TYPES OF EXTRAORDINARY SITUATIONS OF TECHNOLOGY AND ACTIVITIES IN EXCEPTIONAL SITUATIONS WITH THE RELEASE OF RADIOACTIVE SUBSTANCES

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Abstract: *There is an analysis of the major emergencies that occur in our daily lives. Technogenic emergency situations with the release of radioactive substances, separation of dangerous chemical substances and distribution of biological substances are briefly identified. Their impact on humans and the environment is shown and what action is needed to take in the event of an emergency with the release of radioactive substances and radiation.*

KEYWORDS: *EMERGENCIES, RADIOACTIVE SUBSTANCES, DANGEROUS CHEMICAL SUBSTANCES, BIOLOGICAL SUBSTANCES, ACTION, POLLUTION*

1. Introduction

It is accepted that emergency situations (IS) are called conditions that occur as a result of the action of natural disasters (natural IS), accidents and disasters in industrial production or in transport (technogenic IS), ecological catastrophes, diversions or actions of social , political or military nature, characterized by a large or abrupt deviation from the normal course of processes and phenomena in society and resulting in a significant impact on the viability of people, living nature, the economy, society the sphere and the surrounding objects and facilities [6].

Emergency situations of a technogenic nature that are related to man's production can be associated with environmental contamination or without such contamination. Environmental pollution can occur in accidents in industrial plants with the disposal of radioactive, chemical and biologically hazardous substances.

2.1. Types of emergencies of a technogenic nature

Emergencies with the discharge or risk of discharges of radioactive substances may occur in the operation of nuclear power stations, research nuclear reactors, nuclear fuel manufacturing or processing plants, nuclear craft and in the event of the accident of vehicles transporting nuclear reactor components. Such an accident is also possible for enterprises operating for military nuclear programs or for units containing nuclear weapons or their components associated with the nuclear chain reaction. As a result of such accidents and depending on the meteorological phenomena occurring in the area, pollution of the environment or adjacent water areas may be different in degree and scope [4]. The consequences of such accidents are long-term and examples are the Chernobyl disasters (USSR, Ukraine), Fukushima (Japan) and others.

Nuclear weapons pose a huge threat to man and our environment. With its striking factors, it is one of the most deadly weapons ever created by man. Any one of the striking factors, even on their own, could kill thousands of people, break an ecological system or destroy an infrastructure [1].

Other failures of a technogenic character are those related to the discharge or the risk of discharges of hazardous chemical substances. This can happen in chemical plants, enterprises handling dangerous chemical substances or in places where they are stored. Most often this is accompanied by environmental pollution with chemical substances outside the sanitary area of the site, collective poisoning of the population and consequent undesirable environmental pollution, which may lead to the need to carry out degassing of the site and sanitation of the infrastructure and the population.

The main actions for the elimination of the consequences of the use of combatant toxic chemicals are as follows:

- meteorological monitoring (vertical atmospheric stability, atmospheric pressure, wind direction and speed, air temperature and rainfall);

- conducting a chemical reconnaissance to establish the type and concentration of BTWB and the determination of chemical contamination zones;

- evacuation of the population in the opposite direction of the distribution of aerosols from BTWV;

- Separation of sites for special and sanitary treatment in non-contaminated areas [11].

The latter type of accidents of this type are the accidents associated with the disposal or the risk of discarding biologically active substances. These are accidents in which environmental pollution has occurred with hazardous biological substances when discharged from research centers or industries in which bacterial materials are investigated, developed, prepared, processed or transported.

Towards IP without environmental pollution we can account for accidents that are accompanied by blasts, fires, demolition of buildings, destruction of hydrotechnical devices, disturbance of transport system integrity and communications, etc. Due to the fact that this kind of accidents do not emit radioactive, chemically dangerous and biologically dangerous substances, we will not stop at them [7].

2.2. Emergencies with release of radioactive substances

In the current dynamic time, different sources of ionizing radiation and radioactive substances are increasingly being used in every branch of the economy.

On our planet, everything is about the perturbation of various natural and anthropogenic, terrestrial and cosmic sources of ionizing radiation, ie. in particular in the natural and manufac- tured environment. Ionization beams accompany the life of the planet in various areas of concern at all stages of the world. They are an integral part of our existence because, as we all know, the largest source of light and heat in our universe is the sun, and there is a continuous thermonuclear process and we reach the gamma rays that determine the natural radioactive background in the Earth's atmosphere [9].

Science of the construction of the atom has enormous opportunities for development, but also a serious danger to mankind and the environment, as evidenced by the consequences of nuclear experiments and accidents in the United States, England, France, the USSR, Japan and a number of Pacific islands.

The first serious environmental and soil pollution caused by human activity is that in Japan, dated August 6-9, 1945. Above the Japanese cities of Hiroshima and Nagasaki, with no special military necessity, the Americans throw the first atomic bombs in the history of mankind. Previously, a nuclear experience has been made in the Nevada desert, for which there is hardly any information in the public domain. The era of the atomic race began, including the former USSR, France, Britain, etc., and the number of nuclear states today is over 20.

Of course, the pollution of the environment and the soil with radioactive substances is also increasing with the emergence of the

nuclear industry. This was not known at first, and there was a lack of reliable information on the negative impact of radiation on the environment and humans due to insufficient theoretical and field studies and the secrecy of production, was not an opportunity to accurately assess the amount of this pollution, environmental and social damages caused by it.

For a long time, due to lack of information, it was considered to be relatively limited, local and not very dangerous. Later it was found that the various stages of production of uranium fuel (open or closed mines, hydrometallurgical production and uranium concentration, purification, enrichment, etc.) is possible to "enrich" the environment with uranium radionuclides and especially with radon (radon-222). The waste from the major hydrometallurgical plants was first discharged without purification and sufficient additional treatment in the nearest water bodies and, when irrigated, polluted the agricultural areas and the plants grown on them. Only about 50 years ago it is recommended that uranium-contaminated and other radioactive products lead to the cultivation of special crops that can extract and concentrate uranium and purify water, and indirectly protect the soil from radioactive contamination [10].

Of course, the most radioactive contamination of the environment and the soil after the crash in Chernobyl, Ukraine (former Soviet Union) on 26.04.1986, Trimail Island - USA - 1976; Fukushima, Japan - March 2011 and other minor nuclear accidents and accidents.

Local pollution of the environment and soil was also described in Spain in 1966, as a result of a collision in the air of a nuclear-carrying aircraft with a tanker. Radioactive substances from the unexploded nuclear device were scattered over an area of several thousand hectares. 990 tonnes of soil was buried and buried in tombs for radioactive substances in South Carolina, USA. These and a number of other known and unknown cases indicate that in the current armament, despite the high degree of certainty, the risk of nuclear pollution in vast territories actually exists, even in relatively peaceful times and quiet regions.

In the aftermath of the major accidents in Chernobyl and later in Fukushima, more attention has been paid to the need to train specialists whose main task is preventive action to prevent radiation accidents and mitigate the consequences of their eventual occurrence. Increasing influence is being given to the prevention of work with sources of ionizing radiation in more and more sectors of the economy, healthcare and related activities. A special place is also devoted to possible terrorist acts in which sources of ionizing radiation and various radioactive isotopes can also be used. This would affect all inhabitants of a region, continent or larger territory of our planet without being interested in nationality, religion, gender, race or other distinctive features of people.

Nowadays, modern biotechnologies have been developed in a number of countries where, with the help of special algae, uranium is extracted and concentrated in their biomass and thus water is cleansed [12].

Nuclear materials must be transported, stored and processed. Each of these activities leads to an increase in the risk of radioactive contamination of the environment, damage and, respectively, disease to humans, animals and the animal world. Every radiation accident is associated with an accident that leads to the disposal of radioactive products and ionizing radiation in larger dimensions than the predetermined and accepted safety standards.

As a rule, the main causes of the failures in the operation of the nuclear power plant are events related to the passage of safety thresholds across the various components of the reactor core. The cause of an accident may be the formation of critical mass when loading, transporting and storing fuel elements.

In the event of disturbing the controlled neutron reproduction, the reactor core reactor may cause thermal or nuclear explosions. As a result, uncontrolled chain reaction will occur, which in turn will cause an increase in energy released and destruction of the reactor core, accompanied by explosion and release of radioactive substances and an overdose of γ-rays.

The radioactive impact on the staff of the damaged facility and the people who work and live in the infected area may be characterized by a dose of internal and external contamination. Here we have to note that under external influence we understand the direct irradiation of the person from the sources of ionizing radiation, which are outside his body, most often these are sources of neutrons and γ-rays. When the source is in the human body, we have internal irradiation and such sources are concentrated in the most sensitive organs - the thyroid gland, arteries, and so on. It should be noted that radioactive substances can not penetrate the human skin, and they reach the inside of the human body through the absorbed food and beverages and particles of the inhaled air. The radionuclides that accumulate in the body accumulate in one or more bodies called "critical", the accumulation being predetermined by the physical and chemical properties of each radionuclide. The essence of treatment is the use of agents that accelerate the release of radionuclides from the body. There are specific treatments for each radionuclide [8]. Urgent action is needed against two groups of radionuclides (isotopes of iodine and strontium), since early treatment after their entry into the body is most effective.

Radiation is dangerous to humans because ionizing radiation causes the formation of a huge amount of free radicals that the body is unable to neutralize in a timely manner. Free radicals are chemically extremely aggressive, they attack cell membranes and vital molecules (nucleic acids, enzymes, etc.). As a result, both the function and structure of cell membranes and biomolecules are impaired. This initiates the atypical processes at the cellular and molecular level for the healthy organism, which subsequently manifest themselves as different diseases.

2.3. Radiation protection activities

Radiation protection activities can be divided into three stages:
- preparatory (prior to the terrorist attack, with radioactive contamination); The preparatory stage includes selection, testing and, if necessary, calibration of available dosimetry equipment; providing the necessary equipment and individual protective means; establishing a link between the team entering the radioactive contamination area and the relevant command center;

- operational (during radioactive contamination);

- final (measures to eliminate the consequences).

When issuing the hazard alert, the instructions given on the radio, television, special means of communication or in any other pre-established manner (sirens, bells, megaphones, etc.) are observed. It is working to change the legislation and to include in the announcement the mobile operators operating in the country, because through them the information will reach for maximum time to maximum number of users.

It is especially important for people to be pre-prepared by the media not to panic and to trust the reported official information.

The most effective protection is provided by pre-prepared hiding places. With hermetic closure and filtration facilities, hideouts are completely isolated from radioactive contamination. It is a problem at the given stage of development that in Bulgaria, unlike Russia, these hiding places are practically unusable for the most part.

The main precaution is to restrict the access of radioactive materials to the premises. Therefore, in the case of a shortage of hiding places, any massive (panel, brick) building and each dwelling can be used to protect the premises if the premises are sealed (before or after the danger signal). The least that can be done right away is to close the doors and windows, towels, scarves, better moistened. In the open, the body is protected with thicker clothing, hats, shoes, gloves, polyethylene cladding.

The underground premises (basements, garages) provide a higher level of protection than the building's floors. Where possible, use such premises or rooms on low floors without external access

It is important to control the dose of radiation exposure of the rescue workers by dosimetry [5].

The basic principle is that surgical emergency always takes precedence over radiological emergency.

Clothes contaminated with radioactive material are not discarded, shaken or brushed or washed, but folded gently with the lining outside and harvested in polyethylene bags. The envelopes are tied firmly and, where possible, subjected to dosimetric control that will decide the fate of the clothing. If the radioactive contamination is massive, the clothes should be destroyed by burying them deep in the ground. The burning of clothes is unacceptable because the fire and the smoke transmitted by the wind will disperse the radioactive material on a wide perimeter around.

Consumption of water and food after radioactive contamination

1. Water and beverages in closed containers are unavailable for radioactive contamination, so they can be used without restrictions. It is a good idea to keep the bottled mineral water safe for children.

2. The risk of using water from springs and wells is minimal. Water can be used for hygiene and drinking (if there is no bacteriological risk).

3.Water water from the urban water supply network can be used without limitation as long as the treatment facilities (chlorination) are working properly and the pipelines are not interrupted (in case of damage to the pipes the risk is bacteriological).

There is virtually no risk of internal contamination with radioactive materials: even if they fall on large open waters (dams), they are quickly settled on the bottom and kept from the mud.

4. Exclude rainwater tanks detected if rainfall coincides with radioactive contamination. Such water can not be used without dosimetric control.

5. The use of water for hygienic purposes (washing, bathing, cleaning with a wet cloth, etc.) is possible in all cases mentioned above in the section. 1, 2 and 3. Cleaning is by no means a vacuum cleaner; the radioactive material gathered there will turn it into a small dirty bomb.

6.Any "unprotected" food (from a container, a jar, a container, a suitable package) should be considered contaminated, whereas with dosimetric control it can not be proven otherwise, only in case of extreme necessity, such products as fresh fruit , vegetables, meat - provided that mandatory precautions are taken: thorough washing with water, scraping, peeling, cutting (ie all possible ways to remove the surface layer).

7. Milk, especially if given to children, should be used very cautiously and in reduced quantities. It is possible for the animals to be pastilles of grass polluted with radioactive material. Then the radionuclides pass and even concentrate in the milk. Under no circumstances should milk be purchased from private producers but only packaged in large milk-based compartments where, in the event of an accident, dosimetric control will be organized.

8. Decontaminating bulk products (flour, sugar, salt) are "left aside" until their radioactivity is reduced or used by mixing them with appropriate uncontaminated batches to reduce their specific radioactivity to acceptable levels & Quot; dilution effect & quot;).

9. In general, all canned products (in metal or glass packaging), as well as products stored in refrigerators or ordinary cabinets, are not contaminated. The only necessary precaution is to wash the wrapping or wiping with a damp cloth on the fridge before opening them.

10. Domestic animals and birds that have been outdoors in a contaminated area (after the radioactive material has settled) may be slaughtered and consumed. Additional measures are added to the usual procedures to avoid contamination of the meat (abundant washing). The skin and intestines must be disposed of (buried).

11. Eggs can be consumed without restrictions after washing with water and soap (the radioactivity accumulates in the shell) [3].

Where there is evidence of the use of radiological weapons and contamination in a particular territory with radioactive materials, the task of predetermined and specialized training groups (Civil Protection Teams, Medical Teams) is to identify the boundaries of the infected area with dosimetric equipment, entering and leaving the area, the number of those affected, who need medical assistance, the type of radionuclide used. Hospital evacuees struck by external contamination are subject to complete sanitation.

All teams working in the area contaminated with radioactive materials and the receiving departments of the respective hospitals targeted by the affected persons must have dosimetric equipment and a complete set of individual means of protection for each person of the staff.

Impacted by internal contamination (depending on the amount and type of radionuclide entering the organism), after complete sanitary treatment, are subjected to adequate treatment. The medical teams have ready-made Instructions for the Treatment of Damaged with External or Internal Pollution, where detailed approaches and treatment principles are described [2]. There are different approaches to different groups of radionuclides, different drugs are used and this is also reflected in the Instructions. There are also Instructions for the treatment of combined injuries (radiation in combination with chemical or biological weapons).

3. Conclusions:

1. Emergency training is necessary in view of the current international environment. After passing, learners acquire basic knowledge, skills and habits for action when an emergency occurs due to an incident, accident, terrorist act or otherwise.;

2. Specialized bodies at the Ministry of the Interior and Fire Protection and Population Protection Directorate in Bulgaria, the Ministry of Emergency Situations in Russia or the relevant structures in other countries should be prepared to take appropriate action in the event of an Emergency;

3. Greater attention should also be paid to international cooperation and joint action in the event of an emergency involving more than one country.

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