

RADIATION SAFETY STRESSED AT POWERSTATIONS

Атомная энергия - источник  
универсальной энергии

Moscow TRUD 19 Dec 68 p 4 L

[Answer by Academician A.P. Aleksandrov, director of the Kurchatov Institute of Atomic Energy, to a question from reader V. Koroteyev: "I live in Moscow, not far from the Kurchatov Institute of Atomic Energy. They say that there is increased radioactivity here. It may be that I am frequently ill because, you know, radiation weakens the body. Tell me, does radiation threaten us?"]

[Text] The construction of atomic powerstations is expanding. In this connection, particular interest is focused on the question of radiation safety for those who work at these stations and also for those living in the vicinity. Uninformed people are sometimes inclined to believe narrow-minded chatter about the alleged existence of radiation dangers. Matters sometimes even reach the point of anecdotes: At the beginning of construction on the Lenin nuclear icebreaker, when the reactors were still uncharged, two workers stated that they had been exposed to radiation. The rumor that it is dangerous to live near the Atomic Power Institute because of the supposedly high radioactivity is that same kind of anecdote. It is, of course, complete nonsense. The whole vicinity is under careful control. Samples are constantly taken of the soil, plants, air, and water. The most thorough observations are made of ventilation pipes and drains. Many years of control show that sanitary conditions here are perfectly good and that there is no radiation danger whatsoever. Many institute workers, including myself and my children and grandchildren, live very close to the institute.

Because of the great interest in the problem of radiation safety, I think it appropriate to talk about it in TRUD.

In fact, in the atomic reactor of every atomic powerstation a vast number of radioactive substances, so-called "fission fragments," are formed as a result of the fission of uranium and plutonium in a chain reaction process. These radioactive fission fragments are formed inside so-called "fuel elements." The fuel elements are hermetic tubes containing a uranium fuel composition and, of course, radioactive fission fragments. These tubes are very stable and retain their hermetic nature during their whole working life that is, the entire fission radiation is sealed inside them.

However, it is not impossible for a very small number of fuel element tubes to lose their hermetic nature. In that case the fission fragments contained in them are partially released from the fuel element and radioactively contaminate their cooling water, which circulates in the reactor and the steam generators in the closed primary circuit.

The water in the primary circuit is always radioactive because it contains a small quantity of substances which become radioactive when they pass through the core of the reactor. It is, therefore, carefully hermetically sealed. Special equipment is used to control the entry of radioactive fission fragments into it and also its own radioactivity. The water's purity is maintained by a water purification system. Within the limits allowed by sanitary norms, the hermeticity of each fuel element is carefully checked at regular intervals and elements with damaged casings are removed from the reactor and stored.

The steam which drives the powerstation's turbines is formed in the secondary circuit, which is separated from the water in the primary circuit by reliable and thick heat-exchange apparatus--steam generators. The water in the secondary circuit is not radioactive, but it is also continuously controlled.

... a ... - ...

... cause of some kind of breakdown, the water in the primary circuit enters secondary circuit, and there appear in the latter traces of radioactivity-- approximately the same kind that is to be found in the Narzan mineral water which we drink without any danger--then the corresponding section of the secondary circuit is switched off. Thus, the radioactivity in the water in the primary circuit and the fuel elements is safely contained. At the station the entire reactor and primary circuit are inside a very thick (several meters) biological shield. This is made with such a margin that even in the greatest conceivable emergency radioactivity is not released.

At atomic powerstations however, in addition to radioactivity in the water, a small quantity of radioactive substances can also be found in the air. Argon gas, for example, of which there is about 1 percent in the air, becomes activated when it passes near the reactor in the neutron zone. This radioactive argon decomposes rapidly--in 2 hours its radioactivity is halved. A small quantity of this radioactive argon is disposed of through the ventilation system after necessary "cooling." High ventilation pipes near powerstations discharge small quantities of argon and sometimes, when there are disturbances, they discharge a small amount of inert radioactive gases. The height of the pipes and the cooling time for the gases which are ventilated are chosen in such a way that, assuming the worst possible breakdown, the concentration of radioactive gases and aerosols in the surface soil does not exceed the permitted sanitary norms. These continuously controlled observations carried out over many years have demonstrated that the concentration of radioactive gases and aerosols does not exceed the norm.

Thus, atomic powerstations, even in the case of very rare disruptions of their normal work (and even more so under conditions of normal work) are completely safe for people in the vicinity.

At the beginning of the development of nuclear physics and atomic technology, when very little was known about the harmful effects of radiation, there were indeed many unfortunate accidents. Marie Curie, who discovered radium, died as a result of a disease caused by irradiation. A case of mass sickness at a foreign factory is well known. There, girls applied radioactive luminous paints to clock faces with brushes and moistened the brushes with their tongues. Mass malignant tumors appeared in their oral cavities. From 1946 through 1948 some of our employees got radiation cataracts of the eyes. Now, however, medicine has analyzed in detail the harmfulness of radioactive emission, technical means of protection from radiation have been worked out, and a system of warning signals has been set up. All this insures total safety in operating atomic power stations.

It is necessary to remember that everyone is exposed to the effects of radiation throughout his life. This includes the effect of cosmic rays and the radiation of radioactive substances which are found in the earth's composition and in rock species and construction materials. There is also the radiation of radioactive potassium, which is part of the salt composition of our body and our food.

The effect of radioactive substances--fission fragments that have appeared in the atmosphere and the soil because of nuclear weapon testing--has been added to these natural factors over the past 20 years.

5

Earlier, radioactivity in the human body was determined mainly by the radioactivity of the potassium in it. But now it has more than doubled in everybody because of the radioactive Cesium-137, obtained because of nuclear testing, which enters the human body mainly through food. Atomic powerstations add practically nothing to these factors already affecting the whole population.

Measurements of radioactivity carried out over a long period in the region of the Novovoronezh atomic powerstation have shown that over the course of time, as in other regions of the world, radioactivity in the soil is diminishing. This is linked to the partial prohibition of nuclear weapon testing, adopted at the suggestion of the Soviet Union. Radioactive substances are the results of an explosion which determine the radioactivity of the soil and which gradually decompose and become nonradioactive. The Novovoronezh atomic powerstation itself does not add to the soil's radioactivity.

In addition, conventional powerstations, where coal and especially shale serve as fuel, give off a larger quantity of radioactive substances in the form of ashes than do atomic stations, not to mention the enormous discharge of carbon dioxide, sulfur compounds, and so forth. Therefore the broad development of atomic powerstations and replacement of thermal powerstations with atomic powerstations, as is now done throughout the world, leads to an improvement in the population's living conditions.

This is the situation regarding safety from radioactivity for the population. And what is the situation for workers of atomic powerstations? Strict safety regulations for radiation exist at all atomic powerstations.

When these regulations are observed and backed up by instruments in all premises and individual dosimeters carried by all workers, then irradiation received by personnel is within harmless limits. The limited dosage of irradiation permitted by our and international norms is five rems per year (a rem is a unit measuring the dosage of irradiation equal to the action of one roentgen on the organism). Suffice to say that each of us receives such a dosage of irradiation (and often double or treble this), only not in the course of a year, but immediately, when our stomachs or chests are X-rayed. Usually we all undergo this at least once a year by a doctor's direction and do not receive any special nourishment nor supplementary leave as is established for workers of atomic powerstations.

But people might reply to me: But surely there have even been instances of fatal irradiation? Yes, in all branches of industry and in life in general. Unfortunately, we cannot avoid mishaps. The violation of instructions or an accident both in atomic technology and anywhere else can lead to a mishap. However, I must say with satisfaction that the technical means, system of warning signals, and strict control by the USSR Ministry of Health have produced good results in the atomic industry. Accidents are extraordinarily rare in our field.

Thus, the development of atomic power engineering in our country only benefits our people and will facilitate their increased prosperity. Our technology insures the security of the population and is harmless for those working in the atomic industry.