, by using manipulators when working with open and closed sources of radiation, rational design of premises and its sufficient size.

Shielding protection is used in case of work with X-rays and gamma radiation; it is achieved by using special plumbum screens in the form of containers, shields, plumbum rubber aprons, gloves, etc. Screens that are used in case of work with beta radiation sources are made of aluminum and plexiglass. In order to protect members of the surgical team from the X-ray radiation in case of trauma and orthopedic surgery special modernized and mobile protective screens are used.

The work with *X-ray equipment* must be guided by Sanitary Rules and Regulations 42-129-11-4090-86 “The Department of Radiology”.

The work with X-ray equipment must be carried out in specially equipped premises of the Department of Radiology by using isolated control panels. In case of mobile equipment use there should be protective plumbum screens on the mobile platform.

*Fluoroscopy electron-optical converters* reduce the radiation dose to which the health care personnel are exposed. Great importance has the correct diaphragm of the converter. The sensitivity control of X-ray amplifier for minimum value of the dose rate at the receiver of the X-ray image (40-80 mR/hr) reduces the radiation dose in 5-6 times. The intermittent X-ray tube work even in case of high voltage switching reduces the total exposure and contributes for the reduction of the radiation dose to which the health care staff and patients are exposed.

Stationary and mobile X-ray units must be equipped with light and audible alarm systems, the latter should automatically turn on when the X-ray tube is used.

The annual radiation dose to which the X-room personnel are exposed is on average 1 mSv, so it does not exceed even the 0.05 of the permissible average dose. However, special radiographic investigations determined that the exposure level of the unprotected body parts can reach 0.5 mGy and 3-4 mGy for hands per one study. Physicians that do not have X-ray profile (category B) often participate in such investigations. For this category there should be used pharmacological and cosmetic skin protection.

The work with different types of *electromagnetic radiations* is regulated by Sanitary Rules and Regulations 3.3.6.096-02 "Sanitary rules and regulations in case of work with the sources of electromagnetic fields". The sources of electromagnetic fields must be shielded by metal screens made of steel, brass or aluminum sheets, by copper mesh screen, microwires fabric or metallized glass.

The working conditions concerning the ion composition of the air should comply with the requirements of the Building Code 2152-80 "Sanitary norms of permissible levels of air ionization in industrial and public buildings".

Working with *lasers* should be in accordance with the Sanitary Norms and Regulations 5804-91 "Sanitary norms and rules in case of operation with lasers".

The prevention of harmful effects of laser radiation to which the medical personnel is exposed should be implemented by taking into account the class and type of lasers that are used. Before putting into operation the laser device there should be carried the sanitary and dosimetric control of the laser radiation by determining the degree of its reflection from all working surfaces of the equipment and medical instruments, as well as the reflection from walls and ceilings of the premises. In those premises where the laser system works, the walls and ceilings should have a matte finish. In these premises it is prohibited to use devises and



objects with reflecting surfaces. The work with laser devices should be carried out in bright light.

There are rather effective local suction systems that are integrated in the structure of the laser and thus decrease the concentrations of harmful substances in the air in 12-15 times.

Measures for reducing adverse effects of chemical factors on the health of medical personnel

The content of chemicals in the air in the main working areas of medical facilities must comply with the requirements of GOST 12.1.005-88 “General hygiene requirements to the working areas”.

In the working areas of pharmacies general ventilation should be used, as well as the local exhaust ventilation, for example exhaust hoods, for the preparation of solutions, tools washing, etc.

In order to reduce the hand contact with a variety of hazardous chemical agents it is advisable to use rubber gloves and hand protective creams and lotions. The use of compressed pharmaceutical dosage forms such as tablets, pills, etc. reduces the chemical exposure.

In some cases, there can be used adsorbent-special cartridges with activated carbon that are hermetically attached to the exhalation valve of the anesthesia machine. Considering the sorption properties of anesthetic vapors there should be a systematic wet cleaning of walls and equipment in the operating room. It is necessary to undertake the laboratory control of the anesthetics concentrations in the operating rooms in order to avoid the exceeding of its threshold limit value (TLV). When several anesthetics are used together the ratio between the factual concentrations of these anesthetics and their TLV must not exceed unit maximum.

However, the most effective preventive measure against the toxic effects of anesthetics to which the healthcare staff is exposed is the use of intravenous and spinal anesthesia.

The work with other chemical agents, such as volatile solvents, disinfectants, acids, alkalis, with which the healthcare personnel has to deal, must be conducted in fume hoods and in inhalation therapy rooms – for patients. Furthermore, such personal protective equipment as rubber gloves, safety glasses, goggles, masks, aprons and even overalls should be used. In order to prevent the development of allergic reactions it is necessary to use protective creams and lotions. For the same purpose tableted drugs are more preferable.

### *Measures for the prevention of harmful effects of biological factors*

The level of bacterial contamination in the air must be in accordance with the requirements of general sanitary laws.

In order to reduce the microbial contamination of indoor air in small premises it is recommended to use air purifiers “BOIP-0.9” and “BOIP-1.5”. Their 15 minutes work can reduce dust and bacterial contamination in 7-10 times.

Air contaminated with free floating microorganisms can be treated with UV-radiation as traditional methods fail to disinfect air effectively or are not applicable a priori. So, different UV air disinfection systems can be used. Depending on the design of these disinfection systems they can operate temporary or permanently, both in presence and absence of people. In operating and bandaging rooms, children’s wards, delivery rooms UV lamps are used; it is used direct light in the absence of people and scattered reflected light during their presence.

For the prevention of infectious diseases to which primary care physicians, otolaryngologists, infectious disease specialists, etc. are exposed it is recommended to have vaccination in the pre-epidemic period.

When contacting patients with infectious diseases that are spread via air and during epidemics with all patients it is necessary to use gauze masks.

Those people that have an elevated risk of infectious diseases should have to undergo courses of ultraviolet radiation, as well as food fortification, especially vitamin C in autumn and spring.

In order to prevent infectious diseases in the health care facilities it is recommended to conduct wet mopping using disinfectants (chloramine, etc.) and other agents that are effective against nosocomial infections: 3 % Lysol solution, 4-5 % caustic soda solutions, 2-3 % calcium hypochlorite solution, etc.

### ***Prevention of hospital-acquired infections***

Prevention of nosocomial infections is the responsibility of all individuals and services providing health care. Everyone must work cooperatively to reduce the risk of infection for patients and staff. This includes personnel providing direct patient care, management, provision of materials and products, and training of health workers. The chief physician or his / her deputies are responsible for the management and control of hospital-acquired infections; this includes strict abidance by sanitary and anti-epidemic rules in the health care facility. Nosocomial infection control in health care facilities should be carried systematically (according to some indices - daily). Therefore, the regional sanitary-epidemiological station has to specify the objects of such a control, the list of indicators and the frequency of different kind of examinations /surveillances.

The nosocomial infection rate in patients in a facility is an indicator of quality and safety of care. The development of a surveillance process to monitor

this rate is an essential first step to identify local problems and priorities, and evaluate the effectiveness of infection control activity. Surveillance, by itself, is an effective process to decrease the frequency of hospital-acquired infections. For the best prevention of hospital-acquired infections it is necessary to investigate objectively and promptly every case of the nosocomial infection and to check how all the preventive measures were carried out; it is important to conduct epidemiological analysis of nosocomial infections and to implement routine immunization for health care personnel, etc.

The specific objectives of a nosocomial infection surveillance program include:

- to register every case of hospital-acquired infection;
- to study etiological structure of the health care facility;
- to carry out sanitary-bacteriological studies of various objects in health care facilities;
- to study the circulation of pathogenic and conditionally pathogenic microorganisms;
- to determine the area distribution and the microbial resistance spectrum to antibiotics, antiseptics, disinfectants, etc.;
- to monitor the health state of medical personnel (nosocomial infection diseases, carriage of resistant microorganisms);
- to monitor the compliance with sanitary and anti-epidemic regime in the medical facilities;
- to conduct an epidemiological analysis (current and retrospective) concerning the incidence of nosocomial infections, which allows to make conclusions about the sources, pathways and transmission factors and about the conditions that contribute to the infection;

Comprehensive analysis of all the data that was obtained is the basis for planning and taking preventive and control measures.

In the health care system there should be organized a qualified medical and preventive support and help programme for health care personnel in workplaces or in specialized medical facilities; there should be clinical supervision, the in-depth study of incidence among the health care workers, temporal or permanent transfer of medical personnel to the more light and safe employment, etc.

### ***Organization of labor and working time of medical personnel***

In order to organize the organization of work and working time of medical personnel, the total duration of working time should not exceed the weekly norm.

In accordance with the Order of the Ministry of Health of Ukraine of 25.05.2006 №319 "On Approval of Hours of Time for Employees of Health Care Institutions and Institutions", the following standards of working time were established for employees of institutions and health care establishments (except for those working in harmful working conditions):

- 38.5 hours per week for heads of structural units (departments, divisions, laboratories, offices, etc.) among doctors and specialists with basic and incomplete higher education, doctors and specialists with basic and incomplete higher medical education (medical staff), etc.

- 33 hours a week for doctors employed exclusively by outpatient admission of patients: outpatient clinics; outpatient clinics, health care points (health posts), paramedics and paramedic and obstetric stations, etc. ;

- 40 hours a week: for heads of institutions and institutions of health, their deputies; chief specialists (chief nurses, chief medical assistants); for the younger nurses for care of the sick, the sisters-hosts; for pharmacists, pharmacy pharmacists, engaged only in the release of drugs and other products of the pharmacy assortment, etc.

Work at night is paid in increased amount (Article 108 of the Labor Code), established by the general, branch (regional) agreement and collective agreement, but not lower than 20 percent of the tariff rate (salary) for each hour of work at night.

### ***Medical examinations of health workers***

According to the Law of Ukraine, Article 17 "Labor protection", Article 26 "Sanitary and epidemiological welfare of the population" and the resolution of the Cabinet of Ministers of Ukraine No 559 dated May 23, 2001 "The list of organizations and industries whose workers must undergo compulsory medical examinations" health care workers should undergo mandatory medical examinations which are organized and carried out according to the legislation and in accordance with the Order of the Ministry of Health of Ukraine No 246 dated May 21, 2007 "On approval of conducting medical examinations for certain categories of workers".

## **REQUIREMENTS TO THE PERSONAL PROTECTIVE EQUIPMENT AND WORKWEAR OF THE MEDICAL PERSONNEL**

*Personal protective equipment (PPE)* – these are commercial products that are used directly by the workers in order to reduce the impact of harmful factors on the wearer’s body.

PPE can be presented by:

- special protective clothing and footwear;
- equipment that is designed to protect respiratory organs (respirators, self-contained breathing apparatus etc.), hands, head, hearing, eyes and face.

PPE also includes safety and rescue belts, electrical insulation mats, etc.

Health care workers are given free special clothing and footwear according to the Order of Ministry of Health No 65, USSR, January 29, 1988 “Industry standards of the free issue of uniforms, footwear and other personal protective equipment” and Normative Legal Acts containing Labor Law Norms 0.00-4.01-08 “Regulations concerning the provision of special clothing, footwear and other personal protective equipment” approved by the Order No 53 dated March 24, 2008, State Committee of Ukraine on Industrial Safety. Medical headwear that is used in health care facilities must comply with GOST 23134-84 “Medical headwear” and hospital gowns must comply with GOST 24760-81 “Ladies medical uniform” and GOST 25194-82 “Men’s medical uniform”.

There must be also provided equipment that is designed to protect respiratory organs according to Normative Legal Acts containing Labor Law Norms 0.00-1.04-07 “Rules concerning selection and the use of personal protective equipment that is designed to protect respiratory organs” approved by the Order No 331 dated December 28, 2007, State Committee of Ukraine on Industrial Safety.

The most important items of PPE that create a barrier between the health care worker and the possible infection are medical gloves and masks.

Health care personnel should have a strong stereotype to use medical gloves when working with any patient; this is the key not only to their personal safety but also to the safety of the patient.

If there is a possibility to contact with blood or different liquid secretions from the organism or in case of contact with mucous membranes or broken skin of any patient, as well as in case of presence of cuts or other skin damages, special medical gloves should be used.

The skin flora consists of permanent (resident) and temporary (transient) microorganisms. Permanent microorganisms live and multiply on the skin while the temporary microbial flora reflects the recent contamination; it lives only a limited amount of time.

Most of the permanent microorganisms reside in the surface layers of the skin, and 10-20 % of them can live in the deep layers.

Washing and disinfecting of hands (the removal of microorganisms from the hand skin) is an important element of the single system of the infectious diseases prevention both for medical staff and patients in the health care facility during diagnostic and therapeutic manipulations.

Medical gloves that are used in health care facilities can be divided into:

- disposable and reusable;
- surgical or diagnostic/exam;
- specialized;

All gloves come in different sizes, so it is taken into account when choosing and purchasing them.

It is determined by standards that medical gloves can be made of both natural latex and synthetic materials. Disposable gloves include all synthetic and latex gloves. Reusing and sterilization of disposable gloves is unacceptable as it can lead to their destruction and loss of protective properties.

When using medical gloves the fingertip sensitivity decreases, the hand skin may become dry and flaky, so medical equipment can slip out of hands. However, it should be remembered that medical gloves are the most reliable means of protection against infections and the technology of their production has been developing every year.

Surgical gloves should be strong, resilient and longer than exam gloves. They must reach the forearm and have the same anatomical shape in order to reduce hand fatigue during long surgical procedures. There must be a package labeling – for the right hand and for the left hand. At the fingertips the rubber should be thin and on the cuff it must be firm; there should be no roll.

In modern models there is a textured surface on the palm and fingertips of gloves, so that the medical instruments can be securely fixed in the hand of the surgeon. Very thin gloves are designed for microsurgical operations; and firm gloves that are tear resistant even with considerable effort are used at the Department of Traumatology.

Exam gloves are universal and can be put on any hand; the main thing is to choose the correct size; they are shorter and have a roll.

#### *Recommendations for wearing gloves*

In case of gloves use the preference should be given to disposable gloves because the disinfection destroys the reusable gloves directly proportional to the frequency of the disinfection.

The disinfection of gloves during the operation is not carried out. If necessary they should be changed. Before putting the gloves on the hands must be disinfected depending on the type of the manipulation that is carried out.

Finally after taking off the gloves (at the end of the manipulation) it is important to wash hands with antibacterial soap or to use antiseptic.

After being used disposable gloves are disinfected and then utilized.

*It is not allowed to:*

- use the same pair of disposable gloves during performing medical manipulations to several patients even if they are washed or disinfected;
- use spirituous solutions for disinfection of latex gloves because these solutions destroy the protective layer of the gloves;
- to sterilize repeatedly gloves that are made of new synthetic materials (neoprene, vinyl or nitrile) using high temperatures; but these gloves are resistant to the influence of antiseptic agents, so they can be used repeatedly for examination of several patients (sterile gloves are not necessary), but it is important to use antiseptics after the examination of each patient;

If medical gloves are contaminated with blood or other secretions the contamination should be removed with gauze that is moistened with disinfectants. Then the gloves must be removed and put in a tank with an appropriate sanitizing solution.

If one of the gloves is damaged, both should be replaced immediately because it is impossible to take off one glove without making dirty another one.

The way of cleansing reusable rubber gloves (disinfection and sterilization) is regulated by Sanitary Rules and Regulations 1.2.731-99 “The security while working with microorganisms (3-4 pathogenicity classes) and helminthes”. During the work these gloves can be disinfected using 70 % alcohol, 1 % chloramine solution, etc.

*Eye safety in the workplace*

Safety glasses, safety goggles, face shields should be used when performing any manipulation that is associated with the possible splashes of blood and other body fluids in eyes (during the childbirth, cesarean section, pelvic examination, etc.).

*Respiratory protection*

Medical mask is intended to be worn by health professionals during surgery and at other times to catch the bacteria shed in liquid droplets and aerosols from the wearer's mouth and nose.

There are two main types of medical masks: *medical procedure masks* (Fig. 1a) (with rubber-bands for fixing behind the ears) and *surgical masks* (Fig. 1b) (ordinary laces).

Medical masks should cover mouth and nose and be comfortable when using them.

Simple medical masks protect wearers from being splashed in the mouth with body fluids and prevent transmission of body fluids from the medical professional to the patient. They also remind wearers not to touch their mouth or nose, which could otherwise transfer viruses and bacteria after having touched a contaminated surface.



Fig. 1. Medical procedure mask (a) and surgery (b) mask

It should be emphasized that medical procedure and surgical masks are not designed to protect the wearer from inhaling airborne bacteria or viruses particles. They cover part of face and thus create a barrier to the spray; its filter provides some limited protection against large droplets and particles. However, due to the lack of its tight fit to the face, the use of medical masks is associated with the leakage of unfiltered air from the side. So, simple medical masks are not definitely reliable means of personal respiratory protection.

A *respirator* is personal protective equipment that is designed to protect healthcare workers; it covers nose and mouth and purifies effectively the inhaled air though the filter material (Fig. 2b). For optimum respiratory efficiency it is necessary to fit the respirator tightly to the face, so most types of respirators require a special individual fit to the form of user's face.





Fig. 2. Modern respirators – without valve (a) and with exhalation valve

Most health care facilities in developed countries have the following *standards for using medical masks*:

- masks should be used during all the time in the operation unit;
- mask is a disposable personal protective equipment, so they must be thrown away when they are used and changed between manipulations, procedures and operations, before examining a new patient;
- mask should not become wet;
- mask should cover the mouth and nose;
- during the breaks between the manipulations, the mask should not be put into the pocket or be hanged on neck;
- after the mask is used it should be immediately removed without touching the surface of the filter; by holding the strings it should be placed in appropriate medical waste container (Fig. 3);
- in case of touching the mask and after taking it off it is important to disinfect hands with antiseptics;



Fig. 3. Utilization of medical masks by holding the strings without touching the working surface of the filter

Unfortunately there are no recommendations how to select medical masks and respirators for health care workers; the regulatory framework governs the distribution of “gauze respirator” only to health care workers of certain departments without specifying the degree of necessary protective properties; this approach allows to select and use PPE formally. International experience and official recommendations of the World Health Organization, US Centers for Disease Control and Prevention and Public Health Agency of Canada indicate the necessity to select medical masks and respirators in proportion to the possible risk. It may be useful to focus on the following functional classes of modern respiratory protection:

#### **Hospital waste: definition and classification**

Definition Health-care waste includes all the waste generated by health-care establishments, research facilities, and laboratories. In addition, it includes the waste originating from “minor” or “scattered” sources—such as that produced in the course of health care undertaken in the home (dialysis, insulin injections, etc.). Between 75% and 90% of the waste produced by health-care providers is non-risk or “general” health-care waste, comparable to domestic waste. It comes mostly from the administrative and housekeeping functions of health-care establishments and may also include waste generated during maintenance of health-care premises. The remaining 10–25% of healthcare waste is regarded as hazardous and may create a variety of health risks. This handbook is concerned almost exclusively with hazardous health-care waste (also known as “health-care risk waste”); general wastes should be dealt with by the municipal waste disposal mechanisms. Classification of hazardous health-care waste is summarized in Table 1

**Table 1. Categories of Hospital waste**

<b>Waste category</b>	<b>Description and examples</b>
Infectious waste	Waste suspected to contain pathogens e.g. laboratory cultures; waste from isolation wards; tissues (swabs), materials, or equipment that have been in contact with infected patients; excreta
Pathological waste	Human tissues or fluids e.g. body parts; blood and other body fluids; fetuses
Sharps	Sharp waste e.g. needles; infusion sets; scalpels; knives; blades; broken glass
Pharmaceutical waste	Waste containing pharmaceuticals e.g. pharmaceuticals that are expired or no longer needed; items contaminated by or containing pharmaceuticals (bottles, boxes)
Genotoxic waste	Waste containing substances with genotoxic properties e.g. waste containing cytostatic drugs (often used in cancer therapy); genotoxic chemicals
Chemical waste	Waste containing chemical substances e.g. laboratory reagents; film developer; disinfectants that are expired or no longer needed; solvents
Wastes with high content of heavy metals	Batteries; broken thermometers; blood-pressure gauges; etc.
Pressurized containers	Gas cylinders; gas cartridges; aerosol cans
Radioactive waste	Waste containing radioactive substances e.g. unused liquids from radiotherapy or laboratory research; contaminated glassware, packages, or absorbent paper; urine and excreta from patients treated or tested with unsealed radionuclides; sealed sources

## **Hospital waste generation**

Several surveys have provided an indication of typical health-care waste generation. Waste generation depends on numerous factors such as established waste management methods, type of health-care establishment, hospital specializations, proportion of reusable items employed in health care, and proportion of patients treated on a day-care basis. It is therefore suggested that these data are viewed only as examples, and not used as a basis for waste management within an individual health-care establishment. Even a limited survey will probably provide more reliable data on local waste generation than any estimate based on data from other countries or types of establishment. In middle- and low-income countries, Hospital waste generation is usually lower than in high-income countries. However, the range of values for countries of similar income level is probably as wide in highincome countries as in less wealthy countries. The amount of radioactive health-care waste is generally extremely small compared with the radioactive waste produced by the nuclear industry.

## **MATERIALS FOR SELF-CONTROL:**

### **A. Tasks for self-control (tables, schemes, figures, diagrams):**

1. Develop an algorithm (procedure) how to provide first aid to the health care worker in case of needle stick injury or other sharp instrument injury during the care of HIV-infected patients.
2. Tabulate the advantages and disadvantages of different types of personal protective equipment.

### **B. Exercises for self-control:**

1. Specify the requirements of occupational safety in case of work at the department of radiology in the healthcare facility.
2. Specify the requirements of occupational safety in case of work at the department of pathology and in morgues in the healthcare facility.