SAFTEY TECHNIQUES IN THE USE OF INFLAMMABLE, EXPLOSIVE AND TOXIC MATERIALS (FOUO 21/79)

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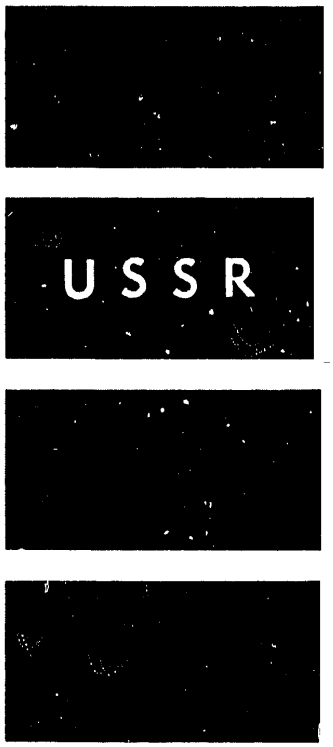
JPRS L/8528

20 June 1979



TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY

BIOMEDICAL AND BEHAVIORAL SCIENCES

(FOUO 21/79)

SAFETY TECHNIQUES IN THE USE OF INFLAMMABLE, EXPLOSIVE AND TOXIC MATERIALS

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APPROVED FOR RELEASE: 2007/02/09: CIA-RDP82-00850R000100060039-2

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Kiev TEKHNIKA BEZOPASTNOSTI PRI PRIMENENII POZHAROOPASNYKH, VZRYVOOPASNYKH I TOKSICHNYKH MATERIALOV in Russian 1978 signed to press 11 Oct 77 pp 3-37, 78-108

[Introduction, 11 chapters, bibliography and table of contents from book by G.T. Maksimenko and V.M. Pokrovskiy, Budivel'nyk, 40,000 copies, 108 pages]

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/Text/ Introduction

Concern for the preservation of workers' health and high work fitness is an important state task of socialist society. Decrees on the length of the work day (11 November 1917) and on social insurance (4 January 1918) were adopted at the very outset of Soviet rule. The statute on the socialist enterprise envisages measures reflecting workers' fundamental interests and aimed at constantly improving working conditions and eliminating the causes of injuries and occupational diseases, which greatly contributes to an accelerated rise in workers' labor productivity and standard of living.

The high rates of development of capital construction and continuous increase in the volumes of use of highly effective, new polymeric building materials, articles and structures require increased attention to problems of labor protection and safety techniques. Therefore, the work done in this direction becomes even more important and responsible. The expansion of the list of anticorrosive, heat insulating, finishing and other materials at the expense of effective, new substances possessing properties of inflammability and toxicity at the processing stage requires the development of new, as well as revision or addition of existing, rules of safety techniques and fire prevention during the execution of construction and installation work, including work on loading, unloading, transporting and warehousing materials and on the use of special measures and devices for workers' individual protection.

The present norms of and requirements for labor protection and fire safety pertaining to the use of new inflammable, explosive and toxic materials in construction make it possible to ensure further improvement in the efficiency of work done by services concerned with safety techniques in all the subdivisions of capital construction. Fire protection requirements and rules of

safety techniques help to improve labor organization, to reduce injuries and occupational diseases to a minimum and to eliminate losses of physical assets, which facilitates the fulfillment of the state plan and contributes to an increase in labor productivity. Of great importance are problems connected with reducing fatigue during work with harmful and inflammable substances, which, like the reduction in injuries and occupational diseases, can be viewed from the standpoint of economic efficiency.

This study generalizes the basic rules of safety techniques and fire protection requirements during the execution of construction and installation work with the use of inflammable, explosive and toxic materials.

General Information on the Organization of Work With the Use of Inflammable, Explosive and Toxic Materials

Chief construction engineers implement measures dealing with safety techniques at building sites and auxiliary facilities in accordance with the existing Construction Norms and Rules III-A. 11-70 "Safety Techniques in Construction," as well as departmental norms, rules, directives, instructions and construction norms and rules for individual types of operations.

Construction work at existing chemical, metallurgical and other specialized enterprises is done in accordance with the rules of safety techniques approved by the administration of these enterprises and only after permission is received from the enterprise administration.

When new polymers and other materials not included in existing normative documents are introduced, the requirements for safety techniques set forth in the technical specifications and instructions coordinated with fire and sanitary supervision bodies at the place of location of a construction facility should be followed.

Upon receiving a new type of polymeric material and before beginning working with it, the administration must organize with workers and engineering and technical personnel a study of its properties (inflammability, explosiveness and toxicity) and of the safety measures during its use.

Imported materials (glues, mastics and so forth) should be used in accordance with firm directives and instructions for safety techniques during work with these materials, or according to the instruction for their use coordinated with sanitary supervision bodies and approved.

Organization of a Building Site and Permission To Work

Construction and installation work with the use of toxic and explosive materials should be done on the basis of work plans, which should be developed according to the "Instruction for the Procedure of Preparation and Approval of Plans for the Organization of Construction and Work Plans" SN 47-74.

The plan for the organization of construction and the work plan should contain (paragraph 1.6 of the Construction Norms and Rules III-A. 11-70) the following technical solutions:

for the creation of conditions for a safe and harmless performance of work at a building site, facilities and work places under ordinary and winter conditions;

for sanitary and hygienic services for people working at a building site;

for an adequate illumination of a building site, passages, thoroughfares and work places.

In accordance with paragraph 1.7 of the Construction Norms and Rules III-A. 11-70 a building site must have domestic sanitation premises and installations, coat closets, lavatories, premises for drying, decontaminating and removing dust from special work clothing, premises for women's personal hygiene, premises for warming oneself, regulated rest and protection from solar radiation and atmospheric precipitation, food centers, health centers and so forth executed and equipped in accordance with the requirements of chapter II-M. 3-68 of the Construction Norms and Rules "Auxiliary Buildings and Premises of Industrial Enterprises. Planning Norms."

According to the "Statute on the Relationships Between the Organizations of Main Contractors and Subcontracting Organizations" approved by the USSR State Committee for Construction Affairs and the USSR State Planning Committee on 31 July 1970, when work is performed simultaneously by a main and subcontracting (or several subcontracting) organizations, the adoption of measures of a general nature for safety techniques (installing enclosures, protective visors and nets, enclosing openings and manholes in apertures, additional illumination and so forth) is the duty of the main contracting organization.

Every facility must have medicine chests, a set of fixing splints and other devices for providing first aid to victims.

Workers performing jobs with toxic and explosive materials are provided with special work clothing and footwear and individual protective equipment of the necessary sizes in accordance with the nature of the work done and the "Standard Sectorial Norms of Free Distribution of Special Work Clothing and Footwear and Safeguards to Workers and Employees Engaged in Construction, Construction-Installation and Construction Repair Work" (approved by the decree No 1097/P-27 dated 30 February 1969 of the State Committee for Labor and Wages of the USSR Council of Ministers and the Presidium of the All-Union Central Trade Union Council).

The individual protective equipment distributed to workers should be checked and workers should be instructed in the procedure of its use. Work managers should not permit individuals without appropriate special work clothing and footwear and individual protective equipment to work. The proper storage, periodical repairs and washing of special work clothing should be organized at construction facilities. It is forbidden to take out special work clothing outside construction facilities.

Line engineering and technical personnel (foreman, work superintendent, section mechanic and power engineer) and other engineering and technical personnel, according to the list approved by the chief engineer or work manager of a construction and installation organization, should annually undergo a test of their knowledge of the rules of safety techniques, in particular, safety measures during the use of inflammable, explosive and toxic materials. If their knowledge of the rules of safety techniques is unsatisfactory, they must not be permitted to supervise work.

Newly hired workers are permitted to work only after receiving introductory instructions in safety techniques and industrial sanitation, as well as instructions in safety techniques directly at a work place, which should also be given during every transfer to another job, or when working conditions are changed. Workers of overall brigades should be instructed and trained in safe methods for all the types of jobs performed by them.

Repeated instructions should be given to all workers no less often than once in 3 months. The instructions given are recorded in a special log.

In addition to instructions, no later than 3 months after workers are hired for construction work they must be taught safe methods and techniques of work according to the program approved by the chief engineer of a construction and installation organization. After the completion of training, subsequently the chief engineer of a construction organization must also annually ensure the checking of workers' knowledge of the indicated methods and techniques of work, as well as a documentary formulation of the checking and issue of certificates to workers.

The occupations of workers employed in construction and installation work, on which additional (increased) requirements for safety techniques are placed, are indicated in the bibliography. Individuals who underwent course training according to standard programs, who passed examinations and who have a certificate confirming their right to perform work, as well as those who have the permission of a medical commission confirming their right to do work with toxic (harmful) substances, can be permitted to perform these jobs. Before receiving training and medical certification these individuals are not permitted to do independent work.

In accordance with paragraphs 1.24 and 1.25 of the Construction Norms and Rules III-A. 11-70 individuals engaged in work with harmful substances should periodically undergo a medical examination on the dates set by the order No 400 dated 30 May 1969 of the USSR Ministry of Health depending on the use of the following substances:

lead compounds, including during the preparation of painting compositions, once in 6 months;

sulfuric, hydrochloric and nitric acids and their anhydrides, once in 12 months;

coal tar, pitch and shale resins, once in 12 months;

chlorinated and brominated hydrocarbons of the fatty series (perchlorovinyl resins, dichloroethane, carbon tetrachloride, methylene chloride, ethyl bromide, methyl bromide and so forth), once in 6 months;

styrene, polystyrene and divinyl, once in 6 months;

toluene and xylene as solvents, once in 12 months.

Individuals with injuries to their integuments are not permitted to work with toxic materials. When diseases connected with the effect of the indicated substances on the body are detected, workers should be transferred to another job.

When working conditions are especially dangerous or harmful (for example, emergency work on premises, in whose air the content of toxic vapors exceeds the permissible amount), before carrying it out, workers must be given a written permissive licence determining safe working conditions and indicating the dangerous zones and necessary measures dealing with safety techniques. The degree of danger involved in work is established and the permissive licence is signed by the chief engineer of a construction organization. The permissive licence is issued for the period necessary for the performance of a given volume of work. In case of an interruption of more than 24 hours in the performance of work the permissive licence is canceled and, when work is resumed, a new licence is issued.

Soviet legislation forbids individuals under the age of 18, pregnant women and nursing mothers to work with explosive and toxic materials (solvents, synthetic glues and mastics and so forth).

To prevent fires, explosions and accidents during the operation of electric equipment, it is necessary to observe the "Rules for Setting up Electric Installations" (PUE), as well as the "Rules for the Technical Operation of Electric Installations of Consumers" and the "Rules of Safety Techniques During the Operation of Electric Installations of Consumers."

To prevent fires, explosions and accidents during the operation of vessels and pipes operating under pressure, depending on working conditions it is necessary to observe the "Rules for the Installation and Safe Operation of Vessels Operating Under Pressure," the "Rules for the Installation and Safe Operation of Stationary Compressor Units, Air Ducts and Gas Lines," the "Rules for the Installation and Safe Operation of Pipelines for Fuel, Toxic and Liquefied Gases" (PKhG-69) and the "Rules of Operation and Safety Techniques During Work on Autoclaves."

General Safety Measures

The buildings and rooms in which work with inflammable, explosive or toxic substances and materials is done should be isolated from other premises and locked. They should be equipped with general suction-exhaust ventilation and, if necessary, with local extract ventilators ensuring a concentration of the vapors of the indicated substances in the air no higher than the maximally permissible concentration.

The electric equipment of the room in which work with inflammable and explosive materials is done should be explosionproof. Disconnecting and starting devices, including light switches, should be taken outside the room at a distance of no less than 6 meters.

When work with toxic and explosive materials is done on premises and in closed capacities it is forbidden:

to use open fire, as well as to utilize various mechanisms and devices that can cause spark formation;

to store lubricating oils and fuels in quantities exceeding the daily need at a work place;

to store oiled wiping materials (these materials must be collected into a metal box and after the completion of work removed from the room in order to avoid self-combustion);

to throw on the floor metal parts, tools and other objects and materials that, when dropped, can cause a spark;

to walk in shoes under which metal nails, horseshoes and so forth are put.

Any operations connected with the use of open fire (for example, electric or gas welding and cutting), or capable of causing spark formation (metal riveting and chiseling) are forbidden near these premises--at a distance of 25 meters.

To avoid spark formation during impact, inflammable and explosive substances should be kept at a work place in a container made of nonferrous metal (aluminum, zinc or copper), or of plastic. When working with these substances, it is forbidden to use tools made of ferrous metal.

For the purpose of protection against static electricity and a secondary manifestation of lightning (electrostatic and electromagnetic induction), which can cause fires and explosions, it is necessary to ground the equipment, utility lines and capacities in which static electricity can accumulate; to use materials increasing the electric conductivity of the medium (graphite, magnesium oleate and so forth); to humidify the air in dangerous places on the premises to 75 percent of relative humidity and higher, or to wet the surfaces of the electrifiable material and to install floors with a higher electric conductivity and conducting grounding of the zone for the removal of the charges of static electricity accumulating in people.

The use of flat-belt drives, which are the most powerful and dangerous source of static electricity, as well as of nonmetal conveyer belts with a low conductivity, is not permitted on premises (rubberizing, paint preparation and other premises), on which explosive vapor and gas concentrations can be formed as a result of production conditions or an accident. On explosive premises it is permitted to use V-shaped belts (of trapezoidal cross-section) if their resistance does not exceed 6 meg-ohms. Driving belts should be kept clean and be protected against the penetration of dirt, oil, water and so forth, which can lower electric conductivity, into them.

To remove the charges of static electricity accumulating in people, before the entrance to explosive and inflammable premises it is necessary to equip conducting grounded zones, grounded plates and grounded metal pipes, on which, when passing, people should put their hands. Conducting floors should be installed on these premises and the shoe soles of people working on these premises should conduct current well. Floors made of dielectric materials (linoleum or slab) should not be installed and rubber runners should not be laid.

On production premises (rubberizing, paint preparation and so forth) it is necessary to periodically (in coordination with the local sanitary and epidemiological station) check the concentration of explosive and toxic substances in the atmosphere of the work zone in order to take measures to lower their concentration to the concentration permissible according to sanitary norms. If it is impossible to lower the concentration of explosive and toxic substances, workers should work in gas masks with discharge hoses.

Table 1. Safety Signs and Areas of Their Application

Name of Sign	Picture	Recommended Area of Application
	1. Prohibiting Signs	
Use of Open Fire Prohibited		To be attached: on the exterior of the doors of warehouses with highly inflammable explosive materials and substances; inside these warehouses; on the sections of work with the indicated materials; on equipment presenting a danger of explosion or inflammation and on the approaches to such equipment.
Smoking Prohibited		To be attached: as indicated above. In addition, it should be hung in places where there are toxins, usually with the additional inscription "Smoking, Eating and Drinking Water Prohibited"
Pedestrian Traffic Prohibited		To be attached: near entrances to dangerous zones

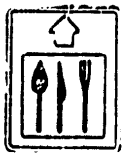
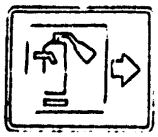
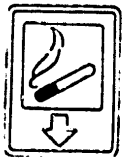
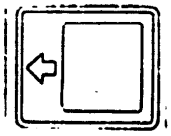
2. Warning Signs

Be Careful! Inflammable Substances		To be attached: on containers with highly inflammable materials and substances; on the approaches to warehouses and sections of work with these materials and substances
Be Careful! Explosive Substances		To be attached: on the exterior of the doors of warehouses with explosive substances and materials; inside warehouses; on sections of work with explosive substances; on containers for the storage and transportation of explosive substances and materials
Be Careful! Radioactive Substances		To be attached: on the exterior of the doors of warehouses with radioactive substances; inside these warehouses; on premises designed for work with the use of radioactive substances; on containers for the storage and transportation of radioactive substances
Be Careful! Electric Current		To be attached: on the exterior of the doors of power switchboards, switch chambers and transformer panels; on the external surfaces of boards and assemblies of cabinets with electric equipment and various machines and machine tools
Be Careful! Toxic Substances		To be attached: on the exterior of the doors of warehouses with toxic substances; on containers for the storage and transportation of toxic substances
Be Careful! (Other Dangers)		To be attached: near dangerous zones not marked by the symbol. It requires a mandatory explanatory inscription

3. Directing Signs

Work in a Helmet		To be attached: on sections of work connected with the possibility of the caving in and falling of objects
Work Here		To be attached: on structures and in places where work safety is ensured
Work in Protective Gloves		To be attached: on work sections connected with the danger of injuries to hands

4. Indicating Signs

Power Supply Center Above		To be attached: on production premises for indicating the way to the power supply center
Fire Extinguishers to the Right		To be attached: on production premises for indicating the shortest way to fire extinguishers
Smoking Place Below		To be attached: on production premises for indicating the way to the smoking place
First Aid Center to the Left		To be attached: on production premises for indicating the shortest way to the first aid center

To prevent cases of poisoning, ethyl, not methyl (wood), alcohol should be used for washing instruments and parts.

Places where work with the use of inflammable and explosive materials is done should be equipped with manual fire extinguishing equipment and with manual fire signaling.

Furthermore, premises that are especially dangerous as far as fire is concerned (rubberizing and paint preparation shops and warehouses) should be equipped with automatic fire signaling.

To prevent diseases of the integument as a result of the effect of organic solvents, resins, hardeners and other irritating substances, the administration should provide workers with protective ointments and pastes free of charge.

Places where inflammable and toxic materials are stored and places where work with the use of these materials is done should be protected with prohibiting, warning and indicating safety signs with due regard for the requirements of GOST /All-Union State Standard/ 15 548-70 "Color-Signal Safety Signs for Industrial Enterprises."

Prohibiting signs--a red circle with a white area inside and a symbolic representation colored black and crossed out with a red strip. Instead of the symbol the sign can have an explanatory inscription, for example; "Smoking Prohibited," "Use of Open Fire Prohibited" and "Entrance Prohibited."

Warning signs--a yellow equilateral triangle with the apex upwards with a symbol colored black and for signs of radiation and electric current danger colored red. They warn about the danger of explosion, inflammation, effect of poisonous and toxic substances, high temperature and injury by electric current; for example, "Explosion Danger!", "Fire Hazard!", "Danger of Poisoning!" and "Radioactive Danger!".

Directing signs--a green square with a symbolic representation colored white, or a green square with a white circle inside and an explanatory inscription in black. They permit work only if specific requirements for safety techniques are observed; for example, with the use of individual protection or only in specific places: "Work in Gas Masks!", "Work in Protective Gloves!" and "Work Here!".

Indicating signs--a blue rectangle with a white arrow and with a symbol or inscription in black inside a white square. These signs indicate where a certain facility or installation--first aid center, safety zone, emergency exit, place of storage of rescue equipment, fire hydrants, smoking place and so forth--is located.

Safety signs and areas of their application are presented in table 1.

Classification and Description of Inflammable, Explosive and Toxic Substances and Materials

Substances and materials that can catch fire from the following pertain to inflammables:

from external heat sources (flame, incandescent bodies, hot air, electric arc or spark, friction and sun rays); for example, wood, paper, plastics, solvents and their vapors;

during contact with other substances and materials; for example, acid with organic materials, bitumen with slag wool and oil with oxygen;

from heat released during chemical self-oxidation processes and leading to self-ignition; for example, metal powders, colophony, moist sawdust in piles and wiping oil impregnated materials.

Noncombustible substances and materials giving off fuel gases during contact with other substances, for example, calcium carbide with water and acids (sulfuric, hydrochloric and nitric) with metals, or increasing the fire danger of fuel substances, for example, oxygen, compressed air and sodium nitrate, are also inflammables.

According to their capacity for burning (inflammability and combustibility) substances and materials are divided into noninflammable (noncombustible), difficultly inflammable (difficultly combustible) and inflammable (combustible).

Substances and materials not capable of burning in the air pertain to noncombustibles.

Substances and materials, which can catch fire under the effect of a source of ignition, but are not capable of self-combustion after the removal of the latter are difficultly inflammable (difficultly combustible).

Substances and materials capable of catching fire from an ignition source and of continuing to independently burn after the removal of the latter pertain to inflammables (combustibles).

Readily combustible substances and materials stand out among inflammable substances and materials. Inflammable substances and materials, which during storage in the open air or in a room are capable, without preliminary heating, of catching fire from a short-term effect of an ignition source of negligible energy (match flame or electric spark) are readily combustible.

Explosives include substances and materials that can explode from the above mentioned external heat sources; for example, fuel gases, compressed and liquefied gases and solvent vapors; from impact, for example, detonating

materials; during contact with other substances and materials, for example, quick lime or calcium carbide with water in a closed vessel, acetylene with copper salts and liquid oxygen with organic substances.

The dust of some solid and liquid substances and materials (for example, aluminum powder, wood dust and pulverized solvent) is also explosive. All explosive substances and materials, including their aerosols and aerogels, are inflammable (aerosol or aerosuspension is the dust of solid and liquid substances and materials in the air; aerosol is the dust that settled on the surface of walls, floors or equipment).

The fire and explosion danger of substances and materials is characterized by a number of indicators, the most important of which are the following:

Flash point--the lowest temperature of an inflammable substance at which vapors or gases capable of igniting in the air from an external ignition source are formed over its surface. The flash point makes it possible to judge the temperature conditions under which a substance becomes inflammable in an open vessel.

The temperature of a substance 10°C lower than the flash point should be considered safe with respect to the possibility of forming explosive vapor or gas air mixtures.

The flash point of inflammable substances is taken into account during the classification of production facilities, as well as premises and installations, according to the degree of fire danger.

Depending on the flash point highly inflammable liquids are divided into three categories:

First category--especially dangerous highly inflammable liquids with a flash point in an open vessel ranging from -13°C and lower;

Second category--constantly dangerous highly inflammable liquids with a flash point in an open vessel ranging from -13 to +27°C;

Third category--highly inflammable liquids dangerous at a high air temperature with a flash point in an open vessel ranging from +27 to +66°C.

Ignition temperature--the lowest temperature of an inflammable substance at which it gives off fuel vapors or gases at such a speed that after their inflammation from an external ignition source the substance burns steadily.

Ignition temperature is characteristic only of inflammable substances and materials, because it characterizes their capacity for self-combustion.

Self-ignition temperature--the lowest temperature of a substance (or of its optimum mixture with the air) at which it ignites without an external ignition source.

The self-ignition temperature of gases and vapors is taken into account when:

classifying the gases and vapors of highly inflammable liquids according to groups of explosion hazard for the selection of the type of electric equipment;

selecting temperature conditions for a safe use of a substance on being heated to high temperatures;

calculating the maximum permissible temperature for heating nonheat insulated surfaces of industrial, electric and other equipment;

investigating the causes of fires if it is necessary to determine whether a substance could ignite spontaneously from a heated surface.

The maximum permissible temperature for a safe heating of nonheat insulated surfaces of industrial, electric and other equipment comprises 80 percent of the self-ignition temperature of gases or vapors (°C) and should not exceed the minimum self-ignition temperature.

Area of ignition of gases (vapors) in the air--the area of concentration of a given gas in the air, percent or g/m^3, under atmospheric pressure (760 mm Hg), inside of which mixtures of gas with the air can ignite from an external ignition source with a subsequent spread of the flame throughout the mixture.

The boundary concentrations of the area of ignition are the lower and upper limits of ignition of gases (vapors) in the air respectively.

The magnitude of the lower limit of ignition (explosiveness) of gases in the air is followed when production facilities are classified according to the degree of fire hazard.

The magnitudes of the limits of ignition are used when calculating the permissible concentrations of gases inside explosive industrial apparatus and recuperation and ventilation systems, as well as when determining the maximum permissible explosive concentration of vapors and gases during operations with the use of fire and sparking tools.

The amount of gas or vapor concentration in the air inside an industrial apparatus not exceeding 50 percent of the amount of the lower limit of ignition is taken as an explosionproof concentration.

A concentration not exceeding 5 percent of the magnitude of the lower limit of ignition of a given vapor or gas in the air in the absence of the condensed phase (liquid) in the examined apparatus is taken as the magnitude of the maximum permissible explosionproof concentration of vapors and gases during work with the use of fire and sparking tools.

The lower limit of ignition (explosiveness) of a mixture of combustible dusts with the air (aerosuspension of solid substances) is the lowest concentration of a substance in the air, g/m^3, under atmospheric pressure, at which the mixture can ignite from an external ignition source with a subsequent spread of the flame throughout the mixture volume.

According to explosion and fire hazard mixtures of combustible dusts with the air are characterized as follows:

the most explosive (first category)--with a lower limit of explosiveness of up to 15 g/m^3;

explosive (second category)--with a lower limit of explosiveness of 15 to 65 g/m^3;

the most inflammable (third category)--with a self-ignition temperature of up to 250°C;

inflammable (fourth category)--with a self-ignition temperature of more than 250°C.

Mixtures of combustible dusts with the air pertain to inflammable mixtures with a lower limit of explosiveness of more than 65 g/m^3.

The lower limit of ignition of aerosuspensions is taken into account when production facilities are classified on the basis of fire hazard in accordance with the Construction Norms and Rules II-M.2-72 and the Rules for Setting up Electric Installations, as well as when safe operating conditions of pneumatic transport, dust settling and other installations are calculated.

A concentration of aerosuspension inside industrial equipment not exceeding 50 percent of the magnitude of the lower limit of ignition (in the absence of settled dust in an apparatus) can be considered explosionproof.

Substances and materials causing a disturbance in the processes of vital activity of the entire human body or individual organs or affecting integuments are toxic, harmful or poisonous.

According to the nature of toxic effect on the human body toxic substances are divided into:

those affecting the nervous system (ammonia, organophosphorus compounds, benzine, alcohols, aniline, hydrogen sulfide, tetraethyl lead, tricresyl phosphate and so forth);

those affecting the liver (carbon tetrachloride, dichloroethane, phosphorus and selenium);

those affecting the blood (carbon monoxide, nitro compounds, benzene, toluene, xylene, lead and its compounds);

those affecting respiratory organs (chlorine, ammonia, fogs of acids and caustic alkalis, acrolein, sulfur dioxide, nitrogen oxides, benzene, toluene, styrene, naphthalene, anthracene and silicate dust);

those affecting integuments (acids: sulfuric, nitrogen, hydrochloric and acetic; caustic alkalis: caustic soda and caustic potassium; acid and basic oxides, chromates, dichromates and phenols);

carcinogenic substances--contributing to the onset of cancer diseases (petroleum asphalts, coal and shale tars and oils, coal tar and petroleum pitches, anthracene and some insecticides);

general poisonous substances--affecting several human organs or the entire body (hydrocyanic acid, mercury compounds and radioactive substances).

Acute and chronic poisoning is distinguished. Acute poisoning is the consequence of a short-term effect of poisonous substances entering the body in a significant quantity.

Chronic poisoning develops as a result of a gradual and continuous effect of toxic substances entering the body in small doses and is noted for a great persistence of poisoning symptoms. As a result of chronic poisoning occupational diseases (nervous and skin diseases, catarrhs of mucous membranes and silicosis) appear.

The safety of work with toxic substances in the form of vapors, aerosols and gases is characterized by the maximum permissible concentration of these substances in the air of the work zone of production premises.

Concentrations that with daily work within 8 hours during the entire length of service cannot cause in workers diseases or deviations in their state of health detected by modern methods of investigation directly in the process of work or during remote periods are the maximum permissible concentrations of toxic substances in the air of a work zone.

A space up to 2 meters above the level of the floor, or a site on which the places of workers' permanent or temporary stay are located, is considered a work zone.

The maximum permissible concentrations of toxic (harmful) substances in the air of a work zone approved by the USSR Ministry of Health are presented in the "Sanitary Norms for the Planning of Industrial Enterprises" (SN 245-71).

For toxic substances, whose maximum permissible concentrations have not been approved, temporary maximum permissible concentrations and the conditions for the use of these substances in each specific case are set by the USSR Ministry of Health.

The concentration of toxic (harmful) substances in the air of a work zone is determined by means of gas analyzers.

The characteristics of fire danger, explosion hazard and toxicity of the basic substances and materials used in construction are presented in appendix 2.

Loading-Unloading and Transport Operations

Damage to and the lack of air tightness of containers carrying inflammable, explosive and toxic materials, careless handling of containers and materials (bumps, shocks or heating), open fire, sparks, joint transportation of incompatible materials (for example, oxygen with fuel gas, highly inflammable liquid or oil), work without special protective equipment and permitting untrained personnel to work present a danger during the loading, unloading and transportation of the indicated materials.

Therefore, the loading, unloading and transportation of inflammable, explosive and toxic materials should be carried out by especially trained and instructed personnel in accordance with the requirements of section 7 of the Construction Norms and Rules III-A. 11-70 "Safety Techniques in Construction" and chapter 20 of "Rukovodstvo po Organizatsii Truda pri Proizvodstve Stroitel'no-Montazhnykh Rabot" /Handbook of Labor Organization During the Performance of Construction and Installation Work/ (Central Scientific Research and Planning Experimental Institute for the Organization, Mechanization and Technical Assistance to Construction, Moscow, 1971).

Furthermore, during the operation of motor transport it is necessary to fulfill the requirements of the "Rules of Safety Techniques for Motor Transport Enterprises" of the Central Committee of the Trade Union of Workers in Motor Transport and Highways and the "Rules of Road Traffic" approved by the USSR Ministry of Internal Affairs dated 25 August 1972.

The motor vehicle designed for the transportation of inflammable and explosive materials should have fire extinguishing equipment and a warning signal (red flag).

Before the loading and unloading of inflammable, explosive and toxic materials every cargo place should be examined carefully. In case damage to containers is detected, the work superintendent should be summoned to the place of work and indicate safe work methods.

Places of loading and unloading of inflammable and explosive materials should be illuminated with low-voltage electric lamps of no more than 36 V in explosionproof fittings.

The railroad cars in which inflammable, explosive and toxic materials are transported must be cleaned and washed with water after the unloading.

The loading and unloading of highly inflammable and combustible liquids (gasoline, kerosene, diesel fuel and solvents) should be carried out by means of pipeline pumps. Pipelines should have attachments for fully emptying them after pouring off or pouring in. Heat insulated materials for pipelines should be noncombustible.

It is forbidden to lay pipelines for highly inflammable liquids (gasoline, kerosene and solvents) in common canals with gas, steam and hot water pipes and with heavy and weak current cables.

It is permitted to lay pipelines for combustible liquids (diesel fuel, drying oil and lubricating oils) in common canals with steam and hot water pipes.

The transportation of highly inflammable and combustible liquids is permitted only in special tanks or in metal barrels with tightly screwed corks. All capacities with these liquids should have the inscriptions "Fire Hazard."

Tank trucks should be equipped with grounded circuits.

When highly inflammable, combustible and other fire hazardous goods are transported on sided trucks, mufflers must be guarded by protective (reinforced asbestos) covers.

It is forbidden to transport highly inflammable combustible liquids on trucks in large bottles, containers, pails and similar capacities.

People are also forbidden to stay in the bodies of sided trucks transporting combustible liquids, compressed gas cylinders and explosive or toxic materials.

When loading, unloading and transporting ethyl gasoline, it is necessary to take into account that its vapors, in addition to fire hazard, have a poisoning effect on the human body. Tanks, barrels and canisters with ethyl gasoline should have big inscriptions in indelible paint "Ethyl Gasoline. Poison."

Trucks on which ethyl gasoline is transported must be subjected to careful cleaning after each transport operation.

Trucks on which compressed gas cylinders are transported should be equipped with special shelves with grooves, according to the diameter of cylinders, covered with felt. Cylinders must be stacked with protective caps in one direction across the truck body within the height of the sides. Protective caps should be screwed tightly. During summer cylinders must be protected against sun rays with tarpaulin or another cover.

It is permitted to transport compressed gas cylinders in a vertical position with rubber packings between cylinders and a joint fastening of the group of cylinders to the truck body.

The loader accompanying the truck should have documents attesting to his right to transport compressed gas cylinders. When cylinders are loaded and unloaded, they must not be dropped or hit each other.

It is not permitted to load oxygen cylinders on trucks in whose bodies there are oil traces, dirt and trash.

The joint transportation of the following is not permitted: cylinders with oxygen and cylinders with fuel gases or chlorine; cylinders with oxygen and drums with calcium carbide; cylinders with oxygen and capacities with fats, oils and highly inflammable and combustible liquids.

The loading and unloading of compressed gas cylinders by means of hoisting cranes can be carried out with the observance of the following conditions: Cylinders must be placed in a special container with a hoisting shackle. The container should have an inscription indicating the empty and maximum weight of the transported load, the inventory number and the date of the last test. The container for cylinders should undergo annual tests for a double load (cylinder mass plus container mass). After the test report is drawn up, its results are recorded in a log. The container should be subjected to a detailed examination once in 10 days.

When loading, unloading and transporting drums with calcium carbide, it is necessary to protect them from bumps, shocks, rain and snow. It should be kept in mind that, when the vacuum seal of drums with calcium carbide is impaired, as a result of the latter's contact with the air moisture, explosive and toxic acetylene can be formed.

Drums with calcium carbide should be unloaded from railroad cars and trucks by rolling them down obliquely placed boards, because, when drums are dropped even from a small height, their air tightness can be impaired.

When loading, unloading and transporting barrels with chlorinated lime, the precautionary measures indicated for calcium carbide are necessary, because, when the air tightness of containers is impaired, the decomposition of chlorinated lime with the release of toxic chlorine is possible. Therefore, in addition to special work clothing, loaders must be provided with gas masks.

The joint transportation of chlorinated lime with metal, explosive substances, fire hazardous products, lubricating oils and compressed gas cylinders must be avoided.

When the decomposition of chlorinated lime or self-ignition are detected in barrels, they must be wheeled out to a safe place and taken apart and lime must be covered with earth.

Drums with aluminum powder should be transported and unloaded very carefully--without bumps, shocks or rolling.

Drums with aluminum powder should not be dropped from transport facilities because this will lead to an impairment of their air tightness.

If damage to the drum is detected during unloading, the powder should be immediately reloaded into hermetically closed containers.

Small toxic dust is formed during loading and unloading operations and the transportation of coal tar pitch. Settling on the skin, it causes irritation and inflammation. These phenomena occur especially rapidly and intensively on sunny days. In order to avoid these diseases, all loading, unloading and transport operations should be mechanized and performed at night or during premorning hours. As an exception, it is permitted to perform these operations with coal and tar-like materials by means of picks, shovels, handbarrows and so forth. It is not permitted to take coal tar pitch or tar-like materials in hands even in mittens.

Explosive materials must be loaded, unloaded and transported in accordance with the "Unified Safety Rules During Blasting."

It is permitted to bring railroad cars with explosive materials to warehouses for loading and unloading by means of motor trolleys and diesel engines equipped in accordance with paragraph 73 of the "Instruction for the Transportation of Explosive Materials" (supplement 6 to the "Unified Rules..."), as well as storage-battery locomotives and winches.

Steam engines can be used for these purposes only at a distance no closer than 50 meters from the warehouse, and trolley locomotives, to the warehouse fence. The limits of the permissible travel of steam engines and trolley locomotives should be designated with signs clearly visible at any time of the day.

On the warehouse territory the traveling speed of railroad cars should not exceed 10 km per hour.

In every warehouse it is permitted to unload or load no more than two normal-gage and four narrow-gage railroad cars simultaneously.

Steam engines servicing railroad cars or trains with explosive materials should have spark extinguishers, efficient furnaces and ashpits.

When departing for the warehouse territory, the operator must close the furnace and ashpit and stop siphoning at the places where there are pertinent signs.

On the territory of the warehouse with explosive materials it is prohibited to perform operations that may involve the formation of fire or sparks, that is, furnace cleaning and the use of torches during the examination of steam engines, motor trolleys, diesel engines and electric locomotives.

In warehouses and storage facilities it is permitted to use storage battery loaders for the mechanized loading and unloading of explosive materials of the second group and of demolition cords.

Acids and caustic alkalis can be loaded and unloaded in special warehouses or on platforms, whose floor must be on the same level as the floor of the railroad car.

Work on loading and unloading acids and caustic alkalis should be done by experienced workers in appropriate special work clothing. Every loader must be equipped with a gas mask.

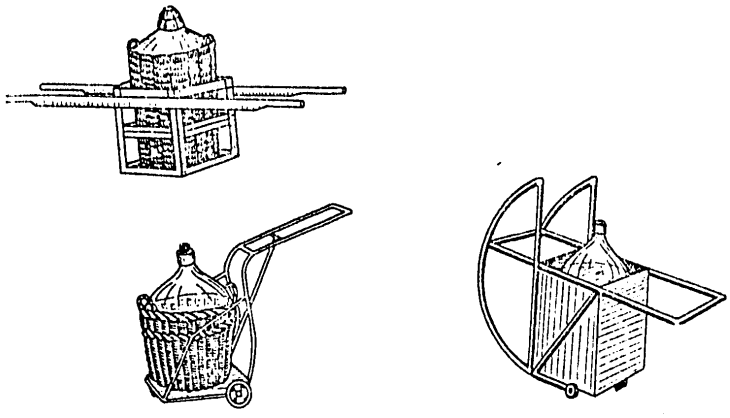


Fig. 1. Devices for the Transportation of Acids and Alkalis

During the transportation of acids and alkalis in metal containers or tank trucks an inspection of containers and tank trucks for checking their condition is mandatory before every trip.

Acids and alkalis in glass containers should be transported from the place of unloading to the warehouse and from the warehouse to the place of loading on special safe trolleys, wheelbarrows or handbarrows (fig. 1). It is not permitted to transport this cargo without special devices.

Glass containers should be in woven or wooden baskets, without which their transportation is not permitted.

Trolleys, wheelbarrows, handbarrows and other devices should have nests according to the sizes of transported containers. Nest walls should be padded with soft material (bast matting or felt). Large bottles and other glass containers must be placed in them on the side, for which the nests should have side doors with locks ruling out their spontaneous opening.

Large bottles with acid can be carried with basket handles only over short distances. The intactness of the basket bottom must be checked in advance. If the basket is damaged, it should be placed in a special iron box in which it should be carried or transported to the warehouse.

It is categorically forbidden to carry large bottles with acid and alkalis on the back, shoulder or in front of oneself.

It is not permitted to transport, load, and unload acids and alkalis by means of hoisting mechanisms, with the exception of elevators and shaft lifts.

When capacities with acids and alkalis are transported in the truck body, the following rules should be observed:

glass capacities with liquids must be placed vertically (with the corks up);

every cargo place must be fixed in the body so that during travel, stops and turns it could not be moved on the body floor or tip over;

cargo in glass containers should not be placed on each other (in two rows) without the appropriate packing ensuring the safety of cargo.

It is not permitted to place people in the bodies of trucks transporting acids and alkalis. This also applies to the personnel directly servicing transport operations.

Two loaders should load and unload acids and alkalis, as well as place them in transport devices.

Containers emptied of acids (large bottles) should be handled as carefully as filled containers, because there can be acid residues in them.

At the place of loading or unloading of acids and alkalis there should be pure water for immediate washing of the calcined place in case of a burn with acid or alkali.

When broken bottles and boxes, spilled acid or loose caustic alkali are detected, workers must put on gas masks and do the cleaning in them.

Spilled acid is neutralized with milk of lime, then this place is covered with sand or ash, after which everything is carefully removed with a shovel and then this place is covered with earth.

After the cleaning the floor inside the premises is washed with a large amount of water.

Liquid paint-and-varnish materials, solvents and mastics for gluing the polymeric coatings of floors are transported in hermetically closed containers. They are loaded, unloaded and transported like the inflammable and toxic materials previously indicated in this section.

As a rule, loading and unloading operations with dusting materials (cement, lime, gypsum and so forth) should be performed in a mechanized way.

During the manual loading and unloading of dusting materials loaders should have protective goggles and respirators.

The loading, unloading and transportation of radioactive substances are done in accordance with the "Basic Sanitary Rules of Work With Radioactive Substances and Other Sources of Ionizing Radiation" (OSP-72), the "Standards of Radiation Safety" (NRB-69) and the "Rules of Transport of Radioactive Substances."

Warehousing and Storage of Materials

To meet the current needs of construction organizations, service warehouses of physical assets, including inflammable, explosive and toxic materials, are established. The fire fighting gaps between the service warehouses of these materials, on the one hand, and the closest buildings and installations adjacent to them, on the other, should be adopted in accordance with the Construction Norms and Rules II-M. 1-71 "Long-Term Plans of Industrial Enterprises. Planning Norms" (table 2).

In accordance with the Construction Norms and Rules II-P.1-62* "Warehouse Buildings and General-Purpose Installations. Planning Norms" the height of warehouse premises in buildings should be no less than 4.2 meters and in basements, no less than 3 meters. The materials used for floor installation should ensure a smooth and nonskid surface convenient for cleaning.

In coordination with the bodies of the State Fire Inspectorate it is permitted to establish warehouses, with the exception of warehouses of highly inflammable and combustible liquids, calcium carbide and other fire hazardous and explosive substances and materials, in buildings under construction.

In service warehouses timber must be stacked with the observance of fire fighting gaps.

Round timber (logs) should be stored in stacks no higher than 1.5 meters. For steadiness between rows (in height) boards are placed across and props against rolling are installed.

The sizes of stacks of round timber should not exceed the length of a log in width and 100 meters in length.

Sawn timber (beams, boards and so forth) should be stored in stacks and placed on gaskets made of strips or boards of the same thickness in four or five rows. When it is placed manually by the ordinary method, the height of a stack should be no more than one-half of its width and, when it is placed crosswise, no more than the width of a stack. "Air holes" measuring 1 to 2 cm for drying should be left between boards.

Table 2. Smallest Distances From Ground Service Warehouses to Buildings and Installations

(1) Склады	Расстояние от границ складов до зданий и сооружений, м, со степенью огнестойкости (2)		
	I – II	III	IV
Лесоматериалов емкостью, м³: (3)			
от 1000 до 10 000 (4)	15	24	30
менее 1000 (5)	12	15	18
Сгораемых материалов (щепы, опилок и т. д.) емкостью, м³: (6)			
от 1000 до 5000 (7)	18	30	36
менее 1000 (5)	15	18	24
Легковоспламеняющихся жидкостей емкостью, м³: (8)			
от 1000 до 2000 (9)	30	30	36
от 600 до 1000 (10)	24	24	30
менее 600 (11)	18	18	24
Горючих жидкостей емкостью, м³: (12)			
от 5000 до 10 000 (13)	30	30	36
от 3000 до 5000 (14)	24	24	30
менее 3000 (15)	18	18	24

Remarks: 1. For sawn timber warehouses, when a stack is no more than 2.5 meters high, the distances indicated in the table for buildings of the third and fourth degree of refractoriness must be increased by 25 percent. 2. The distances indicated in the table from warehouses of timber and highly inflammable and combustible liquids to buildings with production facilities of categories A and B, as well as to residential and public buildings, should be increased by 25 percent. 3. During the joint storage of highly inflammable and combustible liquids the effective warehouse capacity is determined on the basis of the fact that 1 cubic meter of highly inflammable liquids is equated with 5 cubic meters of combustible liquids. 4. During the underground storage of highly inflammable or combustible liquids the distances indicated in table 2 can be reduced by 50 percent. 5. The distance between warehouses of various materials should be taken according to Construction Norms and Rules II-M.1-71, table 5.

Key:

1. Warehouses
2. Distance from the boundaries of warehouses to buildings and installations, meters, with the degree of refractoriness
3. Of timber of a capacity, cubic meters
4. From 1,000 to 10,000
5. Less than 1,000
6. Of combustible materials (wood chips, sawdust and so forth) of a capacity, cubic meters
7. From 1,000 to 5,000
8. Of highly inflammable liquids of a capacity, cubic meters
9. From 1,000 to 2,000
10. From 600 to 1,000
11. Less than 600
12. Of combustible liquids of a capacity, cubic meters

13. From 5,000 to 10,000
14. From 3,000 to 5,000
15. Less than 3,000

The stacks of sawn timber should not exceed in their length and width the length of a board (beam) and in their height, 8 meters. The gaps between stacks should be no less than 2 meters.

The number of stacks in a group should be no more than 12, the maximum length of a group being 50 meters and width, 15 meters. Gaps of no less than 25 meters should be maintained between groups of stacks.

In warehouses of building sites stacks should be placed so that there may be longitudinal and transverse passages no less than 1.0 meter wide between them.

A longitudinal passage should be made in the middle of a warehouse site and transverse passages, every 25 to 30 meters. Fire passages are made in accordance with the work plan.

Service warehouses and warehouses of building sites should have through passages or circular detours for motor vehicles.

The warehousing of wood sawdust together with strips and chips is not permitted. Wood sawdust should be poured into especially assigned places or boxes and other waste (rags, metal chips and so forth) should be warehoused separately from wood waste. The places where wood waste (chips, shavings, cuttings and so forth) is dumped should be at a distance of no less than 50 meters from the closest buildings and boundaries of a timber warehouse.

The following should be clearly marked on the containers or packages in which fire hazardous, explosive and toxic materials arrive at warehouses: the name of the manufacturing plant or the trademark, the name of the material, its brand, the number of the batch and the date of manufacture and the number of GOST or of the technical specifications according to which the material is manufactured. Furthermore, containers should have markings (fig. 2 and 3).

In addition to this, containers with fire hazardous materials, for example, solvents, glues and mastics, should have the inscription "Fire Hazard."

Every batch of supplied materials or articles should be accompanied by a document certifying their quality and correspondence to the requirements of GOST or technical specifications.

Every batch of materials and articles should be accompanied by an instruction for the use of materials or articles with a mandatory indication of the rules of labor protection and safety techniques.

Fig. 2. Rigging Marking of Cargo

Key:

1. Top
2. Keep Away From Dampness
3. Caution, Breakable, Fragile Glass
4. Keep Away From Cold
5. Don't Tilt
6. Keep Away From Heat
7. Liquid
8. Keep Away From Light
9. Don't Pick Up With Hooks
10. Open Here
11. Lift Here

It is permitted to store highly inflammable and combustibe liquids in containers in especially designed storage facilities, the degree of refractoriness of which, according to the classification in the Construction Norms and Rules II-A. 5-70 "Fire Protection Norms for the Planning of Buildings and Installations," should be no lower than II during the storage of liquids at a vapor flash point of up to 120°C and not lower than III during the storage of liquids at a vapor flash point of more than 120°C.

It is permitted to build warehouses for the storage of petroleum products, as well as highly inflammable and combustible liquids, whose storage conditions and properties connected with explosion and fire danger are similar to analogous properties of petroleum and petroleum products, in accordance with the Construction Norms and Rules II-P. 3-70 "Warehouses of Petroleum and Petroleum Products." Standard plans of small-tonnage warehouses of fuels and oils, highly inflammable liquids and chemical reagents are presented in table 3.

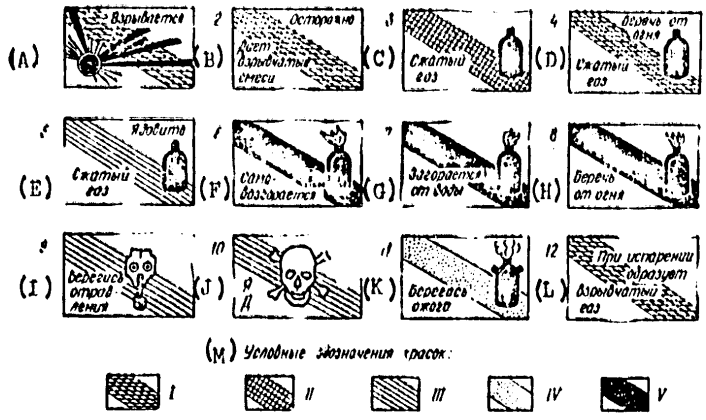


Fig. 3. Designations of Dangers of Substances and Materials:

I--orange; II--green; III--yellow; IV--blue; V--red.

Key:

A. Explodes
B. Caution, Produces Explosive Mixtures
C. Compressed Gas
D. Guard Against Fire, Compressed Gas
E. Toxic, Compressed Gas
F. Ignites Spontaneously
G. Catches Fire From Water
H. Guard Against Fire
I. Beware of Poisoning
J. Poison
K. Beware of Burns
L. Forms Explosive Gas During Evaporation
M. Conventional designations of colors

It is not permitted to store liquids with a vapor flash point of 28°C and lower on semibasement and basement premises.

The storage of all highly inflammable liquids is permitted only in serviceable and hermetically sealed metal containers.

The joint storage in one storage facility of highly inflammable and combustible liquids in a container, in general, of no more than 50 cubic meters is permitted.

The stacking of barrels with liquids at a vapor flash temperature of 28°C and lower is permitted only in one row and the stacking of barrels with other liquids, in no more than two rows.

During a mechanized stacking of barrels on shelves the number of shelve tiers should not exceed five for combustible liquids and three for highly inflammable liquids at a vapor flash point of no more than 28°C.

The stacking of barrels on shelves should be carried out in one row at every shelve tier regardless of the type of liquid.

In every stack or shelve no more than two barrels should be placed along their width and no more than 15, along the length of a stack or shelve.

The main passages for the transportation of barrels should be no less than 1.8 meters wide and the auxiliary passages between stacks or shelves, no less than 1 meter.

To open barrels with highly inflammable liquids, special devices should be used (fig. 4). It is forbidden to use tools that can cause spark formation.

Ethyl gasoline should be stored, distributed and obtained in accordance with the requirements of section XII "Safety Techniques During the Use of Ethyl Gasoline" of the Rules of Safety Techniques for Motor Transport Enterprises.

The storage of ethyl gasoline in open containers is forbidden. Fuel warehouses should have separate capacities and gasoline lines for ethyl and non-ethyl gasoline.

Wiping materials used during work with ethyl gasoline and other toxic liquids should be stored in metal boxes and be burned subsequently.

Containers emptied of gasoline and other highly inflammable liquids, as well as of toxic substances, should be stored on an especially assigned site removed from the warehouse at a distance of no less than 50 meters.

It is forbidden to repair (weld, rivet, solder and so forth) metal containers emptied of combustible liquids and toxic substances before they are washed or decontaminated.

Explosive substances should be stored and recorded in accordance with the "Unified Safety Rules During Blasting."

Cylinders with compressed and liquefied gases should be stored in accordance with the "Rules of Installation, Maintenance and Inspection of Cylinders for Compressed, Liquefied and Dissolved Gases." Every cylinder should have a color and inscription indicating the kind of gas that is placed in a cylinder. Cylinders with gases should be stored on special closed, ventilated warehouse premises, or under awnings protected from direct sun rays numbering no more than 50.

Table 3. Standard Small-Tonnage Warehouses for the Storage of Fuels and Oils, Highly Inflammable Liquids and Chemical Reagents

No of Standard Design	Name of Design	Organization Developing the Design	Organization Distributing the Design
704-1-42	Horizontal welded tank for petroleum products of a capacity of 3 cubic meters	Central Scientific Research and Planning Institute of Building Metal Structures	Kazakh Affiliate of the Central Institute of Standard Designs
704-1-49	Vertical cylindrical steel tank for petroleum and petroleum products of a capacity of 100 cubic meters	"	"
704-1-35	Warehouses of fuels and oils of 5 tons; type 1, brick walls; type 2, rubble concrete walls	All-Union State Planning and Surveying Institute of Forestry	All-Union State Planning and Surveying Institute of Forestry
704-1-33	Open-storage warehouses of fuels and oils of 12 cubic meters	"	"
704-1-34	The same, of 30 cubic meters	"	"
704-4-4	Ground warehouse for the storage of fuels and oils in containers of a capacity of 12 to 15 tons	State Institute for Planning and Research in the Petroleum Production Industry	Sverdlovsk Affiliate of the Central Institute of Standard Designs
704-4-5	The same, underground warehouse	"	"
704-4-1/70	Warehouse for container storage of fuels and highly inflammable liquids of a capacity of 30 tons	State Institute for the Planning of Enterprises of the Woodworking Industry	State Institute for the Planning of Enterprises of the Woodworking Industry

704-1-94	Ground diesel fuel storage facilities of a capacity of 3, 5 and 10 tons; 2X3; 2X5; 2X10 meters	State All-Union Planning Institute of the USSR Ministry of Communication	State All-Union Planning Institute of the USSR Ministry of Communication
705-2-2	Warehouse of toxic chemicals of 27 tons	All-Union State Planning and Surveying Institute of Forestry	All-Union State Planning and Surveying Institute of Forestry
705-4-15	Sections of trackside warehouses of packaged chemical reagents 18 meters wide (heated)	State All-Union Institute for the Planning of Special Structures, Buildings and Sanitary-Engineering and Power Installations for Enterprises of the Chemical Industry	State All-Union Institute for the Planning of Special Structures, Buildings and Sanitary-Engineering and Power Installations for Enterprises of the Chemical Industry
709-111	Warehouse of resin and chemicals in containers of a capacity of 100 tons	All-Union State Planning and Surveying Institute of Forestry	All-Union State Planning and Surveying Institute of Forestry
409-29-28	Cement warehouses of a capacity of 25 tons for repair and construction bases	State Republic Institute for the Planning of Municipal Construction	Kiev Affiliate of the Central Institute of Standard Designs

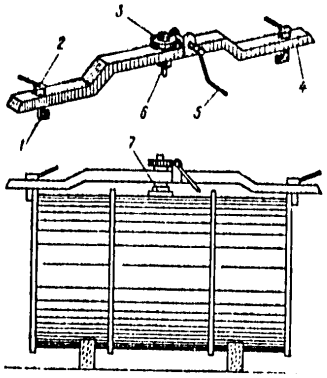


Fig. 4. Device for a Safe Opening of Barrels:

1--clamps; 2--wing nuts; 3--worm gear; 4--beam; 5--handle; 6--Kennedy key; 7--plug

When it is necessary to store more than 50 cylinders with gases, the "Rules of Installation and Safe Operation of Vessels Operating Under Pressure" should be followed. Warehouses of cylinders with gases should have natural or artificial ventilation ensuring the removal of gases that can evolve from cylinders. The temperature at warehouses should not exceed +35°C.

The distance between cylinders and furnaces and other sources of heat with an open flame should be no less than 10 meters.

Cylinders filled with gas should be stored in a vertical position. To avoid a fall, they should be placed in especially equipped nests and cages or be enclosed by barriers.

Cylinders that do not have shoes can be stored in a horizontal position on wooden frames or shelves. At the same time, the height of stacks should not exceed 1.5 meters. All cylinder valves should be turned to one side. Cylinders should be equipped with steel or cast iron safety caps.

Cylinders with oxygen and cylinders with fuel gases, as well as cylinders with compressed and liquefied gases together with calcium carbide, combustible liquids and lubricating and wiping materials, cannot be stored in one place. Combustible and wiping materials cannot be stored closer than 10 meters from the warehouse with cylinders.

It is not permitted to perform operations with the use of open fire (soldering, welding, forging and so forth) at a distance of 10 meters around a warehouse with cylinders.

Calcium carbide should be stored in closed metal drums in a dry, well ventilated warehouse with a light roof and natural lighting. The warehouse floor should be raised no less than 0.2 meters over the ground level. It is not permitted to store calcium carbide on basement premises. The installation of a water pipe and heating is forbidden in places where calcium carbide is stored.

Drums with calcium carbide must be stored in a vertical position on wooden pads no less than 200 mm high. They should be stacked in no more than two tiers in height with a pad no less than 200 mm thick between the tiers of boards and panels. The width of passages between the stacked drums with calcium carbide should be no less than 1 meter.

The temperature at which the storage of calcium carbide is permitted should be no higher than +35°C. It is forbidden to store calcium carbide together with other materials.

Drums with calcium carbide can be opened only by means of special tools and devices ruling out the possibility of spark formation (fig. 5).

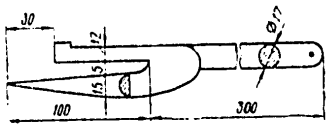


Fig. 5. Knife for Opening a Drum With Calcium Carbide

Before opening, the drum cap should be lubricated with a layer of consistent lubricant, for example, solid oil, 2-3 mm thick, which, facilitating the process of cutting, rules out the possibility of spark formation. At the same time, one must stand on the side opposite the longitudinal seam on the drum wall. Smoking during the opening of drums is prohibited.

The calcium carbide that poured out of drums must be stored in hermetically closed containers. The remainder of calcium carbide in the drum should be closed with a cap and rubber or tarpaulin should be placed on top of it. The opening of drums with calcium carbide, weighing of calcium carbide and sifting of fines and dust should be carried out in a separate place protected from atmospheric precipitation. It is forbidden to perform such operations at a calcium carbide warehouse.

It is not permitted to crush calcium carbide on warehouse premises or at the place where drums are opened.

It is not permitted to store opened or damaged drums in a calcium carbide warehouse. In case immediate use is impossible, calcium carbide should be transferred to hermetically closed containers (special cans) and be used first. The storage of calcium carbide in open vessels is forbidden.

The accumulation of carbide dust at a warehouse is not permitted. It must be collected every day and water must be poured over it in open air. The capacity of a vessel for the decomposition of this dust should be no less than 200 liters. No more than 10 kg of carbide dust and fines can be decomposed in a vessel of such a capacity without changing water. Carbide dust should be poured into the vessel with water in small portions of 200 to 500 grams. The next portion can be poured only after the complete decomposition of the previous portion.

The storage facility must be cleaned of the remainders of calcium carbide every day. Carbide silt or extinguishing residues can be dumped into a pit located at a distance of no less than 10 meters from the warehouse. Near the pit there must be a plate with the inscription "Fire Danger. No Smoking."

Drums emptied of calcium carbide, after their thorough cleaning of carbide dust with dry rags, brushes and so forth, should be stored in stacks so that their falling or slipping one after another may be ruled out.

Aluminum powder must be stored on dry closed warehouse premises packed in metal drums (cans) of a capacity of 25, 30 or 50 kg (GOST 5494-71) protected from moisture and removed from heating units and open fire. Dry boards 40 to 50 mm thick should be placed between drum tiers.

It is forbidden to store aluminum powder in open or damaged drums in a warehouse.

The electric equipment and illumination at the warehouse where aluminum powder is stored should be explosionproof.

Unslaked lime should be stored on closed warehouse premises and the entry of water into it must be avoided.

Toxic (poisonous) substances must be stored on separate, well ventilated premises removed from residential buildings, restaurants, reservoirs, as well as from places where construction and installation work is carried out. The following warning signs should be hung on premises where the indicated substances are stored: "Dangerous! Poison!".

Chlorinated lime should be stored only in plant packaging on closed, darkened and well ventilated warehouse premises, on which a temperature no higher than 20 to 25°C should be maintained. The floors in chlorinated lime warehouses should be made of asphalt, brick or clay. The warehouse roof should be made of roll roofing materials or asbestos cement sheets, but not of sheet steel.

Barrels with chlorinated lime should be stacked in a horizontal position. A three-tier stacking of barrels of a capacity of 275 liters and a five-tier stacking of barrels of a capacity of 50 to 100 liters are permitted. At the same time, the last barrels in each tier should be wedged. Barrels must be stacked in such a way that the openings with caps are turned toward the passage. Barrels with chlorinated lime should be protected from bumps and shocks.

Every wherehouse where chlorinated lime is stored must have no less than two gas masks for warehouse workers, because chlorinated lime, on accidentally coming in contact with moisture, decomposes, releasing toxic chlorine.

The warehouse for the storage of acids should be located separately from warehouses of other materials. It is not permitted to store acids on basement premises. No other materials can be stored in an acid warehouse.

Acids can be stored in tanks, containers, barrels and in a small amount in glass bottles. Glass bottles with acid should be stored on closed fireproof dry and ventilated premises and protected from the effect of sun rays and heat from heating units. The recommended air temperature on these premises should be from 3 to 10°C. At a negative temperature acids freeze and bottles break.

The sites for the placement of bottles should be lined with acidproof material and drainage chutes for removing accidentally spilled acid should be installed at the edges.

Glass bottles should be packed into woven willow baskets or wooden lattices reaching the level of the necks of bottles. The bottom and sides of bottles are carefully covered with straw or wood shavings.

Bottles should be closed with glass or calcined clay caps and sealed with alabaster or special putty. The necks of bottles and caps are wrapped with fabric.

Bottles with acid should be placed in groups, no more than 100 bottles in each group, in two or four rows, pads should be stacked between rows and passages no less than 1 meter wide should be left between groups.

A tag indicating the manufacturing plant, the name of the acid, the number of the batch, the gross and net weight and the GOST number is attached to the neck of every bottle.

Bottles emptied of acids are stored with the same precautions as full bottles.

The same designations as on the tags of bottles should be applied with durable paint on the bottoms of barrels by means of stencils. Tanks and containers with acid are accompanied by certificates with similar designations.

Acid stored in metal containers (barrels and tanks) corrodes iron. At the same time, hydrogen is released, forming with air oxygen an explosive detonating mixture. Therefore, to avoid an explosion, it is not permitted to open iron barrels and tanks with a steel instrument, which can cause the appearance of sparks.

Acids should be transferred from bottles to service containers only through funnels by tilting bottles placed on special supports or trolleys with tipping hinged devices ensuring a forced incline of bottles. To prevent the spraying of acids during the transfer, special nozzles are placed at the necks of bottles. It is forbidden to suck acid with the mouth through a hose.

Acid warehouses (in case of a spill) should always have sand, ash and neutralizers (5- to 10-percent solution of sodium bicarbonate and milk of lime). Neutralization should be carried out in gas masks with a simultaneous ventilation of the warehouse.

Calcium chloride should be stored in metal barrels or glass bottles under conditions similar to the conditions of acid storage.

Drums with caustic alkalis (caustic soda, sodium aluminate and caustic potash) are stored on closed dry premises placed in stacks up to 1.5 meters high in no more than two rows divided by pads.

Caustic alkalis burn clothes and, penetrating the skin, cause burns. They are extremely dangerous for the eyes. Therefore, when working with caustic alkalis, warehouse workers must use special rubber work clothing and wear protective goggles.

Blue and iron vitriol should be stored in wooden barrels or plywood drums in a dry, closed and mandatorily unheated place.

Warehouse premises where paint and varnish materials and mastics are stored should be fireproof, dry, well-aired or ventilated, adequately illuminated, kept clean and provided with firefighting equipment.

Paints, mastics and glues on organic solvents should be stored in hermetically closed containers in a dark room equipped with ventilation and adapted for the warehousing of highly inflammable substances at a distance of no less than 2 meters from water heating units. Other types of heating are not permitted on these premises. The temperature on these premises should not exceed 20°C.

Owing to a possible ignition, a joint storage of oil paints, drying oil, mastics, glues and lubricants with paper, fibrous materials, that is, oakum, felt and mineral wool, as well as with cylinders containing oxygen, hydrogen, acetylene, propane-butane, chlorine and ammonia, is prohibited.

Synthetic resins, plasticizers and liquid hardeners should be stored in closed warehouses (preferably in underground storage facilities) at a temperature no higher than 15°C.

FA and FAM resins are delivered and stored in bottles or in ordinary iron barrels and tanks. Under winter conditions FA and FAM resins should be stored only in iron barrels for the convenience of subsequent warm-up.

Epoxy resins should be stored on warm warehouse premises in metal cans at a temperature of 10 to 30°C.

Glue No 88-n should be stored in an unheated warehouse at a temperature of +15 to -15°C in clean hermetically closed containers made of aluminum, duralumin, tin plate, galvanized sheet steel, stainless steel or glass.

Leykonat /solution of triphenylmethanetriisocyanate in dichloroethane used for cementing rubber to metal/ should be stored in glass containers closed with cork or rubber caps in a dark and dry place. The cap should be sealed with paraffin from above and tightly tied with fabric.

Polyisobutylene should be stored in rolls rolled on wooden sticks. Rolls are packed in plywood or board latticed boxes and stored in closed rooms at a temperature of +30 to -30°C and at a distance of no less than 1 meter from heat radiating units.

Uncured rubber, ebonite and semiebonite should be stored in rolls rolled on wooden sticks and stacked on metal shelves on premises of second degree of refractoriness equipped with artificial lighting in water- and dust-proof fittings and with electric wiring in gas pipes. The ventilation of the warehouse should be natural through fanlights, the floor should be made of concrete and it should have water heating.

Polyvinyl chloride plastic and plasticized material in sheet form should be stored in wooden latticed boxes or containers similarly to polyisobutylene.

Polyethers should be stored in glass bottles or aluminum cans at a temperature of 5 to 250°C without letting sunlight in.

Benzosulfonic acid, when heated above 60°C, decomposes, in connection with which it is recommended that it be stored on premises at a temperature of 10 to 15°C in steel barrels, which are stacked in one row.

Benzoperoxide is a fire hazardous product, because it is capable of exploding during friction, impact or heating. On the basis of these properties it should be stored in polyethylene, ceramic or glass bottles on premises at a temperature no higher than 20°C.

Isopropylbenzene hydroperoxide should be stored in iron barrels of the heavy type with the inscriptions "Fire Danger" and "Poison." For small quantities glass containers with ground-glass caps or special vessels are used for storage (fig. 6).

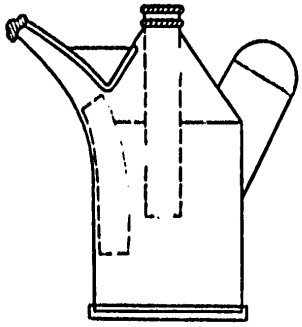


Fig. 6. Vessel for a Safe Storage of Highly Inflammable Liquids

Cobalt naphthenate is delivered and stored in hermetic aluminum capacities at a temperature of 10 to 15°C.

Perchlorovinyl primers, varnishes and enamels should be stored in cans, flasks and metal barrels on dry unheated premises and protected from the effect of sun rays and moisture. When stored in small containers (cans), the latter are packed in wooden boxes. All capacities should have the inscription "Fire Danger."

Ruberoid, brizol /bituminous-rubber waterproofing material/, izol /roofing material/, hydroizol and roofing felt should be stored in dry closed warehouses at a temperature of +30 to -5°C in rolls placed in two rows, between which a timber floor, without resting on the lower row, is installed.

Arzamit powder should be stored in closed wooden or plywood containers and arzamit solution, in metal barrels or glass bottles with tightly closed caps in a separate room at a temperature no lower than -10 and no higher than +20°C.

Sodium fluosilicate should be stored in closed wooden or plywood containers in an insulated room. Containers should have the inscription "Poison."

Felt made of mineral wool on bitumen binding should be stored in stacked form in containers on dry premises at a temperature no higher than 20°C.

Resol resin FRV-1A should be stored in closed galvanized metal barrels of the standard type or in aluminum cans at a temperature of 20 to 23°C in tight (hermetic) packaging with a space factor of no more than 0.8.

The VAG-3 catalyst should be stored in galvanized metal barrels at a temperature of 20 to 23°C in tight (hermetic) packaging. It is not permitted to stack barrels filled with VAG-3 and FRV-1A products in a warehouse higher than in two tiers. It is not permitted to store these materials in open barrels.

Semicylinders made of FRP-1 foam plastic should be stored on closed warehouse premises placed horizontally on shelves or on pads made of wooden beams (the height of a stack should be 1.5 meters). The storage of semicylinders made of FRP-1 foam plastic under an awning is permitted.

Petroleum bitumens should be stored in cylindrical metal or rectangular reinforced concrete capacities equipped with steam heaters. Bitumen can be stored in pieces and drums on individual sites equipped with a fireproof awning on a concrete basis if it is stored for a short time.

Chip and wood fiber boards should be stored on dry covered premises at a temperature no lower than 10°C and a relative air moisture no higher than 65 percent in stacks placed horizontally on flat places.

On premises where polymeric and other materials giving off fire hazardous and explosive vapors are stored it is forbidden to smoke and to perform operations connected with the use of fire or causing spark formation. The lighting fixtures and electric motors used on these premises should be explosionproof. It is necessary to take measures to prevent the possibility of occurrence and accumulation of static electricity charges, in particular, not to use polymeric materials for floor covering and not to wear clothing made of polymeric materials at work.

Warehouses for the storage of polystyrene foam are equipped with exhaust ventilation and stationary fire extinguishers. Furthermore, it is necessary to edge the floor to prevent the spread of burning polystyrene, because, when 1 cubic meter of polystyrene foam burns, 23 liters of a liquid substance form and, when this substance decomposes, a large amount of toxic vapors and gases are released.

Warehouses for the storage of highly inflammable and combustible liquids, gas cylinders, calcium carbide, oil paints and polymeric materials should be provided with the fire extinguishing equipment indicated in table 4.

Prohibiting and warning placards ("Fire Danger," "Explosion Danger," "Toxic Substances" and "Smoking Prohibited"), instructions for safety techniques during the warehousing of materials stored in a warehouse and instructions for giving first aid during accidents connected with the warehousing and storage of these materials should be hung in a prominent place in every warehouse.

Table 4. Fire Extinguishing Equipment

(1) Здания, помещения, склады и сооружения	(2) Единица измерения	(3) Средства пожаротушения			
		(4) Огнетушители		(7)	(8)
		(5) химические ОП-5	(6) углекислотные	Ящик с песком (v=0.5 м³) и лопата	Бочки с водой (v=250 л) и два ведра
Хранилища легковоспламеняющихся и горючих жидкостей (9)	На 50 м² площади (10)	1 (но не менее двух на складе) (11)	—	1 (в ящике с песком должна быть кошма) (12)	—
(13) Склад баллонов со сжатыми, сжиженными и растворенными газами	На 200 м² площади (15)	1	—		—
(14) Склад карбида кальция	На 100 м² площади (16)	—	1	1	—
Закрытые склады горючих материалов (масляные краски, олифа, пенька, пакля и др.) (17)	•	1	—	—	1
Помещения для хранения эпоксидных составов и других полимерных материалов (18)	•	3	—	1	—
Дворовая площадка склада (19)	На 200 м² площади (15)	1	—	—	1

Key:

1. Buildings, premises, warehouses and structures
2. Unit of measurement
3. Fire extinguishing equipment
4. Fire extinguishers
5. Chemical OP-5 /foam fire extinguishers/
6. Carbonic acid
7. Box with sand (v=0.5 m^3) and a shovel
8. Barrels with water (v=250 liters) and two pails
9. Storage facilities for highly inflammable and combustible liquids
10. On an area of 50 square meters
11. 1 (but no less than two in a warehouse)
12. 1 (the box with sand should have felting)
13. Warehouse of cylinders with compressed, liquefied and dissolved gases
14. Warehouse of calcium carbide
15. On an area of 200 square meters
16. On an area of 100 square meters
17. Closed warehouses of combustible materials (oil paints, drying oil, hemp, oakum and so forth)
18. Premises for the storage of epoxy compounds and other polymeric materials
19. Outdoor site of a warehouse

Electric and Gas Welding Work

When ventilation during the welding and cutting of metal is inadequate, the content of dust (aerosol) of metal, nitrogen and carbonic oxides, as well as of other harmful substances, increases in the air of a work zone. Furthermore, fuel gases in a mixture with air can form explosive mixtures and the presence of welders and cutters of combustible materials (oakum, wood shavings, combustible liquids, gases and so forth) near work places presents a fire danger. Welders, cutters and their assistants can receive burns from an electric welding arc and from the flame of a gas welding burner or cutter. Nor is the possibility of affecting electric welders with electric current ruled out.

For the purpose of preventing accidents during electric and gas welding work, the above-indicated conditions for the performance of this work should be fulfilled.

Special ventilated premises should be assigned for welding work constantly done in buildings. The refractoriness of buildings and premises for welding work should meet the requirements of the Construction Norms and Rules II-M. 2-72 "Production Buildings of Industrial Enterprises. Planning Norms."

It is permitted to take a permanent place for welding work out of the general combustible premises of a shop. It should have a solid enclosure from a noncombustible material. The height of the enclosure should be no lower than 1.8 meters and the clearance between the enclosure and floor, no more than 5 cm.

Welding generators and transformers, as well as all auxiliary instruments and apparatus for them, installed in the open air should be covered or protected with moistureproof insulation and placed under an awning made of noncombustible materials, or in a tent made of tarpaulin treated with a fireproof compound. If it is impossible to install awnings, welding work should be stopped during rain or snowfall.

To remove welding aerosols, vapors and gases from a work zone, it is necessary to use general-exchange and local forced ventilation.

General-exchange ventilation should be used to clean the air on closed premises (shop, workshop and so forth), where welding or cutting is carried out. General-exchange ventilation should be suction-exhaust ventilation with heating of the supplied air during winter. Incoming air should be supplied primarily to nonwelding sections.

Local ventilation can be executed with a stationary and mobile suction. When big structures or parts are welded and cut at a permanent work place, it is recommended to equip a stationary side suction fixed on the side opposite to the worker (fig. 7, a), or a mobile suction (fig. 7, б).

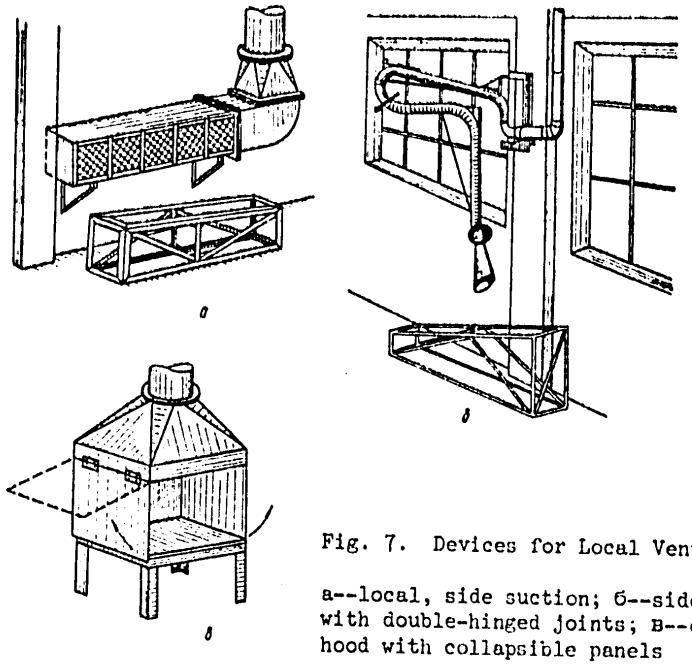


Fig. 7. Devices for Local Ventilation:

а--local, side suction; б--side suction with double-hinged joints; в--exhaust hood with collapsible panels

The mobile suction is fixed on a double-hinged yoke. The intake funnel of the suction is located on a flexible hose. The suction can be moved in horizontal and vertical directions and fixed in the necessary position. When small parts are welded on a permanent work place, it is recommended that an exhaust hood with collapsible side panels be equipped (fig. 7, в).

During work in closed capacities and semiclosed spaces (tanks, cisterns, reservoirs, pipes, sections of sheet structures and so forth) it is necessary to use local ventilation with a portable suction ensuring the exhaust of gases directly from the place of welding (cutting). In addition to local ventilation, the supply of pure air directly to the welder's breathing zone should be ensured in these cases.

The maximum permissible concentrations of most frequently occurring harmful gases and aerosols in the air of welding premises and the limits of explosiveness of explosive mixtures are presented in tables 5 and 6.

During work in closed capacities it is necessary to ensure general-exchange ventilation and a local suction near the welding arc. If it is impossible to ensure ventilation, welding can be done only in exceptional cases with the permission of the work superintendent--in gas masks.

Table 5. Maximum Permissible Concentration of Most Frequently Occurring Harmful Gases and Aerosols in the Air of Welding Shops

(1) Наименование вещества	Величина ПДК, мг/м³ (2)
(3) *Газы*	
Озон (4)	0,1
Окислы азота (5)	5
Окись углерода (6)	20
Фтористый водород (7)	0,5
Аэрозоли металлов и их соединений (8)	
Алюминий, окись алюминия, сплавы алюминия (9)	2
Бериллий и его соединения (10)	0,001
Вольфрам (11)	6
Марганец (12)	0,3
Молибден и его соединения (13)	2
Никель, окись никеля (14)	0,5
Окислы железа (15)	6
Окись железа с примесью фтористых и марганцевых соединений (16)	4
Окислы титана (17)	10
Окись цинка (18)	5
Свинец и его неорганические соединения (19)	0,01
Торий (20)	0,05
Трехокись и пятиокись ванадия (21)	0,5
Хромовый ангидрид, хроматы, бихроматы (22)	0,001

Key:

1. Name of substance
2. Amount of maximum permissible concentration, mg/m^3
3. Gases
4. Ozone
5. Nitrogen oxides
6. Carbon monoxide
7. Hydrogen fluoride
8. Metal aerosols and their compounds
9. Aluminum, aluminum oxide and aluminum alloys
10. Beryllium and its compounds
11. Tungsten
12. Manganese
13. Molybdenum and its compounds
14. Nickel and nickel oxide
15. Iron oxide
16. Iron oxide with a mixture of fluoric and manganese compounds
17. Titanium oxides
18. Zinc oxide
19. Lead and its inorganic compounds
20. Thorium
21. Vanadium trioxide and pentoxide
22. Chrome anhydride, chromates and bichromates

Table 6. Limits of Explosiveness of a Mixture of Fuel Gases and Vapors With Air and Oxygen

Наименование газа (пара) (1)	Пределы взрываемости, проц. горючего газа (пара) в смеси с (2)	
	(3) воздухом	(4) кислородом
Ацетилен (5)	2,3—100	2,3—100
Водород (6)	3,3—74,2	9,2—91,6
Городской газ (7)	3,8—24,8	10—73,6
Коксовый газ (8)	7,0—21,0	—
Метан (9)	4,8—16,7	5—59,2
Пары бензина (10)	0,7—6,0	2,1—28,4
Пары керосина (11)	1,4—5,5	—
Природный газ (12)	1,5—8,4	3—45
Пропан (13)	2,17—9,5	—

Key:

1. Name of gas (vapor)
2. Limits of explosiveness, percent of fuel gas (vapor) in a mixture with
3. Air
4. Oxygen
5. Acetylene
6. Hydrogen
7. City gas
8. Coke gas
9. Methane
10. Gasoline vapors
11. Kerosene vapors
12. Natural gas
13. Propane

In this case no less than two people should participate in work and one of them--an especially trained observer--should be on duty outside the capacity. He should position himself so that he can see and hear the welder and have a knife switch within easy reach in order to, when necessary, immediately cut off the current and give first aid to the worker inside.

An electric welder and a gas welder (gas cutter) should not engage in work inside capacities simultaneously. Nor is cutting with the use of propane-butane gas permitted in capacities and unventilated rooms.

Owing to the possibility of explosion it is forbidden to carry out the welding and cutting of vessels and pipelines under pressure, as well as inside and outside vessels and pipelines in which there were highly inflammable fuels and explosive or toxic substances (liquids, gases, emulsions and so forth) without their careful cleaning (washing and blowing).

When it is necessary to weld containers emptied of petroleum products, they should be carefully cleaned, washed and steamed, because, when metal is heated as a result of welding, even the most negligible residues of petroleum products evaporate and vapors in a mixture with air can explode.

Vessels are washed with a water solution of caustic soda or trisodium phosphate. The concentration of solutions used for washing is 80 to 120 grams of alkali per liter of water.

Furthermore, when washing vessels emptied of mineral oils, it is necessary to add 2 or 3 grams of soluble glass or soap per gram of the indicated solution for the formation of an emulsion. For a better effect of the solution it should be heated up to 60 to 80°C.

The blowing of vessels emptied of gasoline of a capacity of up to 200 liters with live steam should be continued for no less than 2 hours.

Taking into consideration the harmful effect of caustic soda on the skin and eyes, as well as its destructive effect on clothing and footwear, during crushing and other operations connected with its use it is necessary to wear rubber boots with high tops, a tarpaulin suit with trousers worn over high boots and a rubber apron with gloves. Eyes must be protected with white glass goggles.

Before the execution of welding work vessels emptied of acids should be carefully washed from acid residues. Dirt and residues from vessel walls are removed with special wood, brass or aluminum scrapers.

When welding containers, all the openings in them should be open. Work is done under the observation of a foreman.

To avoid fire, sections where welding or cutting work is to be done should be cleaned in advance of wood sawdust, shavings, oakum and other combustible materials in a radius of no less than 10 meters.

Wooden floors or platforms should be protected from an inflammation by sheet iron or asbestos. It is necessary to provide every welding post with a fire extinguisher or a container with water and a pail, as well as with a box with sand and a shovel, and to constantly see to it that fire fighting equipment is available and is in good condition.

The welder and cutter must:

before the beginning of work--check the condition of the equipment and the preparedness of a work place in terms of fire protection (availability of fire extinguishing equipment, that is, internal fire hydrants, sand, shovels, a pail with water and fire extinguishers);

during work--avoid the falling of sparks of molten metal and of the flame of a burner (cutter) on combustible structures and materials;

after work--carefully examine the work place and underlying sites and floors and, when necessary, cool the heated structures and pour water over glowing articles.

Welding work on fire hazardous premises is permitted only in coordination with the local bodies of the State Fire Inspectorate.

Electric Welding Work

Installations for electric welding should meet the requirements of the pertinent sections of the "Rules of Technical Operation of Electric Installations of Consumers" and of the "Rules of Safety Techniques During the Operation of Electric Installations of Consumers."

The floors of premises on which arc welding is done should be made of a noncombustible material. The installation of wooden block floors on a noncombustible base is permitted. It is not permitted to install plank floors.

Individuals not under the age of 18, who underwent a medical examination and special training in accordance with the standard program for training welders, who passed tests in safety techniques and fire fighting measures and who have a certificate attesting to the right to perform appropriate welding work, are permitted to engage in welding work. Every welder must know electric safety rules in accordance with the requirements placed on electric engineering personnel of the second skill group and have the appropriate certificate with him.

Only individuals who passed tests in accordance with the requirements of the "Rules of Certification of Welders" (approved by Gosgortekhnadzor /State Committee for Supervision of Industrial Safety and for Mining Inspection/ on 22 June 1971) are permitted to engage in welding work controlled by Gosgortekhnadzor (welding of vessels operating under pressure and of metal structures of hoisting cranes).

Before the beginning of independent work welders and their assistants must be additionally instructed in electric safety rules and taught practical methods of administering first aid during accidents.

The bodies of the Fire Inspectorate give the permission to engage in welding work.

Women are not permitted to do electric welding work inside closed capacities (in tanks, boilers, reservoirs and so forth).

Before embarking on welding work, it is necessary to reliably ground the body of the welding apparatus with a flexible copper conductor with a cross section of no less than 44 square millimeters and to check the working order of the insulation of wires and electrode holders, as well as the tightness of connections of all contacts.

Electric welding apparatus should not be connected to a lighting network, because this can lead to damage to lighting wiring and to fire. Electric welding units and apparatus should be connected to an electric network only with closed starting switches. Malfunction in welding apparatus can be eliminated only with a disconnected switch.

Conductors supplying current to welding apparatus, switchboards and other equipment, as well as to places of welding work, should be reliably insulated and in the necessary places protected from the effect of a high temperature, mechanical damage and chemical effects.

The insulation resistance of current-carrying parts of the welding circuit should be no less than 0.5 megohms. In manual welding insulation should be checked no less frequently than once in 3 months and in automatic welding under a flux layer, once a month. Insulation should withstand a voltage of 2 kilovolts in 5 minutes.

The electric conductors of a welding apparatus should be placed at a distance of no less than 1 meter from the pipes of oxygen, acetylene and other fuel gases. In some cases it is permitted to shorten the indicated distances by one-half provided conductors are enclosed in a protective metal pipe.

To prevent ignition, the heating temperature of individual parts of a welding unit (transformers, bearings, brushes, secondary circuit contacts and so forth) should not exceed 75°C.

The cores of welding conductors should be connected by means of molding, welding, soldering or special clamps. Conductors should be connected to an electrode holder, welded article or welding apparatus by means of copper cable tips fastened with bolts and washers.

Electrode holders for manual welding should have a minimal weight and a design ensuring a reliable clamping and a rapid change of electrodes, as well as ruling out the possibility of a short circuit between its body and the welded part during temporary stops in work or when it accidentally falls on metal objects. Electrode holders should withstand a current of up to 600 amperes. The handle of an electrode holder should be made of a noncombustible dielectric and heat insulating material.

Tires of any structure, welding plates, shelves and the welded structure itself can serve as a return conductor connecting the welded article with the current source.

The connection of individual elements used as a return conductor should be made very carefully (by means of bolts, screw clamps or clips).

It is forbidden to use internal railway tracks, a grounding or nulling network and metal structures of buildings, utility lines and industrial equipment as a return conductor.

It is prohibited to use the grounding of one apparatus for the grounding of another.

On fire hazardous premises the return conductor from the welded article to the current source should be insulated. In the quality of insulation it should not be inferior to the direct conductor connected to an electrode holder.

Electrodes used in welding should be factory made and meet GOST and the rated intensity of welding current.

For the purpose of reducing the emissions of aerosol and harmful gases during welding, the use of rutile electrodes of brands MR-1, MR-3, ANO-1, ANO-3, ANO-4 and so forth instead of electrodes with manganese coatings (TsM-7, MEZ, OMM-5 and so forth) is recommended.

When changing electrodes in the process of welding, their remainders (discarded metal) should be thrown out into a special metal box installed at the place of welding work.

Welders working at great heights should be equipped with containers or bags for electrodes, as well as with boxes for discarded metal. Discarded metal should not be scattered at the place where work is done, because, when falling from a height, it can injure the people below and cause a fire.

It is forbidden to do welding work from lean-to ladders.

To avoid a burn from the sprays of metal and slag, during work with an open electric arc the welder should be provided with special tarpaulin work clothing, leather footwear, tarpaulin mittens, as well as with a helmet-mask or shield with light filters protected from the sprays of molten metal with simple glasses. The shields or helmets for protecting the face and eyes should be light and convenient in handling. Assistants working together with welders should also have protective shields and goggles.

It is permitted to perform electric welding work inside closed capacities and sheet metal structures only in dielectric overshoes and on a rubber carpet or flooring made of insulating materials. Furthermore, in these cases the welder should wear a rubber hat.

Operation of Cylinders With Compressed Gas

The storage, transfer and operation of cylinders with compressed gases should be carried out in accordance with the "Rules of Installation and Safe Operation of Vessels Operating Under Pressure" (approved by USSR Gosgortekhnadzor on 19 May 1970).

The characteristics of cylinders for gas used in gas welding and cutting are presented in table 7.

Table 7. Characteristics of Cylinders for Gas Used in Gas Welding and Cutting

(1) Газ	(2) Состояние газа в баллоне	(3) Предельное рабочее давление, кгс/см²	(4) Периодичность испытания баллона, годы	(6) Цвет окраски	(5) Надпись: (7) текст	(5) Надпись: (8) цвет
Ацетилен (9)	Растворенный (10)	19	3	Белый (11)	Ацетилен (9)	Красный (12)
Водород (13)	Сжатый (14)	150	5	Темно-зеленый (15)	Водород (13)	»
Кислород (16)	»	150	5 (17)	Голубой	Кислород (16)	Черный (18)
Коксовый газ (19)	»	150	5	Красный (12)	Коксовый газ (19)	Белый (11)
Метан (20)	»	150	5	»	Метан (20)	»
Пропан-бутановая смесь (21)	Жидкий (22)	17	5	»	Пропан (23)	»

Key:

1. Gas
2. State of gas in a cylinder
3. Maximum work pressure, kgf/cm^2
4. Frequency of cylinder testing, years
5. Inscription
6. Paint color
7. Text
8. Color
9. Acetylene
10. Dissolved
11. White
12. Red
13. Hydrogen
14. Compressed
15. Dark green
16. Oxygen
17. Blue
18. Black
19. Coke gas
20. Methane
21. Propane-butane mixture
22. Liquid
23. Propane

Individuals not under the age of 18, who underwent a medical examination, industrial training in safe servicing of cylinders and a check of their knowledge and who have the appropriate certificate, are permitted to engage in permanent work with cylinders.

When received from the warehouse, every cylinder with gas should be carefully inspected. During the inspection it is checked whether the period of regular examination has expired; whether the coloring and inscription (marking) correspond to the existing rules of Gosgortekhnadzor; whether the cylinder body has significant defects (cracks or dents); whether the valve thread is driven in; whether the valve is in good working order and whether gas leaks; whether there are traces of grease or oil on a cylinder (which is especially dangerous for oxygen cylinders).

When even one of the indicated deficiencies is detected and also if the protective cap does not come off, the cylinder should be sent to the filling plant with the inscription in chalk "faulty, with gas."

The storage and transfer of cylinders with gas are permitted only with protective caps screwed onto their necks and with seals on the lateral connecting pipes of valves.

Bumps and shocks must be avoided. Cylinders should be delivered to the place of welding work on special trolleys, handbarrows or sleds. It is forbidden to carry cylinders on shoulders or in hands.

When fuel gas leaks from a cylinder, an explosive mixture of gas with air can be formed. A small heat pulse is sufficient to ignite this mixture. Therefore, during storage, transportation and operation cylinders should be protected from the effect of sun rays and other heat sources. Cylinders with fuel gas placed on premises should be no closer than 1 meter from heat radiators and 10 meters from furnaces and other heat sources with open fire. Cylinders are placed at a distance of no less than 10 meters from a welding burner.

Contact of cylinders and hoses with current carrying conductors should be avoided. This should be observed with special attentiveness at the production sections where electric and gas welding and cutting are carried out simultaneously.

Highly inflammable and combustible substances should not be near cylinders. All equipment coming in contact with oxygen should be cleaned. Individuals whose hands, clothing and tools are contaminated with oil or grease must not be permitted to service oxygen cylinders.

During the storage and transfer of empty cylinders the same safety measures as with filled cylinders should be observed.

In a welding shop the total number of reserve cylinders should not exceed five oxygen and five acetylene cylinders. Reserve cylinders should be stored in special sheds made of noncombustible materials.

At a work place it is permitted to have no more than two cylinders with oxygen and acetylene--one working and the other reserve. Cylinders should be stored in a vertical position or stacked on special handbarrows and secured with clamps.

Cylinders with propane-butane at permanent work places should be in closed cabinets with openings for natural ventilation in the lower and upper parts. The sizes of openings should be such that their total area is no less than one-half of a cabinet's cross section. Openings should be protected with visors or placed so that sparks from a work place cannot fall inside the cabinet. There should be no more than one cylinder with propane-butane at a work place.

It is permitted to place mobile stations with propane-butane only in the open air.

The repair of valves and tightening of threaded joints of cylinders with gas are not permitted. Gas should be let out only in the open air, far from fire sources.

Gas is withdrawn from a cylinder through a reducer designed only for a particular gas. Reducers should have the same color as cylinders. Oxygen reducers are colored blue and acetylene reducers, white. Reducers, regulators and sockets used for lowering the pressure of a propane-butane mixture are colored red.

Reducers for acetylene differ from oxygen reducers only in the fact that instead of a union nut for connection to the cylinder they have a special clamp.

Before connecting the reducer to the cylinder, the valve should be blown through by turning the valve hand wheel by 1/4 revolution. When blowing through, one must not face the connecting pipe of a valve, but stand on the side.

The presence of leaks in a reducer or cylinder valve should be checked with soapsuds. It is forbidden to use fire for this purpose. If there is any defect in a reducer, it is immediately necessary to close the cylinder valve, to let the gas out of the reducer and to eliminate the defect.

A reducer placed on a cylinder must not be repaired. Repairs connected with a partial or full disassembly of a reducer should be made in a special repair center, which for this purpose has the equipment necessary for testing the reducer after repairs. Individuals who received training (minimum required technical knowledge) in the repair of gas reducers make the repairs. A high degree of cleanliness of parts and assembly should be ensured during repairs. All reducer parts are subject to decontamination.

During a cold period and a big withdrawal of gas the water vapors contained in gas can condense in a reducer and freeze, closing the vent. In such cases it is necessary to warm the valve or reducer by covering them with clean, without signs of oil, rags soaked in clean hot water. It is forbidden to use blast lamps or torches for this purpose.

To measure gas pressure, manometers designed only for a particular gas and having the same coloring as the cylinder are used. In a manometer with a body made of black plastic the adjustable ring pressing the instrument glass is colored. The name of the gas should be written on the dial of such a manometer and the dial of an oxygen manometer should also have the inscription "Oil Danger!". Manometers are subject to an annual check and branding.

A manometer should not be used if its pointer is deflected from the zero reading of the dial, its glass is broken or the checking period has expired.

Nor should cylinders with reducers without manometers be used, because this can lead to an accident owing to the impossibility of controlling the amount of gas pressure in rubberized fabric sleeves.

The vents, valves, reducers and manometers of cylinders should be carefully protected from contamination with oil and grease.

Gas can be used from a cylinder as long as the pressure in it is not lowered to 0.5 or 3 kgf/cm^2. Afterwards a cap should be screwed onto the neck and the inscription "Empty" should be written in chalk on the cylinder. During the operation of oxygen distributing ramps the residual pressure in cylinders should be within 4 to 5 kgf/cm^2.

During the operation of oxygen cylinders the danger of explosion or fire can arise as a result of the following defects in the valve: breakdown of the conic stem of the valve (in this case the escaping gas stream and metal parts of the valve can injure a worker); breakdown of the connecting piece, spindle or valve; poor conditions of the thread at the lateral connecting pipe of the valve (in case of a worn out thread gas can break the reducer); passage of gas in the vent (owing to the fact that the vent does not fit the seat gas escapes from the connecting pipe when the valve is tightly closed); passage of gas through the packing nut.

Before beginning working with an oxygen cylinder, first of all it is necessary to become convinced that the connecting pipe of the valve does not have visible traces of oil and grease and that the connecting thread of the valve is in good working order. After that the valve should be blown through by opening it briefly for the purpose of removing foreign particles from it. It is prohibited to be in the zone of an oxygen jet. When the valve hand wheel is turned, the spindle should rotate easily without jamming. If the spindle jams, the cylinder should be sent to the warehouse.

When the valve is opened abruptly, the gas temperature can rise to 400°C and the fiber pads in the valve can ignite. If ignition occurs in the cylinder valve, the valve should be covered and the flame should be extinguished with sand or by means of a fire extinguisher.

It is permitted to place oxygen cylinders no closer than 10 meters from the place of welding work. If this is impossible, a screen made of noncombustible materials no less than 1.5 meters high should be placed between cylinders and the welder's (cutter's) work place. Places where oil can fall on cylinders should be avoided.

Acetylene should not be stored in hollow cylinders, because under a pressure of 1.5 to 2 kgf/cm^2 gas becomes explosive. To reduce explosiveness, acetylene is stored in cylinders filled with activated charcoal impregnated with acetone.

Every year and before every examination conducted once in 5 years the porous mass of acetylene cylinders should be subjected to a check at the filling plant with subsequent branding of the date of check, of the confirmation of the check of porous mass (square brand with a side of 12 mm and the letters "PM" depicted inside) and of the plant.

The pressure of acetylene in a filled cylinder should be no higher than the amounts indicated below:

Ambient Temperature, C degrees	-5	0	5	10	15	20	25	30	35	40
Pressure, kgf/cm^2	13.4	14	15	16.5	18	19	21.5	23.5	26	30

The residual pressure of acetylene in the used cylinder should be less than 0.5 and no more than 1 kgf/cm^2.

The amount of acetylene withdrawn in one minute should not exceed 20 to 25 liters, because with a great expenditure, as well as an excessive emptying of a cylinder, the formation of a gas cushion in it is possible (the holding capacity of an acetylene cylinder of a cubic content of 40 liters for gas is 4 to 4.5 cubic meters).

If slow self-heating is noted in a cylinder with acetylene, it is necessary to disconnect the hose from the reducer and quickly carry out the cylinder into the open air. In the open air it is necessary to completely open the valve and vent of the reducer and immediately cool the cylinder, pouring a heavy stream of water on it. Such a cylinder should be sent to the filling plant as defective.

Finishing Work

Plastering Work

Preparation of solutions. Some materials used for the preparation of plastering solutions have a harmful effect on the human body, that is, quicklime, powdered lime, chlorinated lime, fluorosilicic cement, gypsum, limestone, marshalite, slags in the form of dust and such additive as potash, sodium nitrite, calcium nitrite, calcium chloride, sodium chloride, chlorinated water, ammonia water, hydrochloric acid and so forth. For the purpose of preventing the poisoning and diseases of workers, it is necessary to take the following precautionary measures.

Premises on which work with dust-like binders (cement, lime and so forth) is done, as well as places of installation of machines for crushing, breaking and sifting building materials, must be equipped with ventilation or local devices preventing the pulverization of materials in the air.

The control of mechanisms, closing devices, feeders and so forth on units for processing quicklime, powdered lime, cement and other dust-like materials should be carried out to premises not accessible to dust.

Dissolving units should be equipped with general-exchange suction-exhaust ventilation and local dust vents in accordance with the requirements of the sanitary norms of planning industrial enterprises (SN 245-71).

All the personnel servicing these installations and units should be provided with special work clothing and footwear, as well as with goggles and respirators.

Lime slaking is accompanied by a rapid release of heat, which can cause burns and even fire. Therefore, it should be slaked in a mechanized way in lime slaking machines, because the effect of lime, at first barely noticeable, can lead to serious burns of the open parts of the body.

It is recommended that ground unslaked lime be used in solutions in a mixture with ground additives (slag, ash, clay and so forth) in the form of lime-slag, lime-ash and other solutions, which greatly lowers dust formation. The mixture should be blended on units with a local dust vent and its entry into the air of production premises should be avoided.

Workers engaged in lime slaking and reloading should be supplied with overalls, boots, rubber gloves and goggles and, when working with ground unslaked lime, with respirators.

In case of burns caused by lime, the burned spots should be washed with clean water and then the person should go to the medical center.

Service warehouses of chlorinated lime are located at the places of preparation of chlorinated water and individuals not connected with this work are forbidden to enter these warehouses.

Chlorinated water is prepared at a separate place near the dissolving unit or in the open air at a distance of no closer than 0.5 km from residential buildings. The volume of this place is determined in terms of 40 cubic meters per worker and its height, no less than 3.25 meters.

Chlorinated lime and chlorinated water release free chlorine, which is a poisonous substance. Therefore, all the capacities and pipes of installations should be sealed hermetically.

On premises where chlorinated water and chlorinated solutions are prepared, as well as on premises where chlorinated lime is stored, it is necessary to install suction-exhaust ventilation with a fivefold exchange of air per hour. Suction openings should be placed 1 meter above the floor.

It is forbidden to work with chlorinated lime in basements, hollows and recesses, because chlorine is heavier than the air and accumulates in lower places.

Work with chlorinated lime and chlorinated water must be done in overalls, rubber boots, gloves and gas masks of brand B (yellow case).

Fire hazardous and explosive materials, metal articles, lubricating oils, cylinders with compressed gas and food products must not be stored in one room with chlorinated water.

Ammonia water, which is a water solution of ammonia at a concentration of no less than 20 percent, releases toxic and fire hazardous ammonia. Therefore, it should be stored in glass bottles with ground glass stoppers on ventilated premises.

Work with ammonia water should be done in gas masks of brand K (green case) or M (red case).

Sodium nitrite, calcium nitrate, calcium chloride and their mixtures are stored in an individual warehouse. It is forbidden to store them in one room with acids.

It is forbidden to smoke and work with an open flame (electric welding, gas welding and so forth) in a room where crystalline sodium nitrite is stored. Combustible materials impregnated with the solution of this salt easily ignite and lend themselves to extinguishing with difficulty. Water should not be used to extinguish them, but fire extinguishers or sand should be used.

Capacities used for the storage or preparation of sodium nitrite solutions should have the warning inscription "Poison."

Natural or artificial ventilation should be provided in departments for the preparation of solutions of additives to a concrete mixture (sodium nitrite, calcium nitrate, calcium nitrate nitrite or calcium nitrate chloride nitrite).

Workers engaged in the preparation of solutions of additives should be especially instructed and provided with special work clothing, that is, rubber boots and gloves and protective goggles.

Food should not be eaten on premises where the release of chlorine, ammonia and toxic solvents is possible and where solutions of additives are prepared or stored. It is necessary to guard against the penetration of solutions of additives, especially sodium nitrite, into the skin and food. Before eating, special work clothing must be removed and hands must be carefully washed with soap and water.

Individuals with hand or face skin injuries should not be permitted to engage in work on the preparation of water solutions of additives and, in addition to this, individuals under the age of 18, of sodium nitrite.

It is not permitted to use toxic pigments (red lead, chrome yellow, vermilion and verdigris) for colored plaster solutions.

Plastering and drying of plastered rooms. When plastering surfaces with solutions, whose composition includes lime, chlorine water, ammonia water or sodium nitrite, for the purpose of preventing the harmful effect of these materials on the body, workers should wear, in addition to special work clothing, rubber boots and respirators.

It is forbidden to use plaster solutions, whose composition includes chlorine or ammonia water, inside rooms.

The use of factory made heating units with radiators on liquid or gaseous fuel with infrared radiation gas burners and electric radiators for drying plastered rooms is permitted.

The operation of units with gas burners is permitted if they have the certificate of the manufacturing plant with an indication of the year of output and of the serial number and if they are equipped with automatic blocking stopping gas supply when the burner goes out.

The operation of units with radiators and gas burners should be carried out in accordance with the special instructions of manufacturing plants under the constant observation of trained workers.

Personnel trained according to a special program coordinated with Gosgortekhnadzor and having skill certificates with the right to engage in gas work are permitted to service units with gas burners.

All personnel working on an area or premises where radiators on liquid or gaseous fuel or units with infrared radiation gas burners are used, irrespective of their occupation and departmental subordination, should receive instructions in the basic rules of operation of these units.

Owing to the fact that vapors of combustible liquids and fuel gases form explosive mixtures with the air, it is forbidden to use highly inflammable fuel, for example, gasoline, in radiators. Liquid fuel should not be poured into an operating or heated radiator.

When heating units are fed from cylinders with liquefied gas, cylinders should be at a distance of no less than 1.5 meters from units and heating apparatus and at a distance of no less than 1 meter from electric counters, switches and sockets.

When units operate on liquefied gas, the length of hoses should be as short as possible. The distance from a unit to the most remote drying place should not exceed 30 meters. When the distance of a unit from the drying place is greater, it is necessary to lay a temporary gas line of steel pipes and to connect burners to it with flexible hoses.

Flexible hoses should be connected with a reducer and pipes by means of clamps with bolts and nuts ensuring the air tightness of a joint.

Flexible hoses should be laid no higher than 2 meters, avoiding their bending.

On premises where drying is done, as well as near an operating heating unit, it is permitted to have only one cylinder with liquefied gas connected to it. Filled and used cylinders should be removed from a work place and put on special warehouse premises or in metal boxes placed at the building site. It is not permitted to store cylinders with gas and empty cylinders within the confines of buildings and on basement premises.

The distance from a gas radiator of a mobile or semistationary unit to combustible structures should be no less than 100, to difficultly combustible, 70 and to noncombustible, 40 cm.

Electric radiators operate in accordance with the "Rules of Technical Operation of Electric Installations of Consumers" and the "Rules of Safety Techniques During the Operation of Electric Installations of Consumers." Portable current receivers (tools, machines, lamps and so forth) used during the performance of plastering work should have a voltage of no more than 36 V.

At places where units for drying rooms operate welding, painting, carpentry or metal work must not be done, cylinders with oxygen and acetylene must not be placed and highly inflammable and combustible liquids, as well as combustible materials, must not be stored.

Natural ventilation of rooms (ventilation through air vents) should be ensured during the operation of units for drying rooms. Without the ventilation of rooms the operation of units is prohibited.

It is forbidden to dry rooms with flame guns and fuel combustion products or with a mixture of combustion products with the air.

People are forbidden to stay in a room that is being dried for more than 3 hours.

Painting Work

The materials enumerated below, which are used for painting work, are fire hazardous. These are painting compounds (oil, perchlorovinyl, glyptal, nitroglyptal, nitrocellulose, ethylcellulose, epoxy and organosilicon compounds); varnishes (oil-resin, bitumen and asphalt based, nitrocellulose and ethylcellulose, alcohol and so forth and other varnishes); glues (rubber, polyisobutylene, polychlorvinyl and polyester glues); thinners (drying oils and emulsion thinners); solvents (white spirit, kerosene, gasoline, alcohols, acetone, toluene, xylol, ethylcellosolve, ethyl acetate, butyl acetate, solvent, turpentine, dichloroethane, chlorobenzene and so on); aluminum powder.

In addition to this, the indicated solvents and compounds that include these solvents are explosive and toxic. When falling on the integument, they cause diseases. Some solvents, for example, methyl alcohol and toluene, cause diseases of the nervous system.

Pigments on the basis of lead, mercury and copper compounds (white lead, chrome green, red lead, vermillion and verdigris), when entering the human body, cause diseases of the stomach, nervous system and blood.

Individuals not under the age of 18, who underwent a medical examination and are familiar with safety measures during work with these materials, are permitted to engage in painting work with the use of the mentioned materials.

The requirements set forth in the section "Manufacture of Reinforced Concrete and Concrete Articles" should be observed in work with aluminum powder.

To prevent fires, explosions and accidents during the preparation of painting compounds and the painting of surfaces, it is necessary to meet the requirements set forth below.

Preparation of painting compounds. Paint preparation (coloring) shops are located in one-story buildings. They cannot be placed on basement or semi-basement premises.

The premises of shops located in one building with other production shops should be located at the external wall of the building and be separated from other production shops with blind refractory walls up to the ceiling and have no less than two outside exits. The height of production premises from the floor to the ceiling can be no less than 4 meters.

The walls of premises should meet the requirements of convenient cleaning. The internal surfaces of walls are plastered and painted with a bright oil paint.

The floors of shops are made to be noncombustible, strong, level and nonslippery and can be easily cleaned of impurities.

Shops are heated with water or vapor heating units. Heating units should be protected from the possible falling of paint drops on them.

Sanitary and technical equipment (heating units, pipes and so forth) should be painted and have a smooth surface for convenient cleaning.

Warehouses for the storage of paint and varnish materials at coloring shops are located in separate buildings equipped with underground storage facilities (tanks) for solvents.

Warehouse premises are provided with artificial or natural ventilation. The openings of exhaust ventilation pipes and channels are located 0.2 meters above the warehouse floor and are protected with nets.

All the paints, enamels, primers, fillers, solvents and thinners received at warehouses should have in every batch certificates or records with a mandatory indication of the chemical composition of paint and varnish materials. Every barrel, can and container with fire hazardous and toxic materials has a tag or a sticker with the precise name or designation of these materials, as well as with the warning inscriptions "Fire Danger" and "Poison."

The paint and varnish materials received at a paint preparation shop are recorded in a special log with an indication of the certificate of the manufacturing plant, as well as of the results of analyses and check of the quality of materials.

The acceptance and delivery of paint and varnish materials to production facilities are entrusted to individuals familiar with the rules of handling them, methods of packaging and safe transportation.

The formula of the finishing compounds manufactured directly at an enterprise is coordinated with local sanitary inspection bodies. Unchecked materials cannot be used.

Paint and varnish materials are delivered to the place of processing in a volume not exceeding, as a rule, the need of one-half of a work shift, but no more than the shift need.

Carelessly handling fire near capacities (cans and barrels) emptied of paint and solvents, or accidentally hitting them can result in an explosion of the mixture of solvent vapors with the air and cause serious injuries and considerable material losses. Therefore, containers emptied of paints, varnishes, enamels, solvents and thinners should be cleaned (decontaminated)

both inside and outside. They should be stored at a special site located at a distance of no less than 20 meters from the warehouse and production premises. It is forbidden to store empty containers on working premises.

Combustible and highly inflammable liquids, including solvents, should not be stored in open containers, nor should they be carried in pails. Highly inflammable liquids are poured by means of pumps into hermetically closed metal containers. Siphons must not be used for sucking off liquids with the mouth.

Metal containers with paint and varnish materials should be opened and closed only with tools not causing spark formation, which are designed for this purpose.

Storerooms for the storage of current stocks of paint and varnish materials at shops should be refractory with the possibility of placing the daily need for materials in them. An external outlet for the acceptance of materials is installed in a storeroom.

An independent tool distributing storeroom is set up for the storage of tools, devices and auxiliary materials.

Laboratories controlling paint and varnish materials are located at paint preparation shops on separate premises with an installation of an independent external outlet.

Shops are equipped with general and local suction-exhaust ventilation executed according to a calculation with no less than a double exchange of air in 1 hour.

Incoming air should be supplied to the upper zone of a room or diffusely to the working zone at such an intake rate that the air mobility at a work place does not exceed 0.3 to 0.5 m/sec.

During cold and transitional periods of the year incoming air must be heated to the air temperature in the room. Incoming air is taken outside at a height of no less than 2 meters from the ground level in places where it is polluted the least. The discharge pipes of exhaust ventilation of painting shops are brought out no less than 2 meters above the roof ridge.

The content of solvent vapors in the air of the working space of shops should not exceed a 50-percent concentration corresponding to the lower level of their explosiveness, or the maximum permissible concentration (table 8).

Local and general ventilation is connected 10 minutes before the beginning of work and disconnected 5 minutes after the completion of work.

The electric equipment of finishing shops, pulverizing chambers and transport facilities, as well as fire signaling and telephones, should be explosionproof.

Table 8. Characteristics of Solvents

(1) Наименование или марка растворителя	Температура, *град* С (2)		Нижний предел воспламенения (взрываемости) паров (5)		Предельно допустимая концентрация (ПДК), *мг/м³* (8)
	(3) вспышки	(4) самовоспламенения	объемный, проц. (6)	*г/м³* (7)	
Амилацетат (9)	20	378,5	1,1	58,3	100
Ацетон (10)	—20	500	2,15	52	200
Бензол (11)	—14	580	1,5	9,5	20
Бензин-растворитель (12)	—30	250	1	37	300
Бутилацетат (13)	13	371	1,7	80,6	200
Дихлорэтан (14)	—	—	6,5	—	10
Ксилол (15)	17	495	1	43,5	50
Скипидар (16)	30	253	0,65	36,2	300
Сольвент-нафта (каменноугольный сольвент) (17)	34	495	—	58,2	100
Спирт бутиловый (18)	28	410	1,68	51	200
» изобутиловый (19)	27,5	371	1,89	7,3	200
» метиловый (20)	—1	475	3,5	46,5	50
» этиловый (21)	11	432	2,6	49	1000
Толуол (22)	4—7	549	1,3	48,2	50
Уайт-спирит (23)	35	270	1,4	—	300
Этилацетат (24)	—4	400	2,3	82,7	200
Этилцеллозольв (25)	40	245	1,8	66	200
646 (состав, проц.: бутилацетата — 10; ацетона — 7; толуола — 50; бутилового спирта — 15; этилового спирта — 10 и этилцеллозольва — 8) (26)	—7	403	1,87	60,2	50
647 (толуола — 41,3; бутилацетата — 29,8; этилацетата — 21 и бутилового спирта — 7,7) (27)	5	424	1,61	52,6	50
648 (бутилацетата — 50; толуола — 20; бутилового спирта — 20 и этилового спирта — 10) (28)	13	388	1,65	57,5	50
649 (ксилола — 50; этилцеллозольва — 30; бутилацетата — 20) (29)	25	383	1,76	57,5	50
651 (уайт-спирита — 90 и бутилового спирта — 10) (30)	29	247	—	46,2	200
(31) Р-4 (толуола — 62; ацетона — 26 и бутилацетата — 12)	—7	550	1,65	48	50
(32) Р-5 (ксилола — 40; ацетона — 30 и бутилацетата — 30)	—1	497	1,83	59,6	50
(33) Р-40 (толуола — 50; этилцеллозольва — 30 и ацетона — 20)	—7	415	1,54	43,7	50
(34) РДВ (толуола — 50; бутилацетата — 18; бутилового спирта — 10; этилацетата — 9 и ацетона — 3)	2	424	1,83	55,7	50
(35) РКВ-1 (бутилового спирта — 50 и ксилола — 50)	25	376	1,54	46	50

/Continued on following page/

РКБ-2 (бутилового спирта — 95 и ксилола — 5) (36)	34	346	1,79	45,7	50
РС-1 (толуола — 60; бутилацетата — 30 и ксилола — 10) (37)	9	490	1,38	50,2	50
РС-2 (уайт-спирита — 70 и ксилола — 30) (38)	30	382	—	46,7	50
РЭ-1 (ксилола — 50; ацетона — 20; этилового спирта или гидролизного спирта и изобутилового спирта — 15) (39)	14	455	2,04	57,2	50

Key:

1. Name or brand of a solvent
2. Temperature, C degrees
3. Of a flash
4. Of self-ignition
5. Lower level of ignition (explosiveness) of vapors
6. Percent by volume
7. g/m^3
8. Maximum permissible concentration, mg/m^3
9. Amyl acetate
10. Acetone
11. Benzene
12. Gasoline solvent
13. Butyl acetate
14. Dichloroethane
15. Xylol
16. Turpentine
17. Solvent-naphtha (coal solvent)
18. Butyl alcohol
19. Isobutyl alcohol
20. Methyl alcohol
21. Ethyl alcohol
22. Toluene
23. White spirit
24. Ethyl acetate
25. Ethyl cellosolve
26. 646 (composition, percent: butyl acetate, 10; acetone, 7; toluene, 50; butyl alcohol, 15; ethyl alcohol, 10 and ethyl cellosolve, 8)
27. 647 (toluene, 41.3; butyl acetate, 29.8; ethyl acetate, 21 and butyl alcohol, 7.7)
28. 648 (butyl acetate, 50; toluene, 20; butyl alcohol, 20 and ethyl alcohol, 10)
29. 649 (xylol, 50; ethyl cellosolve, 30; butyl acetate, 20)
30. 651 (white spirit, 90 and butyl alcohol, 10)
31. P-4 (toluene, 62; acetone, 26 and butyl acetate, 12)
32. P-5 (xylol, 40; acetone, 30 and butyl acetate, 30)
33. P-40 (toluene, 50; ethyl-cellosolve, 30 and acetone, 20)
34. RDV (toluene, 50; butyl acetate, 18; butyl alcohol, 10; ethyl acetate, 9 and acetone, 3)
35. RKV-1 (butyl alcohol, 50 and xylol, 50)
36. RKB-2 (butyl alcohol, 95 and xylol, 5)
37. RS-1 (toluene, 60; butyl acetate, 30 and xylol, 10)
38. RS-2 (white spirit, 70 and xylol, 30)
39. RE-1 (xylol, 50; acetone, 20; ethyl alcohol or hydrolytic alcohol and isobutyl alcohol, 15)

All metal structures, apparatus, pipes, flexible hoses and paint heating containers supplying paint and varnish materials must be grounded reliably. Air ducts, ventilators, electric engines, compressors and other equipment are also subject to grounding.

The processes of preparation of paint and varnish materials are mechanized and paint mixers are sealed hermetically. Places where paint and varnish materials are packaged (poured) are covered and equipped with a local air vent.

Paint grinding machines are cleaned no less frequently than once a day by a tool not causing spark formation. Before the repair of paint and varnish equipment (capacities, paint mixers, containers and so forth) the latter must be subjected to cleaning, washing and steaming.

Paint pressing tanks, oil and water separators and all equipment operating under pressure should meet the requirements of the "Rules of Installation and Safe Operation of Vessels Operating Under Pressure."

Owing to the possible formation of explosive mixtures compressed nitrozen or carbon dioxide should be used for the supply of paint and varnish materials under pressure.

In cases when for technological reasons it is impossible to eliminate lead, mercury or copper compounds from the composition of paints, enamels and primers paint and varnish materials containing these compounds can be used only with the permission of sanitary supervision bodies.

Milled paints and primers containing mercury, lead or copper compounds are prepared in an especially ventilated room or in a vent hood.

Paint can be diluted by a solvent in an especially assigned place equipped with a local vent. A solvent should be poured into paint in small portions. At the same time, utensils made of metal not causing sparks on impact should be used.

A wooden mixer is used for mixing painting compounds.

Ethylated gasoline, turpentine and benzene should not be used as solvents, because they poison the body. To avoid poisoning cases, nor should methyl (wood) alcohol be used as a solvent.

To give first aid in case of an accident, no less than two people should work simultaneously in paint preparation shops.

On premises where paint and varnish materials are prepared and stored it is strictly forbidden to smoke, start a fire, use blast lamps and carry out electric welding and other work with metal, stone, ceramics and so forth, during which spark and flame formation is possible. Smoking is permitted only in especially assigned places.

During work with paint and varnish materials, alkalis and acids special work clothing (overalls, suits or robes), mittens, special work footwear and masks are worn.

During work with fire hazardous compounds care must be taken not to impregnate special work clothing with them. Special work clothing covered with paint and varnish materials must be immediately replaced with clean clothing.

During work with organic solvents gloves and oversleeves made of chlorinated fabirc (manufactured from vinyl chloride fiber) are worn. Furthermore, pastes prepared from various skin softening materials, for example, ПМ-1 or ХИОТ-6, are used to protect integuments. After work the paste is first washed off and then the hands are washed with soap and warm water. It is forbidden to use solvents for this.

Tools are cleaned with rags impregnated with acetone. Food products must not be stored and food must not be eaten in a work room in painting sections, in a paint preparation department or in a warehouse.

Production premises are cleaned by the wet method during the day and at the end of a shift. It is not permitted to clean floors, walls and equipment with solvents.

Combustible or toxic materials spilled and scattered on the ground should be covered with sand or earth and removed to an assigned place.

Wiping ends, rags, cloths and so forth contaminated with painting compounds should be stored in metal boxes covered with lids and after the completion of work they should be burned in a safe place.

The premises of the paint preparation shop and of storerooms of paints and varnish materials are provided with fire extinguishing equipment in coordination with fire inspection bodies. An unobstructed access to fire implements and equipment is ensured.

A medicine chest with a set of medical supplies and dressings for giving first aid is set up in the paint preparation shop.

Rules of safety techniques, fire fighting rules and instructions for giving first aid are hung on prominent places.

Painting work at facilities. During the execution of painting work at facilities the fire danger, explosion hazard and toxicity of painting materials are taken into consideration when they are brought to the painting consistency, when materials are applied to the surface, when painted surfaces dry out and when painting materials and containers emptied of these materials are stored at a facility.

It is permitted to bring painting compounds to the working consistency at painting stations near facilities if the conditions set forth in the previous subsection are met.

The stock of paint and varnish materials in the painting station is created within the daily need and is stored in tightly closed containers. Paint and varnish compounds are delivered to the work place in a form ready for use in aluminum or plastic containers in an amount not exceeding the shift expenditure. It is forbidden to use glass containers for this purpose.

The cans, pails and other containers in which inflammable or toxic substances are stored and delivered to work places should have the inscriptions "Fire Danger" and "Poison."

It is forbidden to process painting compounds containing lead, mercury and copper compositions and to bring them to the working consistency in the painting station.

Interior painting work with the use of fire hazardous and toxic compounds is done only with open windows or in the presence of ventilation ensuring no less than a double exchange of air per hour.

Continuous work on premises where painting is done with oil paints or nitrocellulose enamel paints is assigned in accordance with the conditions for the performance of work and should not exceed 4 hours.

Work under conditions of natural or artificial ventilation of premises is organized so that the flow of pure air is directed from the unpainted to the painted surface, that is, so that the worker is in the zone of pure air.

When painting work is done outdoors, one must stand on the side exposed to the wind.

In the zone where nitrocellulose enamel paints and other compounds giving off explosive vapors are used it is forbidden to smoke and to perform work connected with the use of fire, as well as causing spark formation. The electric equipment located in the work zone should be explosionproof or de-energized.

Painting apparatus operating under pressure, as well as the rubber-textile hoses for them, are checked before the beginning of work and tested for pressure exceeding the working pressure 1.5 times. Test results are formulated in a document.

Painting compounds containing lead or mercury compositions should not be used for painting surfaces inside premises, as well as for painting surfaces by means of spraying.

To protect respiratory organs from dust formed during the grinding of spackled surfaces or the whitewashing of ceilings, it is recommended that the ШБ-respirator ("Lepestok") or three- to four-layer gauze bandages be used.

When building structures, equipment and closed capacities are painted with perchlorovinyl varnishes (paints), painters are provided with gas masks with a forced air supply.

Interior surfaces of closed capacities and tunnels are painted with their mandatory ventilation with portable ventilators and illumination with portable lamps with a voltage of 12 V under explosionproof conditions. At the same time, it is also necessary to take into consideration the conditions set forth in the subsection "Work in Closed Capacities."

There should be no less than two people simultaneously in the painting station and in the room being painted.

It is forbidden to store empty containers on working premises. Impacts upon empty containers should be avoided.

After work painting and cleaning brushes, paint sprayers and other tools are cleaned and stored in tightly closed pails, under an air vent or in ventilated closed metal cabinets.

Work With Radioactive Substances

Radioactive substances are used in construction mainly for controlling the quality of welded joints of pipes by illuminating them with gamma rays, for controlling the quality of soil stabilization and for determining the moisture of materials.

Socket-and-spigot joints are illuminated with portable gamma flaw detectors. Radioactive isotopes--cobalt-60 or cesium-137--are used as sources of gamma irradiation in gamma flaw detectors.

To measure soil density and the moisture of materials the following instruments are used: the ГПП-1 depth gamma density gauge; the РПГ-60 depth radioisotope density gauge; the ПГП-1 surface gamma density gauge; the НИВ-1 neutron moisture indicator; the РВГ-60 depth radio isotope moisture gauge; the НВУ-1 general-purpose neutron moisture gauge. Cesium-137 is used as a source of radiation in the ГПП-1, РПГ-60 and ПГП-1 instruments, and plutonium-beryllium, in the НИВ-1, РВГ-60 and НВУ instruments.

The use, storage and transportation of natural and artificial radioactive substances and other sources of ionizing radiation, as well as the processing and decontamination of radioactive waste, are regulated by the "Basic Sanitary Rules of Work With Radioactive Substances and Other Sources of Ionizing Radiation" (OSP-72), the "Norms of Radiation Safety" (NRB-69) and the "Rules of Transportation of Radioactive Substances."

The use, storage and transportation of radioactive substances and other sources of ionizing radiation and the processing and decontamination of radioactive waste are carried out under the supervision of the bodies and institutions of the sanitary and epidemiological service, which are given all the information necessary for an evaluation of the possible radiation danger for the personnel and population and for a clarification of the sanitary state of the pertinent facility.

The administration of a construction organization provides conditions for the storage and recording of the arrival, expenditure and writing off of radioactive substances and other sources of radiation under which the possibility of their loss or uncontrolled use is ruled out.

Bodies of internal affairs control the organization of the protection and conditions of safety of radioactive substances and other sources of ionizing radiation.

Irradiation of the human body with gamma- and beta-rays is the basic hazard factor during the use of radioactive substances. Affecting the human body, penetrating radiation ionizes the molecules of living cells, which lose their reproductive capacity. The general disease of the body under the effect of irradiation is called radiation sickness.

Increasing the distance from the irradiation source and shortening the time of stay in a radiation effect zone are the basic measures to reduce irradiation. Therefore, the zone within the limits of which the radiation level exceeds the permissible level should be restricted and posters and signs warning about the danger should be hung at the boundary of this zone.

For the purpose of preventing a radiation injury it is necessary to use individual protective equipment corresponding to the category of the job done, that is, special work clothing, rubber gloves, footwear and, when necessary, a special respirator.

The irradiation of every worker should be controlled by a dosimetric laboratory or by an especially assigned person by means of dosimetric and radiometric equipment and control sources of ionizing radiation.

Individuals not under the age of 18 are permitted to engage in work with radioactive substances. All individuals constantly working in a controlled zone should undergo a mandatory preliminary medical examination when they are hired and periodical annual medical examinations. Individuals not having medical contraindications according to the OSP-72 sanitary rules are permitted to engage in this work.

All individuals directly working with radioactive substances are permitted to engage in work after they are taught the rules of safe performance of work and the rules of personal hygiene. They receive instructions in safe work methods every quarter. Knowledge of the rules of safe work and personal hygiene is checked before the beginning of work and periodically every 6 months. The results of the check of this knowledge are recorded in a special log.

When the nature of work with radioactive sources changes, the category of work rises and so forth, special instructions in and a check of the knowledge of the rules of safe work and personal hygiene are organized.

The unit in which a radioactive source is placed should be resistant to mechanical, temperature and other effects and meet the conditions of its use. In a nonworking position all radioactive sources are located in protective units (containers). To extract the radioactive source from the container, a remote instrument or special devices (manipulators) should be used.

One must not touch radioactive sources with one's hands. Appropriate protective screens and various manipulators are used during work with preparations extracted from protective containers.

Equipment, containers, crates, transport facilities, apparatus and premises designed for work with the use of radioactive substances are supplied with signs of radiation danger. These are warning signs. They are designed to attract attention to facilities of potential or real danger connected with the harmful effect of ionizing radiation on people.

The sign of radiation danger should have the form and size corresponding to the requirements of GOST 17 925-72. When necessary, the sign should have inscriptions explaining or additionally warning about danger, for example, "Gamma-Radiation!", "Neutron Source", "Radioactivity" and so forth. It can also have vertical red stripes designating transport categories.

Radioactive substances are transported inside premises, as well as on the territory of an institution, in containers on special transport devices with due regard for the physical state of radioactive sources, type, amount and activity of radiation and size and weight of a package.

During the transportation of radioactive substances by all types of facilities and their storage the following should be envisaged:

placing radioactive substances in packages for the purpose of preventing irradiation of the service personnel and individuals near them;

implementing measures eliminating the contamination with radioactive substances of the service personnel, warehouses, transport facilities and other goods transported together with these substances;

loading and unloading packages with radioactive substances in as short a time as possible;

placing packages with radioactive substances at distances from places where people stay no smaller than indicated in supplement 3 to the "Rules of Transportation of Radioactive Substances."

Personnel constantly engaged in the loading, unloading, storage and transportation of packages with radioactive substances by all types of facilities should be taught the rules of handling these packages, methods of eliminating accidents and use of individual protective equipment and be familiarized with individual preventive measures. Every permanent worker should pass an examination in the minimum required technical knowledge.

This knowledge should be rechecked every 6 months.

Individuals temporarily (occasionally) enlisted in the loading, transportation and storage of packages with radioactive substances should be instructed before the beginning of work.

It is forbidden to transport packages with radioactive substances by public city transportation (street car, trolley bus, bus, or subway), as well as in freight and passenger taxi cabs. It is forbidden to transport and store packages with radioactive substances together with explosive and highly inflammable substances in one airplane, railroad cab, motor vehicle, semitrailer, general-purpose railroad and other transport containers, ship compartment, as well as in a neighboring railroad car, and so forth, or in a warehouse.

During the transportation and storage of packages with radioactive substances it is necessary to ensure their full safety.

Especially adapted motor vehicles are assigned for permanent intra- and intercity transport of packages with radioactive substances.

The equipment of such a motor vehicle should ensure:

the possibility of easily washing off radioactive contamination from the motor vehicle body, for which the sides and floor of the body are covered with poorly sorbing materials with a drainage for the discharge of a liquid during deactivation;

the protection of the motor vehicle body against the penetration of water and snow into it, for which the body is closed from all sides with a tarpaulin tent or is equipped with another cover;

the protection of the motor vehicle cab weakening radioactive radiation, for which a lead screen (sheet) ensuring a reduction in the irradiation dose in the driver's cab to the permissible dose is installed in the back of the cab.

During the transportation of packages with radioactive substances the dispatcher should place signs of radiation danger on the side of the especially assigned motor vehicle.

It is forbidden to use motor vehicles especially adapted for permanent transportation of packages with radioactive substances for the transportation of people, food products and other goods.

In case of emergency on the road these motor vehicles are fitted with individual equipment for protection against radioactive contamination, as well as with shovels and long tongs.

One-time transportation of packages with radioactive substances is permitted in ordinary--freight and passenger--motor vehicles with subsequent control of their radioactive contamination.

The transportation of packages with radioactive substances in passenger motor vehicles is permitted only in trunks.

Before the departure of motor vehicles assigned for the transportation of packages with radioactive substances, the administration of a motor pool (freight motor station) should thoroughly instruct the drivers of motor vehicles in safety measures. During the instructions the precise traffic route of the motor vehicle is indicated to every driver.

The driver should not be employed in loading and unloading work.

The parking of the motor vehicle on which packages with radioactive substances are loaded at places of people's permanent stay is forbidden.

When a technical failure, which cannot be eliminated on the spot, occurs along the motor vehicle's route, the driver should call for a technical aid motor vehicle from the nearest motor pool.

It is forbidden to transport people, including accompanying personnel, in the body of the motor vehicle on which packages with radioactive substances are loaded. If accompanying personnel are needed, they should travel in the driver's cab.

During the travel of the motor vehicle loaded with packages with radioactive substances the driver must periodically observe the rules of placing freight in the body and, when the fastening is displaced or weakened, immediately take the appropriate measures.

Upon return to the motor pool, before the motor vehicle is parked, it is checked for radioactive contamination.

During an accident, fire and so forth on the transport facilities carrying packages with radioactive substances it is necessary to isolate the accident section from people and goods at the distance indicated in the lable.

When the air tightness of packages with radioactive substances is impaired during transportation, it is necessary to take the following measures: to remove all people from the place of accident to a safe distance; to enclose this place and to install warning signs; to separate adjacent goods in order to avoid their contamination with radioactive substances; to cover the place of contamination with sawdust, earth, sand or another readily absorbing material.

The sanitary supervision bodies of the rayon in which these cases occur immediately notify the dispatcher of the indicated cases (accident, fire and impairment of the air tightness of packages).

Individuals constantly engaged in the loading, unloading, transportation and storage of packages with radioactive substances should strictly observe safety and personal hygiene measures, subject themselves to individual dosimetric control and use special clothing.

The instruments presented in table 9 are used for the dosimetric control and measurement of the radiation power of radioactive substances.

Along with the indicated instruments other instruments, which have a similar function, can also be used.

Table 9. Dosimetric Control Instruments

(1) Наименование прибора	(2) Тип	(3) Назначение
Комплект индивидуального дозиметрического контроля (4)	КИД-1	Индивидуальный дозиметрический контроль (5)
То же (6)	ДК-0,2	То же (6)
Микрорентгенометр медицинский (7)	МРМ-1	Измерение мощности доз гамма-излучения (8)
Переносный радиометр нейтронов (9)	РПН-1М	Измерение потоков нейтронов (10)
Универсальный бета-гамма-радиометр (11)	Луч-А	Измерение бета- и гамма-излучений (12)
Поисковый сцинтилляционный радиометр (13)	СРП-2	Измерение гамма-излучений (14)
Полевой альфа-радиометр (15)	РАП-1	Измерение альфа-излучений (16)
Универсальный радиометр (17)	ТИСС	Измерение альфа- и бета-излучений (18)

Key:

1. Name of instrument
2. Type
3. Function
4. Set of individual dosimetric control
5. Individual dosimetric control
6. Same
7. Medical microroentgenometer
8. Measurement of the dosage rate of gamma radiation
9. Portable radiometer of neutrons
10. Measurement of neutron flux
11. General-purpose beta-gamma radiometer
12. Measurement of beta- and gamma radiation
13. Survey scintillation radiometer
14. Measurement of gamma-radiation
15. Field alpha-radiometer
16. Measurement of alpha-radiation
17. General-purpose radiometer
18. Measurement of alpha- and beta-radiation

Calculation of Explosionproof Ventilation

Calculations of explosionproof ventilation for the performance of such work as painting, rubberizing, insulation, finishing and so forth in closed rooms and structures with materials and compounds containing explosive organic compositions are aimed at ensuring safe working conditions and consist in determining the volume of air subject to exchange and the number of the necessary ventilators and in creating comfortable conditions in terms of the air speed in a room.

The amount of air subject to exchange is determined on the basis of the data on the content of an organic solvent in materials or compounds and of the given intensity of work. The amount of an organic solvent that can evaporate during 1 hour of work, assuming that an organic solvent evaporates at the rate of 90 to 100 percent during that time, is first determined. In most cases it is believed that a solvent evaporates completely, because this eliminates the underestimate of possible serious consequences.

The calculation is made according to the following formula:

$$П = \frac{PqW}{100},$$

where П is the amount of an evaporating solvent, kg/m^2·hour;
P is the normative (estimated) expenditure of mastic per square meter of treated surface, kg;
q is the content of an organic solvent in mastic, percent;
W is the given productivity of insulation, finishing or other work, m^2/hour.

In cases when the evaporation of a solvent does not occur in a full volume and is limited to a certain evaporation surface (for example, during the preparation of insulation mastics or painting compounds the evaporation surface is limited to the area of opening of the mixer or other equipment), the amount of air subject to exchange is calculated with due regard for the data on the evaporation rate of a solvent at the operating temperature according to the following formula

$$П = YCT,$$

where Y is the evaporation rate of a solvent, mg/hour·m^2 (for example, of gasoline, 366,600 and of toluene, 132,300 at T=20°C and P=760 mm Hg);
C is the area of evaporation with open equipment, m^2;
T is the time of evaporation, hour

In the absence of reference data the evaporation rate is determined experimentally. Vessels with a certain area of evaporation bounded by vessel walls are taken for these purposes. A weighed amount of a solvent is poured into vessels and they are placed in rooms or chambers with preset operating conditions. After 1 hour the solvent remaining in vessels is weighed and the evaporation rate is calculated in $mg/h \cdot m^2$ for each experiment (vessel) separately. Then the average evaporation rate used in calculations is computed.

Next the necessary multiplicity factor of the air exchange in a room or installation, where construction work is to be done, is determined according to the following formula:

$$N = \frac{П}{V_п \cdot q_{пд}},$$

where П is the expenditure of an organic solvent in 1 hour with the given productivity, mg;
$V_П$ is the volume of a room or installation, m^3
$q_{ПД}$ is the maximum permissible concentration of the solvent, mg/m^3

After that the volume of air subject to exchange is determined:

$$V'_{об} = V_п N \ м^3/h,$$

where $V_П$ is the volume of a room or installation, m^3;
N is the calculated multiplicity factor of air exchange.

On the basis of the productivity of explosionproof ventilators available to a construction and installation organization or the technical specifications of the ventilators of the types Ц 4-70, Ц 9-57 and so forth manufactured by the industry (see the "List of Electric Engines for Outfitting the Manufactured Ventilators of Sanitary and Technical Systems," Issue 2, ТП-74, USSR State Committee for Construction Affairs, State Planning Institute for Industrial Sanitary and Technical Planning) their necessary number is determined.

$$N_в = \frac{V_{об}}{G}$$

where $V_{об}$ is the volume of air subject to exchange, m^3/h;
G is the productivity of a ventilator, m^3/h

When the volumes of rooms or installations are up to 25,000 m^3, the number of ventilators can be determined according to the nomogram presented in figure 10.

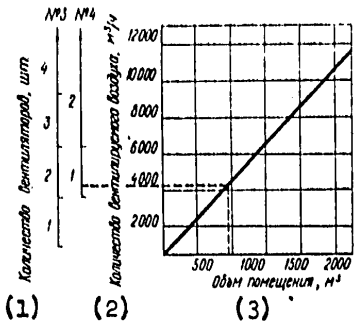


Fig. 10. Nomogram for the Calculation of Ventilation

Key:
1. Number of ventilators
2. Amount of ventilated air, m^3/h
3. Volume of a room, m^3

Knowing the volume of a room, on the nomogram a vertical line is drawn up to the intersection with a straight line and from the point of intersection, a horizontal line. When using the nomogram, it should be taken into account that it is executed with due regard for the limitations of the expenditure of a solvent in an amount not exceeding 0.065 kg/h, which corresponds to an insulation of 40 m^2/h for rooms of a volume of 200 m^3 and 80 m^2/h for rooms of a volume of 200 to 500 m^3.

To ensure comfort from the standpoint of the rate of ventilated air, during work inside such installations as gas holders the area of apertures, openings or manholes for air inflow is determined according to the following formula

$$S = \frac{V_{об}}{3600 \cdot V_в} м^2,$$

where $V_в$ is the permissible wind speed in a room (according to table 2 and paragraph 2.16 of the Construction Norms and Rules II-33-75, 0.5 to 3 m/sec);

$V_{об}$ is the volume of air subject to exchange, m^3/h.

For the purpose of creating comfortable conditions from the standpoint of the rates of ventilated air and its temperature, on production premises with a constant operation of exhaust ventilation systems forced ventilation with forced air heating during the winter period of the year is installed. At the same time, calculations are made on the basis of the requirements of the Construction Norms and Rules II-33-75 "Air Heating, Ventilation and Conditioning. Planning Norms" both in terms of the speed of motion and temperature of the air and the need for air supply for a room in a volume of no less than 90 percent of the volume of pumped out air.

Table 10. Types, Brands and Descriptions of Gas Masks

Gas Masks		Conditions of Use and Brief Description	Airflow Resistance, mm of water column
Type	Brand		
Small MK	A, B, Г, K, КД	They are used for protection against average gas or vapor concentrations (exceeding maximum permissible concentrations dozens of times) during the performance of work of average heaviness. The canister of the gas mask of the MK type, owing to the opening bottom, can be easily reloaded after depletion. The canister's service life lasts weeks and depends on the concentration of gases and vapors. A helmet or a semimask can be used as the facepiece.	No more than 5 during work of average heaviness
Big БК	A, Б, С, Г, КД, БКФ, СО, М, СОХ, КЕ, КВ	They are used for protection against large gas or vapor concentrations (exceeding maximum permissible concentrations hundreds of times) under conditions of heavy work. The service life of canisters lasts several months depending on the gas and vapor concentration.	No more than 18 during heavy work
Hose ПШ-57		The insulating gas mask is used when there is a deficiency of oxygen in the air, as well as with very large concentrations of harmful substances, when filtering gas masks are unsuitable. Air is supplied by means of an electric (if electric current is available) or manual drive. The pump services two gas masks simultaneously. Mask eyepieces do not become covered with condensate. The hose length is up to 40 m. Reinforced hoses possess mechanical strength and resistance to the effect of acids and petroleum products	Airflow resistance is absent

Respiratory Hose Instrument ШДП	Respiratory hose instruments, both self-feeding and with active air supply, serve for breathing pure (outside) air during work inside capacities in an atmosphere of toxic gases and vapors The hose instrument with active air supply consists of a mask, hose and blower to which the hose is attached. The air necessary for breathing is forced by an electric blower (ДПА-5) into the hose and then into the space under the mask. In other cases the hose can be connected to the main line of compressed air. The length of the hose of the self-feeding hose instrument should be no more than 11 m. If, according to working conditions, a longer hose is needed (12 m and more), it is necessary to use active air supply. The mask with glasses covering the face is attached to the head by means of tapes with clasps. It should tightly fit the face and smoothly adjoin the hairy part of the head.	About 20. It is absent during active air supply

Remark. Every industrial filtering gas mask consists of a gas canister, facepiece, corrugated tube and container. Rubber helmet masks, which are manufactured in five sizes, that is, 0, 1, 2, 3 and 4, are used as facepieces.

Table 11. Brands of Gas Mask Canisters and Their Function

Brand	Color	Protection
A	Brown	Against vapors of organic substances (gasoline, benzene, toluene, xylene, carbon disulfide, ethers, aniline, nitrocompounds of benzene and its homologs, haloids and so forth)

В	Yellow	Against acid gases (sulfur dioxide, chlorine, hydrogen sulfide, vapors of hydrocyanic acid, nitrogen oxides, hydrogen chloride, phosgene, and so forth). It partially protects against vapors of organic substances.
Г	Yellow and black	Against mercury vapors
Е	Black	Against hydrogen arsenide and hydrogen fluoride
К	Green	Against ammonia vapors
КД	Gray	Against a mixture of hydrogen sulfide and ammonia
С	Blue	Against sulfur dioxide
СО	White	Against carbon monoxide
М	Red	General-purpose gas mask. It protects against all gases and vapors envisaged by previous brands, including carbon monoxide, with a shorter time of protective action. It does not protect against smoke.
КВ	Yellow-gray	Against a mixture of nitrogen oxides and ammonia
БКФ	Green with a white vertical stripe	Against acid gases, hydrogen arsenide, neutral and toxic gas and fog
СОХ	White-yellow with a black vertical stripe	Against a mixture of carbon monoxide, chlorine and dust

Table 12. Types and Characteristics of Industrial Respirators

Type of Respirator	Protective Properties	Airflow Resistance With Work of Average Heaviness mm of water column
РУ-60м general-purpose with canisters А, В, КД, Г	They protect against all types of coarse and fine dust (with a particle diameter of about 1 μ), as well as against vapors of organic substances and acid gases, depending on the brand of the used canister	About 6
РПГ-67 antigas with canisters А, В, КД, Г	The same	"
РМП-62 for painter-pulverizers	"	"
АСМ--respiratory automatic device for welders and painters	"	"
Ф-45	It protects against all types of coarse and fine dust. It is not used for protection against especially toxic dust. The filters are removable. With periodical cleaning the service life of filters is approximately 1 month.	No more than 5
Ф-46	It protects against dust or gases. The dustproof filters and filtering beds of gas masks are removable. Filters Ф-46 have the same properties as filters Ф-45. Filtering beds are designed for protection against gases with small concentrations (exceeding maximum permissible concentrations several times) during performance of light work. The service life of filtering beds is several shifts. Filtering beds of gas masks can	About 6

	be used for protection against gases, the maximum permissible concentrations of which are no less than 0.001 mg/l. They can be used for protection against mercury vapors	
ШФ-2	Protective properties are the same as those of the respirator Ф-46, from which it differs only in the facepiece (helmet instead of a semi-mask). It is used when it is necessary to protect the eyes and skin of a person against the irritating effect of dust and gases	About 6
Р-2	It protects against dust and gases simultaneously. The protective action is higher than that of the respirator Ф-46. The dustproof filters and filtering beds of gas masks are removable. It can be used during light physical work and work of average heaviness. Filters completely hold back all types of coarse and fine dust (with a diameter of up to 1 μ)	

Table 13. Prescription of Preventive Pastes

Name of Substances Against Which Protection Is Needed	Recommended Pastes (Ointments)
a) Pigments and Organic Dyes	
Oil enamels and varnishes Varnishes with the use of organic solvents Artificial resins	ХИОТ-6, ИЭР-1, ЯЛОТ, ПМ-1
Creosote Coal tar pitch Bitumen Coal tar resins	Antipitch ХИОТ-6, ЦНИЛПИС-1 ЦНИЛПИС-3, ГИПИ
Polychlornaphthalene (halowax)	МХП
Water	

b) Solvents (Aromatic Hydrocarbons, Esters and so Forth)

Benzene Toluene Xylene Solvent-naphtha and so forth Acetone Esters: ethyl, butyl, amyl acetate and turpentine	ХИОТ-6, ИЭР-1, ЯЛКОТ, ПМ-1

c) Alkalis and Acids

Harmful solutions of acids " " of alkalis " " of salts	ЛИОТ-ИГВ, ИЭР-2, Prof. Selisskiy's silicone ointment No 1, "Sperm Whale Ointment"

d) Fuels and Lubricants

Diesel fuel Lubricating machine oils Kerosene Gasoline White-spirit Petroleum ether	ХИОТ-6, ИЭР-1, ЯЛКОТ, ПМ-19 "Biological gloves", "Nikolay" ointment

e) Thermoreactive Resins and Hardeners

Epoxy and polyester resins; polyester resins; polyethylenepolyamine, hexamethylenediamine and so on.	"Invisible gloves"

Table 14. Compositions of Preventive Pastes

Name of Pastes	Compositions of Pastes	Content, %
ХИОТ-6, Former Khar'kov Scientific Research Institute of Labor Protection of the All-Union Central Trade Union Council	Edible gelatin or photogelatin	2.4
	Wheat or potato starch	5.6
	Medical glycerin	72
	Burov's solution	20
ИЭР-1, Scientific Research Sanitary Institute imeni Erisman	Strictly neutral sodium soap (counting 100%-content of fatty acids)	12
	Technical glycerin	10
	White clay (kaolin)	40
	Water	38
ЯЛКОТ, Yaroslavl' Laboratory of Labor Protection of the All-Union Central Trade Union Council	Grained soap	39.6
	Distilled water	39.6
	Castoil Oil	19.6
	Talc	1.2

ПМ-1, Moscow Scientific Research Institute of Labor Protection of the All-Union Central Trade Union Council	Starch (potato flour)	14.1
	Water	43.6
	Talc	8.1
	White clay	10.1
	Gelatin	?
	Glycerin	12.6
	Liquid petrolatum	7.5
	Salicylic acid	0.3
	Ethyl alcohol	1.7
Antipitch paste, former Khar'kov Scientific Research Institute of Labor Protection of the All-Union Central Trade Union Council	Edible gelatin or photogelatin	2.3
	Wheat or potato starch	4.2
	Burov's solution	11
	White clay	18
	Medical glycerin	40
	Zinc oxide	2.2
	Fine ocher	0.3
	Congo red paint	0.01
	Distilled water	22
ЦНИЛПИС-1, Central Scientific Research Laboratory of Water Transport	Finely ground activated coal or graphite	1 weight part
		2 weight parts
ЦНИЛПИС-1	Glycerin	15
	Colophony	10
	Salol	75
	Ethyl alcohol	74
ЛИОТ-ИГВ, Leningrad Scientific Research Institute of Labor Protection of the All-Union Central Trade Union Council	Beeswax	26
	Sunflower oil	
ИЭР-1, Scientific Research Sanitary Institute imeni Erisman	Paraffin	20
	Ceresin wax	15
	Liquid petrolatum	65
"Invisible gloves"	Methyl cellulose	4
	Glycerin	11.7
	White clay	7.8
	Talc	7.8
	Water	68.7
Silicone paste (containing polysiloxans--polymeric silicones)	Silicone oil (dimethylpolysiloxan)	30
	Ester (polyethylene glycol)	7
	Fatty alcohol	15
	Lanolin	0.5
"Biological gloves" (paste)	3% solution of carboxymethyl cellulose	47.5
	Dry casein	12
	25%-ammonia solution	0.1
	Glycerin	11.9
	Ethyl alcohol	28
	Distilled water	38

Prof. Selisskiy's ointment No 1 (zinc stearate)	Liquid paraffin	85
	Stearine	12
	Zinc oxide	3
"Sperm Whale Ointment"	Natural sperm whale oil	41
	Liquid petrolatum	40
	Stearine	14
	Zinc oxide	4
	Odorant	1
"Nikolay" ointment (instead of the "Biological gloves" paste)	70% household soap	20
	Technical lanolin	20
	Kaolin	20
	Water	40
ITBI MKJI	Glycerin	12
	Household soap	15
	Kaolin	35
	Water	38

Remark. Medical personnel prescribe preventive pastes after a medical examination and clarification of the state of the integument.

Individual Protective Equipment

During work with toxic materials and substances individual protective equipment is used for the protection of the respiratory organs, vision and integuments of workers.

Protection of respiratory organs. Two types of gas masks, that is, insulating and filtering (table 10) with gas mask canisters specialized in their function (table 11) and respirators (table 12), are used for the protection of respiratory organs.

Protection of integuments. The following are among the reliable means of protecting the integument: special work clothing, gloves, footwear and headgear.

Preventive pastes, whose prescription is given in table 13 and compositions, in table 14, are used for the protection of open skin sections.

Eye protection. Protective goggles and masks (table 15) are used for the protection of eyes against a chemical effect, when sprays or drops of acids and alkalis enter them, as well as against various vapors and gases of organic substances. To prevent the misting of the glass of goggles, it is recommended that they be lubricated with a solution consisting of gelatin, sugar and water at a ratio of 2:20:50 percent by weight.

Table 15. Goggles and Masks for the Protection of Eyes Against Mechanical Injuries and Harmful Substances at Work

(1) Наименование и марка очков и масок	(2) Защитные свойства
(3) Очки защитные закрытые, полумаска с однослойными силикатными стеклами О33-10	Защита от брызг, химически неагрессивных жидкостей, ветра, пыли, мелких частиц твердых тел (4)
То же и полумаска с однослойными силикатными стеклами «Моноблок» О33-10 (5)	То же (6)
То же и полумаска со сплошным остеклением из пластмассы «Моноблок» О33-10 (7)	»
То же и полумаска с боковыми щитками О33-7 (8)	»
То же и полумаска без боковых щитков О33-4 (9)	»
Маска защитная с прозрачным экраном (ТУ 64-1-456-70) (10)	»

Key:

1. Name and brand of goggles and masks
2. Protective properties
3. Closed protective goggles and a semimask with one-layer silicate glass 033-10
4. Protection against sprays, chemically nonaggressive liquids, wind, dust and small particles of solid bodies
5. The same and a semimask with one-layer silicate glass "Monoblok" 033-10
6. The same
7. The same and a semimask with solid glazing from the plastic "Monoblok" 033-10
8. The same and a semimask with side panels 033-7
9. The same and a semimask without side panels 033-4
10. Protective mask with a transparent screen (TU 64-1-456-70)

First Aid to Victims

The efficiency of first aid tc victims during fires, explosions and poisonings with toxic substances and materials depends on an urgent implementation of measures including the following:

carrying out the victim from the dangerous zone;

maintaining the basic vital functions of the body (during poisoning, an immediate removal of the poison from the body; during suffocation, restoration of effective breathing; during a cardiac arrest, restoration of cardiac activity);

summoning a physician to administer emergency aid.

First aid during poisoning. Poisoning occurs as a result of the penetration of toxic substances and materials into the body during inhalation and swallowing or through integuments.

In cases of poisoning through the respiratory tracts it is necessary:

to move out or carry out the victim from the contaminated atmosphere (administering first aid at the place of accident worsens the condition of the victim and can lead to injuries to the individuals administering first aid);

to remove the contaminated clothing;

to ensure the inhalation of fresh air and rest;

if the victim coughs, to give him warm milk with soda.

If toxic substances penetrate the skin or mucous membranes, it is necessary:

to immediately remove toxic substances with a pad of absorbent cotton or bandage;

to wash the affected surfaces with clean water and soap;

to apply special detoxicating solutions from the first-aid kit:

a) in case of penetration of mineral and strong organic acids, a 2- to 5-percent solution of sodium bicarbonate (1 or 2 teaspoons of drinking soda per glass of water);

b) in case of penetration of alkalis, a 2-percent solution of citric acid (1 teaspoon of citric acid per glass of water);

c) in case of penetration of sodium nitrate, a 1:1000 potassium permanganate solution;

d) in case of penetration of phenol formaldehyde resin into the skin, it should be rubbed with a 40-percent solution of ethyl alcohol and a bandage with a streptocide or synthomycin emulsion should be applied. When the FRP-1 composition enters the eyes, they should be washed with water or a 5-percent solution of drinking soda.

If toxic substances, which do not corrode tissues, enter through the mouth, it is necessary:

to urgently remove them from the stomach with the aid of the vomiting reflex by mechanically irritating the back wall of the pharynx or the root of the tongue with fingers and to repeat the vomiting several times;

If breathing is disturbed, artificial respiration should be given.

If toxic and tissue corroding substances enter through the mouth, the victim's oral cavity should be rubbed with a gauze pad or a handkerchief. Only individuals belonging to medical personnel can induce vomiting and lavage the stomach. Medical workers should perform this procedure through a special probe, which prevents the corrosion of respiratory tracts and of the mucous membrane of the esophagus.

First aid during burns and inflammation of clothing. Thermal and chemical burns are most widespread. Contact with incandescent or strongly heated objects and the effect of burning materials can be the cause of thermal burns. Chemical burns result from the effect of chemical substances, mainly acids and caustic alkalis, on the skin. However, some organic compounds (cresol, phenol and so forth), alkali metals, white phosphorus, bromine, chlorine and so forth can also cause chemical burns.

Four degrees of burns are distinguished: the first, accompanied by skin reddening; second, by the formation of blisters; third, by skin necrosis (death) and fourth, by the charring of and injury to deep tissues (tendons and muscles) and bones.

If clothing is inflamed, it is necessary to extinguish the fire on the burned person, throwing on him an asbestos or woolen blanket or, finally, a robe, coat and so forth, or pouring water over him. After extinguishing the fire, it is necessary to immediately begin administering first aid.

In cases of thermal burns of individual parts of the body the skin near the burn should be rubbed with alcohol, eau de Cologne or vodka and a dry sterile bandage should be applied to the burned surface. Lotions made of freshly prepared 2-percent solutions of drinking soda (sodium bicarbonate) or potassium permanganate also help. It is forbidden to lubricate the burned surface with grease or some ointment. In limited first-degree burns a gauze pad soaked in a 96-percent solution of ethyl alcohol should be applied to the reddened skin.

In second, third and fourth degree burns the victim should be immediately sent to a medical institution.

In burns caused by chemical substances, especially acids and alkalis, the affected skin section must be immediately washed within 10 to 15 minutes with a large quantity of water and then a lotion should be applied to the burned spot, that is, in burns caused by acid, of a 2-percent solution of drinking soda and in burns caused by alkali, of a weak 1- to 2-percent solution of acetic acid.

If the eyes are burned with sprays of caustic substances or solid particles, as well as with aerosols or vapors, they must be immediately washed with an abundant amount of water and then with a 3-percent solution of drinking soda. Only the physician takes all other measures.

Restoration of breathing. To restore breathing, an artificial ventilation of the lungs is performed. At first it is recommended that:

the supply of fresh air for the victim be increased, that the collar be unfastened and that the belt and other parts of clothing that restrict breathing be loosened;

the victim's mouth be cleaned of mucus, sand, earth, blood clots and so forth with the index finger, a twisted handkerchief or a piece of gauze;

removable dentures be removed.

Basic method of mouth-to-mouth or mouth-to-nose artificial ventilation of the lungs. The victim's head is tilted back as much as possible. Something hard is placed under his shoulder blades. The victim's mouth is opened, his lower jaw is pulled downwards and, while the head is held with a hand in the ti ed position, a deep inhalation is performed. A handkerchief or a piece of gauze is applied to the victim's mouth. Air is blown into the victim's mouth from one's lungs and, at the same time, his nose is pinched with the fingers of the hand holding the head. A deep inhalation is again performed (at the same time, the victim's chest collapses and exhalation occurs) and then again air is blown into the victim's mouth. Air should be blown at a rate corresponding to the respiration rate of a healthy individual. Air can also be blown into the victim's lungs through a tube, as well as through the nose, when the victim's jaws are clenched tightly.

Artificial ventilation of the lungs by means of manual respirators. The restoration of breathing by means of these apparatus is done as follows. At first the passability of respiratory tracts is ensured by cleaning them of foreign objects. An air duct is introduced into the mouth and the victim's nose and mouth are tightly covered with a mask. Then, pressing the respirator bag, inhalation is performed. Exhalation occurs through the bag valve. At the same time, exhalation should be twice as long as inhalation.

Other methods of artificial respiration are less effective and are used only in cases of wounds to the face, which rule out the possibility of applying the mouth-to-mouth or mouth-to-nose method.

Kallistov's method. The victim is placed on his abdomen with his hands outstreched in front of him. The victim's head is turned to the side and a blanket, clean clothes or something soft is placed under his face. One long or two tied towels, a belt or a stretcher strap are placed on the victim's shoulder blades and the ends are taken out in front from under his shoulders. The rescuer stands in front of the victim's head facing him and, bending, takes the ends of the towel or strap. Unbending, the rescuer raises the victim's chest 7 to 10 cm above the ground (floor). At the same time, inhalation occurs. When the victim is lowered, exhalation occurs. Respiratory movements should be made 12 to 16 times per minute.

Sylvester's method. The victim lies on his back. The rescuer stands near his head, takes both hands by the forearms and stretches them over the head--inhalation occurs. Then the rescuer presses the hands bent at the elbows against the victim's chest and, continuing to hold them by the forearms, with his hands exerts pressure on the lower section of the victim's chest--exhalation occurs. Movements (inhalation-exhalation) are repeated at a rate of 12 to 16 times per minute. This method is inapplicable if the victim's hands or chest are injured.

Restoration of cardiac activity. Cardiac activity is restored by means of a closed massage of the heart. For this the victim should be placed on his back on a hard surface (earth, floor or table), the place at which pressure should be exerted on the chest must be determined (two fingers above the lower end of the breastbone) and the lower part of the palm of one hand should be placed along the breastbone and the palm of the other hand at a straight angle, above, on its back surface. The hand fingers should be brought together and raised (they should not touch the victim's chest) and sharp rhythmical pressures should be exerted on the lower part of the breastbone with straight hands, not bending them at the elbows, with the force necessary for displacing the chest below by 3 to 4 cm.

After each pressure (60 pushes per minute) the hands should be released, without removing them from the breastbone. After four or five pressures one injection of air into the victim's lungs is made through the mouth or nose. The closed heart massage should not be stopped before the arrival of an ambulance.

Efficiency of Introduction of Safe Working Conditions and Economic Consequences of Injuries

During the introduction of measures for labor protection, industrial sanitation and safety techniques contributing to a reduction in diseases and industrial injuries an evaluation of technical and economic efficiency is made on the basis of the attained decrease in labor losses, average annual output per worker in a day and saving of social insurance funds. In this case the saving is determined according to the following formula:

$$Э = П_д(X_1 - X_2) + Б_с(X_1 - X_2),$$

where $П_д$ is the average annual output per worker in a day, rubles;
X_1 are the labor losses during the base year, that is, before the introduction of a measure, days;
X_2 the same, in the year under review, that is, after the introduction of a measure, days;
$Б_с$ is the cost of the average annual pay in connection with a doctor's medical certificate per day, rubles.

When the economic effect is determined, the average annual output per day is calculated with due regard for the cost of labor of the personnel not connected directly with the production process, which, naturally, is somewhat lower than the average annual output of one worker per day.

The increase in labor productivity as a result of a reduction in diseases and industrial injuries is determined according to the following formula:

$$K = \frac{Э_ч Ф \cdot 100}{Ч_р \text{ of the base year}},$$

where $Ч_р$ is the size of the industrial and production personnel, people;
$Э_ч$ is the saving of the industrial and production personnel, people, determined according to the following formula:

$$Э_ч = \frac{Н_б - Н_о}{100} Ч_{рб},$$

where $Н_б$ is the percent of absenteeism of the nominal work time fund during the base year;
$Н_о$ is the percent of absenteeism of the nominal work time fund during the year under review;
$Ч_{рб}$ is the size of the industrial and production personnel calculated for the actual volume of production of the year under review according to the output of the base year;

$$Ч_{рб} = \frac{Ч_р Ф}{1000},$$

Where $Ф$ is the growth of the volume of production (rate of growth), percent.

However, these calculations do not take into account all the economic consequences of industrial injuries. According to L. A. Kuz'minov's method, in addition to the losses of output and the payment in connection with disability certificates, the cost of treatment, the cost of fixed capital out of order as a result of an accident and so forth are the actual components of expenditures and losses as a result of injuries. In general form, expenditures and losses consist of the expenditures and losses that the organizations and enterprises themselves incur--$П_1$--and the expenditures and losses that other state and public organizations incur--$П_2$--and material damage is expressed as the sum of expenditures and losses.

$$П = П_1 + П_2.$$

The expenditures and losses of an organization or enterprise are determined according to the following formula:

$$П_1 = C_1 + C_2 + C_3 + C_4 + C_5 + C_6 + C_7 + C_8 + C_9 + C_{10},$$

where C_1 is the amount of losses of the profit of an organization or enterprises from the moment of accident to the moment when the victim's place is occupied by a new worker and production is renewed. It is determined according to the following formula:

$$C_1 = aP_oT,$$

where a is the coefficient taking into account the correction for the profit as a result of the difference in the victim's skills and the skills of the average staff worker of an enterprise or organization;

$$a = \frac{K_1}{K_2},$$

where K_1 is the rate coefficient for the victim's category;
K_2 is the average rate coefficient in an enterprise or organization;
P_o is the average profit from the sales of output per man-day determined by the ratio of the annual profit from the sales of output to the product of the number of workers on the industrial staff by the average number of nonappearances at work in a year;
T is the number of man-days of idle time from the moment of accident to the renewal of production at the victim's work place;
C_2 is the amount of losses of an organization or enterprise as a result of the decline in the victim's labor productivity upon his return from treatment if upon his return he is assigned to easy, less skilled, work. This amount is determined according to the following formula:

$$C_2 + (aP_o - a_1P_o) \cdot T_1 + (M_1 - M_2) \cdot T_1,$$

where a is determined according to the formula presented above;
a_1 is the ratio of the rate coefficient for the victim's category after his return to work to the average wage coefficient in the organization;
(M_1-M_2) is the difference in wages before the injury and after return to work;
T_1 is the length of a victim's work according to the lower category, days;
C_3 are the expenditures and losses from the idle time of other workers during the victim's rescue, as well as the expenditures on the transportation to the medical institution determined according to the following formula:

$$C_3 = P_0 \cdot T_2 + M_3 + Д,$$

where $P_0.T_2$ is the loss of profit owing to the idle time of other workers, which is determined by the product of the average profit per man-day from the sales of output by the number of man-days of idle time;

M_3 is the amount of wages paid during the idle time;

Д is the cost of transporting the victim (product of the cost of 1 machine-hour of a transport unit by the number of hours of its operation);

C_4 is the cost of investigation of an accident determined according to the following formula:

$$C_4 = M_4 + И,$$

where M_4 is the amount of wages of engineering and technical personnel and of the specialists engaged in the investigation during the period of investigation;

И is the amount presented to the enterprise by judicial investigating bodies for the investigation and conduct of the proceedings of a given case;

C_5 is the replacement or full value of the buildings and installations that suffered from the accident. It is determined according to the estimates of repair and restoration work or according to the data of the bookkeeping department on the expenditures connected with restoration.

C_6 is the full or replacement value of the damaged equipment, tools, fittings and implements. It is determined depending on the nature of destruction according to the data of the bookkeeping department;

C_7 is the full of partial value of the damaged materials, semifinished products and articles determined according to the defect certificate;

C_8 are the expenditures on training the substituting worker. They represent the amount of wages paid to trainers during the period of training according to the data of the bookkeeping department;

C_9 are the expenditures on the implementation of additional measures aimed at preventing similar accidents in the future;

C_{10} are the expenditures on giving one-time help to the victim or his family (sanitary and health resort treatment, funeral and so forth) from the organization fund.

The expenditures and losses of other state and public organizations are determined according to the following formula:

$$П_2 = У_1 + У_2 + У_3 + У_4 + У_5 + У_6 + У_7 + У_8 + У_9,$$

where Y_1 is the cost of ambulatory treatment (product of the number of visits by the average cost of one visit);

Y_2 is the cost of clinical treatment (product of the number of days of clinical treatment by the cost of one place in the clinic in 24 hours);

Y_3 is the payment in connection with a doctor's medical certificate with the exception of the part that is sometimes paid by the culprit in an accident;

Y_4 is the pension to the victim or to his family for the entire period from the moment of retirement on a pension to the moment of retirement on an old-age pension for this occupation (or to the moment of return to work);

Y_5 are the expenditures of a trade-union organization on giving assistance;

Y_6 are the allowances to the victim's family for the funeral or care of the disabled person from social insurance funds;

Y_7 is the allowance of social insurance in the form of the difference between the pension and average wages that the victim received before the injury;

Y_8 are the special allowances of social insurance in case of group accidents;

Y_9 are state losses as a result of the fact that the victim, retiring on a pension (or in case of death), cannot give the state profit and, in addition to this, does not improve his skills and, therefore, does not give an increase in profit. These losses are calculated according to the following formula:

$$Y_9 = a \cdot P_0 \cdot T_3 \cdot K,$$

where $a \cdot P_o$ is determined according to the formula presented above;

T_3 is the time from the moment of retirement on a disability pension to the moment of retirement on an old-age pension for this occupation. In case of a fatal outcome, the time from the moment of death to the moment of retirement on an old-age pension;

K is the coefficient taking into account the rise in skills determined according to the following formula:

$$K = 1 + \frac{K_3 - K_2}{2},$$

where K_3 is the rate coefficient of the highest category in a given occupation;

K_2 is the wage coefficient for the victim's category before the injury.

The presented method makes it possible to calculate the expenditures and losses for any accident.

Bibliography

1. Bukreyev, S. I., "Tekhnika Bezopasnosti v Stroitel'stve" /Safety Techniches in Construction/, Kiev, Budivel'nyk, 1960.

2. "Vrednyye Veshchestva v Promyshlennosti" /Harmful Substances in Industry/. Handbook edited by N. V. Lazarev. Part 1. "Organicheskiye Veshchestva" /Organic Substances/. Part 2. "Neorganicheskiye i Elementoorganicheskiye Soyedineniya" /Inorganic and Organoelemental Compounds/, Moscow, Khimiya, 1961.

3. Dolin, P. A. "Spravochnik po Tekhnike Bezopasnosti" /Handbook of Safety Techniques/, Moscow, Energiya, 1973.

4. Kluts, L. Ya., Furayev, M. S., and Yakshin, V. S., "Tekhnika Bezopasnosti v Stroitel'stve" /Safety Techniques in Construction/, Moscow, Stroyizdat, 1971.

5. "Osnovy Tekhniki Bezopasnosti i Proizvodstvennoy Sanitarii v Stroitel'stve" /Principles of Safety Techniques and Industrial Sanitation in Construction/, Moscow, Stroyizdat, 1971.

6. "Pozharnaya Opasnost' Veshchestv i Materialov" /Fire Danger of Substances and Materials/. Handbook edited by I. V. Ryabov. Part 1, Moscow, Stroyizdat, 1966. Part 2, Moscow, Stroyizdat, 1970.

7. Rubin, A. A., "Protivopozharnyye Meropriyatiya v Skladskom Khozyaystve" /Fire Prevention Measures in Warehouse Facilities/, Moscow, Stroyizdat, 1969.

8. "Sbornik Ofitsial'nykh Materialov po Okhrane Truda v Stroitel'stve i Promyshlennosti Stroitel'nykh Materialov" /Collection of Official Data on Labor Protection in Construction and Construction Materials Industry/. Issue 1, Moscow, Stroyizdat, 1972. Issue 2, Moscow, Stroyizdat, 1974.

9. "Spravochnyye Dannyye o Pozharnoy Opasnosti Novykh Stroitel'nykh Materialov" /Reference Data on the Fire Danger of New Building Materials/, Moscow, Stroyizdat, 1971.

10. Taubkin, S. I., Baratov, A. I., and Nikitina, N. S., "Spravochnik Pozharoopasnosti Tverdykh Veshchestv i Materialov" /Handbook of Fire Danger of Solid Substances and Materials/, Moscow, RSFSR Ministry of Municipal Services, 1961.

11. "Tekhnika Bezopasnosti i Proizvodstvennaya Sanitariya v Stroitel'stve" /Safety Techniques and Industrial Sanitation in Construction/, Handbook, Moscow, Stroyizdat, 1974.

12. Yudin, K. A., "Tekhnika Bezopasnosti pri Rabote s Khimicheskimi Veshchestvami" /Safety Techniques During Work With Chemical Substances/, Moscow, Profizdat, 1958.

13. Yakshin, V. S., "Bezopasnost' Truda pri Primenenii Polimernykh Materialov i Izdeliy v Stroitel'stve" /Labor Safety With the Use of Polymeric Materials and Articles in Construction/, Moscow, Stroyizdat, 1967.

14. "Spravochnik po Spetsial'nym Rabotam. Svarochnyye Raboty v Stroitel'stve" /Handbook of Special Work. Welding Work in Construction/, Moscow, Stroyizdat, 1971.

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