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Original article

MEDICAL EXAMINATIONS AND PSYCHOPHYSIOLOGICAL TESTS OF NUCLEAR INDUSTRY PERSONNEL AS A TOOL FOR PREVENTION OF RADIATION ACCIDENTS

A.Yu.Bushmanov[1], A.S.Kretov[1], M.Yu.Kalinina[1], I.V.Vlasova[1], A.A.Lomteva[1], A.A.Gugina[1], A.N.Tsarev[1], E.A.Denisova[1], M.A.Soloreva[1], A.S.Samoylov[1]

[1] State Research Center – Burnasyan Federal Medical Biophysical Center of Federal Medical Biological Agency, Moscow, Russian Federation

Abstract. It is noted that at present the connection between the level of health of the worker and his professional reliability is obvious and does not require additional proof. To prevent radiation accidents caused by the human factor, medical examinations and psychophysiological tests of the personnel of enterprises operating nuclear facilities are carried out.
Legislative and normative legal acts regulating the procedure and rules for these medical examinations and inspections are reviewed.
The authors present an algorithm for making decisions on the necessity of organizing various types of mandatory medical examinations and psychophysiological examinations of employees of organizations operating nuclear facilities. The experience of specialists of the Federal Medical Biophysical Center named after A.I. Burnazyan of Federal Medical and Biological Agency of Russia shows that up to 25% of the total number of employees who underwent psychophysiological examination have inadmissible deviations (psychophysiological contraindications). This is an indication for rehabilitation measures. After completion of the rehabilitation course repeated examinations are carried out, according to the results of which 92.3% of workers have positive dynamics and return to professional activity.

Key words: *legal framework, medical examinations of workers in the nuclear industry, psychophysiological examination, regulatory documents*

Conflict of interest. The authors declare no conflict of interest

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Оригинальная статья

МЕДИЦИНСКИЕ ОСМОТРЫ И ПСИХОФИЗИОЛОГИЧЕСКОЕ ОБСЛЕДОВАНИЕ ПЕРСОНАЛА АТОМНОЙ ПРОМЫШЛЕННОСТИ – ИНСТРУМЕНТ ПРЕДУПРЕЖДЕНИЯ РАДИАЦИОННЫХ АВАРИЙ

А.Ю.Бушманов[1], А.С.Кретов[1], М.Ю.Калинина[1], И.В.Власова[1], А.А.Ломтева[1], А.А.Гугина[1], А.Н.Царёв[1], Е.А.Денисова[1], М.А.Солорева[1], А.С.Самойлов[1]

[1] ФГБУ «ГНЦ – Федеральный медицинский биофизический центр им. А.И.Бурназяна» ФМБА России, Москва, Россия

Резюме. Отмечено, что в настоящее время связь между уровнем здоровья работника и его профессиональной надежностью – очевидна и не требует дополнительных доказательств. Для предупреждения радиационных аварий (РА) по вине человеческого фактора проводятся медицинские осмотры и психофизиологические обследования (ПФО) персонала предприятий, эксплуатирующих объекты использования атомной энергии.
Рассмотрены законодательные и нормативные правовые акты, регламентирующие порядок и правила проведения указанных медицинских осмотров и обследований.
Представлен разработанный авторами алгоритм принятия решений о необходимости организации различных видов обязательных медицинских осмотров и психофизиологических обследований сотрудников организаций, эксплуатирующих объекты использования атомной энергии. Опыт работы специалистов Федерального медицинского биофизического центра им. А.И.Бурназяна ФМБА России показывает, что из общего числа работников, прошедших ПФО, до 25% имеют недопустимые отклонения (психофизиологические противопоказания), что является показанием к проведению реабилитационных мероприятий. После завершения восстановительного курса проводятся повторные обследования, по результатам которых 92,3% работников имеют положительную динамику и возвращаются к профессиональной деятельности.

Ключевые слова: *законодательная база, медицинские осмотры, нормативные документы, персонал атомной промышленности, психофизиологическое обследование, радиационные аварии*

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Contact information:
Andrey Yu. Bushmanov – Dr. Sc. (Med.), Prof.; Deputy Director General
Address: 46, Zhivopisnaya str., Moscow, 123098, Russia
Phone: +7(964) 725-32-04
E-mail: radclin@yandex.ru

Контактная информация:
Бушманов Андрей Юрьевич – доктор медицинских наук, профессор; первый заместитель генерального директора
Адрес: Россия, 123098, г. Москва, ул. Живописная, д. 46.
Тел.: +7(964) 725-32-04
E-mail: radclin@yandex.ru

At present, the connection between the level of health of an employee and his or her professional reliability is obvious. Carrying out measures at nuclear facilities aimed at reducing risks of emergency situations caused by the human factor is an important element of radiation protection system [1].

To achieve the aforementioned goal, organizations operating nuclear facilities must organize additional specialized medical examinations and mandatory psychophysiological examinations for certain categories of employees.

Article 3 of the Federal Law "On the Use of Atomic Energy" of November 21, 1995 170-FZ specifies the categories of facilities which are subject to this requirement:

1. Nuclear facilities — facilities and complexes with nuclear reactors, including nuclear power plants, ships and other vessels; spacecraft and aircraft, other transport and transportable vehicles; facilities and complexes with industrial, experimental and research nuclear reactors, critical and subcritical nuclear facilities; facilities, complexes, test sites, installations and devices with nuclear charges for peaceful purposes; other facilities, complexes and installations containing nuclear material, used for production, usage, recycling and transportation of nuclear fuel and materials.

2. Radiation sources — non-nuclear facilities, apparatus, equipment and products that contain radioactive substances or generate ionizing radiation.

3. Storage facilities for nuclear materials and radioactive substances, radioactive waste storage facilities — stationary facilities and installations which are not related to nuclear facilities or radiation sources and are designed for storage of nuclear materials and radioactive substances, storage or disposal of radioactive waste.

4. Fuel assembly of a nuclear reactor — a machine-building item containing nuclear materials and designed to produce thermal energy in a nuclear reactor by means of a controlled nuclear reaction.

5. Irradiated nuclear reactor fuel assemblies — fuel assemblies containing spent nuclear fuel irradiated in and removed from a nuclear reactor.

6. Nuclear materials — materials containing or capable of reproducing fissile nuclear substances.

7. Radioactive substances — non-nuclear materials emitting ionizing radiation.

8. Radioactive waste — materials and substances, as well as equipment, products, which are not subject to further use, including spent sources of ionizing radiation, which content of radionuclides exceeds the levels established in accordance with the criteria approved by the Government of the Russian Federation.

Thus, nuclear energy facilities include not only traditional nuclear industry facilities, but also a fairly wide range of organizations, from medical treatment organizations that use equipment with ionizing radiation sources or equipment that generates ionizing radiation, to enterprises that use radioactive sources for defectoscopy, geological exploration, security, including in transportation, etc.

Certain categories of workers in the field of atomic energy use as defined by the Decree of the Government of the Russian Federation "On Approval of the List of Positions of Workers of Atomic Energy Use Facilities that Must Obtain Permits of the Federal Environmental, Industrial and Nuclear Supervision Service for Works in the Field of Atomic Energy Use" No. 240 of March 3, 1997 must obtain special Rostechnadzor permits, which can be issued only if there are no medical, including psychophysiological, contraindications — Art. 27 of the Federal Law "On the Use of Atomic Energy" of 21.11.1995 170-FZ.

The fact of absence of the above contraindications is established by the results of a specialized medical examination and psychophysiological examination of employees in the field of the use of atomic energy.

In accordance with the Order of the Ministry of Health of the Russian Federation No. 749n dated July 28, 2020 from January 1, 2021 the new requirements for specialized medical examinations and psychophysiological examinations of atomic energy use facilities, the list of medical contraindications for issuing the permit for certain activities in the field of atomic energy use and the list of positions of the atomic energy use facilities employees to which such contraindications apply, as well as the form of a medical report on the presence (absence) of medical contraindications for issuing a permit to perform certain types of activities in the field of the use of atomic energy.

This specialized medical examination is independent and complementary to other types of mandatory medical examinations of workers, including medical examinations in accordance with the order of the Ministry of Health of Russia from January 28, 2021 № 29n.

Employees of organizations on the list of operating especially radiation hazardous and nuclear-hazardous productions and facilities in the field of atomic energy use undergo medical examinations and mandatory psychophysiological examinations in medical treatment organizations subordinated to the authorized federal executive authority. Currently, this is the Federal Medical and Biological Agency of Russia — Federal Law No. 35-FZ dated March 8, 2011 "The Statute on Discipline of the Employees of the Organizations Operating Radiation-Industry and Nuclear Especially Hazardous Facilities and Facilities of Atomic Energy Use"; the Russian Government Executive Order No. 597 dated July 20, 2011 "On the List of Operating Organizations Subject to the Federal Law "The Statute on Discipline of Employees of Organizations Operating Radiation-Industry and Nuclear Especially Hazardous Facilities and Objects."

Specialized medical examinations and psychophysiological examinations of workers in the field of the use of atomic energy are carried out at occupational pathology centers. They are conducted when it is difficult to determine an employee's professional suitability due to a disease or when the employee does not agree with the results of the examinations.

When organizing mandatory medical examinations of employees in the field of the use of atomic energy it is necessary to take into account the mandatory medical examinations and psychiatric examinations of employees involved in certain types of work and in work with harmful and hazardous working conditions — Article 213 of the Labor Code of the Russian Federation.

Employees of the field of use of atomic energy are required to undergo psychiatric examination in cases of contact with an industrial factor or type of work, which are provided by the List approved by the Government of the Russian Federation on April 28, 1993 № 377; the Rules for mandatory psychiatric examinations established by the Government of the Russian Federation on September 23, 2002 № 695 and the order of the FMBA of Russia on June 9, 2018 № 121.

Employees of the field of atomic energy use shall undergo additional preliminary (periodic) medical examinations in cases of contact with an industrial factor (working conditions

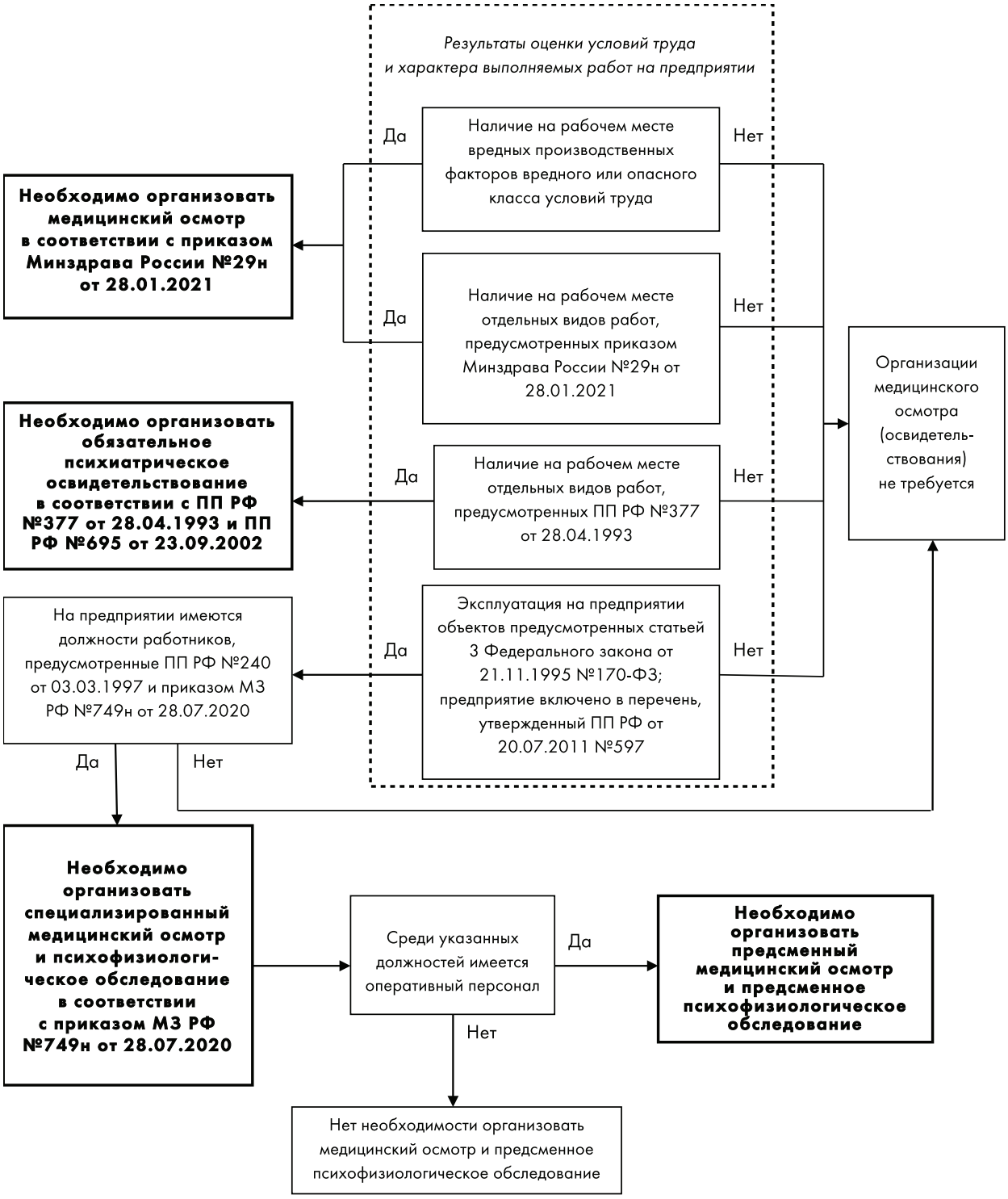

Рисунок. Алгоритм принятия решений о необходимости организации различных видов обязательных медицинских осмотров и психофизиологических обследований на предприятиях, эксплуатирующих объекты использования атомной энергии

Figure. Algorithm of decision-making on the necessity of organizing various types of mandatory medical examinations and psychophysiological examinations at enterprises operating nuclear energy facilities

class 3.1 or higher) or type of work stipulated by Order No. 29n of the Ministry of Health of Russia dated January 28, 2021.

It should be noted that according to the Order of the Ministry of Health of Russia № 29n dated January 28, 2021 all workers undergoing a periodic medical examination in respect of a harmful production factor "ionizing radiation" from April 1, 2021 are subject to compulsory psychophysiological examination.

The algorithm for making decisions on the necessity of organizing various types of mandatory medical examinations and psychophysiological examinations at enterprises operating nuclear facilities is shown in the figure.

Thus, when organizing medical examinations of employees in the field of the use of atomic energy it is necessary to take into account the following:

1. In order to be admitted to work in the field of the use of atomic energy, certain categories of employees must undergo a specialized medical examination and psychophysiological examination regardless of the results of the special assessment of working conditions in order to prevent emergency situations caused by the human factor.

2. Employees of the field of use of atomic energy are additionally subject to requirements of Article 213 of the Labor Code of the Russian Federation on passing mandatory psychiatric examinations in accordance with Resolutions of the Government of the Russian Federation No. 377 of April 28, 1993 and No. 695 of September 23, 2002, on condition of:

- presence at the workplace of a production factor from the List approved by Decree No. 377 of the Government of the Russian Federation on April 28, 1993;
- availability at the workplace of the type of work envisaged by the List approved by Russian Federation Government Decree No. 377 of April 28, 1993.

3. Employees of the field of the use of atomic energy shall be additionally required to undergo mandatory preliminary (periodic) medical examinations in accordance with Order of the Russian Ministry of Health no. 29n of January 28, 2021 (until April 1, 2021 — Order of the Russian Ministry of Health and Social Development no. 302n of April 12, 2011), provided

- presence at the workplace of a production factor stipulated by Order of the Russian Ministry of Health No. 29n of January 28, 2021, characterized by a harmful or hazardous class of working conditions (3.1 or higher);
- availability at the workplace of the type of work stipulated by Order of the Ministry of Health of Russia No. 29n of January 28, 2021.

4. According to Art. 46 of the Federal Law of November 21, 2011 № 323-FZ, during medical examinations the results of previous (not later than one year ago) medical examinations, health examinations, confirmed by medical records of the patient, may be taken into account.

In conclusion it should be noted that up to 500 examinations of nuclear industry employees working under conditions of exposure to ionizing radiation from 3.25 to 1.62 mSv per year are performed at the State Research Center — A. I. Burnazyan Federal Medical Biophysical Center of the Federal Medical and Biological Agency of Russia. Professional duties of the examined employees include the need to make and implement responsible decisions.

Experience shows that out of the total number of workers who underwent psychophysiological examination, 25.1% have unacceptable deviations (psychophysiological contraindications), which is an indication for rehabilitation measures. After completion of the rehabilitation course repeated examinations are carried out, according to the results of which 92.3% of workers have positive dynamics and return to professional activity.

Mandatory medical examinations and psychophysiological examination of nuclear industry personnel are effective elements of the radiation protection system. They make it possible to influence the risks of radiation accidents caused by the human factor and to take timely targeted rehabilitation measures.

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