C. SPECIAL SUPPLEMENT

THE ENVIRONMENT

REPORT ON RADIOACTIVE CONTAMINATION IN CHERNOBYL AREA

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Text of article by Yu. Israel, Chairman of the USSR State Committee on Hydrometeorology and Environmental Control, "The past and the prognosis for the future"

Almost three years have now passed since the accident at the Chernobyl nuclear power station. However, radioactive contamination of the natural environment over a sizeable territory remains a technical and social problem. Unfortunately, the stress in this territory will persist for a long time to come. This is why proposals on the life and economic operations of many thousands of people in the contaminated area need to be formulated.

It is known that immediately after the Chernobyl accident massive measurements of contamination of the atmosphere and terrain were initiated on an emergency basis, and subsequently so were comprehensive studies of radioactivity of all ecosystems, including plants.

The most up-to-date readings of the radiation situation were taken by chemical defence troops on the grounds of the Chernobyl AES and the immediately adjacent area by ground-based means. The USSR Goskomgidromet [State Committee for Hydrometerology] conducted operations in a large area (at hundreds of weather stations and through airborne means) over practically the entire territory of the country, which made it possible to measure a considerable number of additional "radioactive hot spots" along with the main contaminated zone.

The first complete map of the immediate trail (up to 100 km from the site of the accident) was submitted to the government commission by the Goskomgidromet as early as 2nd May 1986, as soon as it became possible to separate with adequate clarity the effect of the plume from ground contamination (radioactivity in the atmosphere due to the continuing emission of radioactive gases). Previously, beginning on 26th April, data on the radiation field at the altitude of plane and helicopter flights (200 to 3,000 m) and scattered ground measurement data were submitted.

From the very first days (approximately seven to 10 days), the direction of the wind changed by 360 degrees, actually describing a full circle. This caused a very wide scattering of radioactivity. In places where rains fell at the time sizeable "hot spots" of radioactive contamination emerged.

At the time of the accident, an instantaneous discharge of radioactive fallout occured, which spread in a westerly direction, accounting for a narrow rectangular area of increased radioactive contamination of terrain on the territory of the Ukrainian SSR. Subsequently, on 26th and 27th April, the migration of radioactive matter from the reactor zone proceeded in the form of a plume in a north-westerly direction over the territory of the Belorussian SSR, the direction changing to north-east by 28th-29th April, and by the end of 29th April (in part, in the beginning of 29th April) and 30th April to the south-east and south.

The most powerful discharge of radioactive products from the unit affected by the accident was noted in the first two to three days after the accident in the north-western and north-eastern directions. The height of the plume on 27th April, according to data from aircraft, exceeded 1,200 m.

The formation of the bulk of the radioactive fall-out in the closest zone ended in the first four to five days. However, the complete formation of the radioactive "plume" and "hot spots" continued over the entire month of May.

The surveys of gamma radiation undertaken were the main basis for urgent decisions to be made by the commission of the Politburo of the CPSU Central Committee and the government.

In several days, a mass sampling of soil from the contaminated territory began with their subsequent analysis in various laboratories (gamma-spectrometry and radiation chemistry) which made it possible to produce maps of isotope contamination of terrain. Agencies of the USSR State Committee for Hydrometeorology, the USSR Ministry of Public Health, the USSR Academy of Sciences, the Ukrainian SSR Academy of Sciences, the Belorussian SSR Academy of Sciences, the USSR Ministry of Defence, the USSR State Committee for the Utilisation of Atomic Energy, the USSR Ministry of the Nuclear Power Industry and the USSR State Agro-Industrial Committee took part in this gigantic work. The Geochemistry and Analytical Chemistry Institute of the USSR Academy of Sciences and the Aerogeologiya scientific production association of the USSR Ministry of Geology joined in taking aerial surveys of gamma radiation.

By now, the total number of samples measured has exceeded one hundred thousuand (as it is, every sample amounts to many hours of work!).

The data obtained made it possible to solve important operational and scientific problems, and were the foundation for the main decisions on evacuating the poopulation, establishing the procedures for residence and economic operations in the contaminated area, as well as for undertaking protective and decontamination measures.

Because of the high levels of contamination and continuous wind shifts which were carrying the radiation away from the damaged reactor, the decision was made to evacuate the population from the 30 km, zone around the station.

A generalised (based on many surveys) map of the dose rate of gamma-radiation adjusted to 10th May 1986 (air-equivalent roentgen meters were used to measure the capacity of doses of gamma-radiation) was the basis for making many decisions. It was the one on the base on which the isoline for evacuating the populace was ultimately determined (over 5 miliroentgens an hour), the reserved zone (20 millioroentgens an hour), and control zone (3 to 5 milliroentgens an hour) with the temporary evacuation of a part of the population (pregnant women and children).

The fall-out was recorded in many regions of the western part of the European territory of the USSR. At the USSR Goskomgidromet stations, the precipitation or contamination of the air by iodine-131 was registered until 2nd May 1986 in the Ukraine – in Kiev, Vinnitsa, Ivano-Frankovsk, Rovno; in Belorussia – in Minsk, Brest, Mogilev; in the Baltic area – in Klaipeda, Riga and many other towns. In most cases, such contamination was short-term in nature. It was associated with the contamination of migrating air masses (and did not pose a danger to the population).

Let me point out that iodine-131 with a half-life of eight days was dangerous for the thyroid gland) in the nearby zone, especially if milk was consumed. This required there to be particularly strict control of its presence in milk.

Appreciable radioactive fall-out with rains reached foreign countries – Austria, the FRG, Italy, Norway, Sweden, Poland, Romania and Finland. The highest contamination there amounted to about 1 curie a square kilometre for caesium-137.

As was already noted, surveys of the radiological situation in the European territory of the USSR showed contamination zones (apart from the main zone, where radiation levels were relatively high): to the north-east of the main zone (at the junction of Mogilev, Gomel and Bryansk Oblasts), to the south of the town of Orel, to the south of the town of Tula (Plavsk); to the west of the main zone (in the area of Pinsk, in the area of Rovno); to the south and south-west of the main zone (in the area of Belaya Tserkov and Kanev, in the area of Ivano-Frankovsk, and subsequently in the area of the southern shore of the Gulf of Finland, on the Kola Peninsula and in the Caucasus) [brackets as published]. The entire contaminated area within the 0.2 milliroentgen an hour isometric line in the initial days amounted to about 200,000 sq km.

In June 1986, isotope analysis of soil samples from remote areas was initiated on a mass scale. As early as 14th-15th June, it was established that the composition of radioactive contamination in these areas is quite perceptibly enriched with the long-lived isotopes caesium-137 and caesium-134. The content of these radionuclides came up to 50% of the overall content of radionuclides in the samples.

Let me point out that temporary norms for the density of soil contamination were established as early as May 1986: for caesium-137, 7 (subsequently 15); for strontium-90, 3.0; for plutonium-239 and plutonium-240, 0.1 curies a sq.km.

Specialists of the USSR Ministry of Public Health measured the doses received by every person with individual dosimeters (SICh) which determined the quantity of caesium-137, the recently most widespread radionuclide, accumulated in the human organism.

Effective equivalent doses of external and internal radiation exposure of people for the first year and subsequent years were estimated in hundreds of settlements. A diligent study of the isotope composition and gamma fields made it possible to do this with an adequate degree of precision.

Individual doses of radiation (internal and external) accumulated by the autumn of 1988 by a majority of the population amounted on the average to 5.3 REM [roentgen equivalent man]. No incidence of radiation sickness in any form has been found among the population.

As a result of the large-scale deactivisation work and agricultural amelioration work and the application to contaminated soil of special substances that bind caesium (or retard its movement through food chains), the radiation situation has begun to stabilise. Gradually, the basic components of contamination that are left are the long-living radionuclides caesium-137 and strontium-90 (with a half-life of about 30 years), and, in the reserved zone, plutonium with an extremely long half-life.

There arose a need to develop recommendations for extended work and life activity in areas under strict control on the territory polluted with caesium-137, since this is the radionuclide that presented the main danger outside the evacuated zone (along with caesium-134). It was no longer a case of short-term recommendations used to solve problems of immediate evacuations of population, but of a lifetime dose which is accumulated very slowly, almost uniformly throughout one's entire life in safe small amounts.

In connection with this the USSR Ministry of Public Health adopted a resolution to establish the limit of the lifetime dose of radiation for population of the disaster regions at 35 REM.

It must be emphasised that at the same time there is a certain leeway in the calculations because the calculations were done for a person born (or moved to this territory during childhood) between 1986 and 1989 who lives within the points during all of a lifetime of 70-75 years.

This norm automatically stipulates (with a particular composition and quantity of contamination of the area and ameliorative measures) a certain dose of radiation (internal and external) for each year of life and a particular concentration of food products in the basic ration.

For example, a density of contamination with caesium-137 of up to 15 curies a sq.km. almost everywhere provides for the given norm in the internal and external dose, but a concentration of caesium-137 in milk which is now established as the normative (0.0001 curies/litre) retains a significant reserve in the dose permitted by this norm (perhaps this is very good?!), but, on the other hand, this is what explains why in the majority of cases there is a divergence – frequently milk is "worse" than the norm in zones where the contamination is less than 15 curies a sq.km. for caesium-137.

Apparently it is necessary to retain 15 curies a sq.km. as the safe normative for contamination of the surface with caesium-137 (if a norm of 35 roentgens during a lifetime is used as a basis), and if there are active deactivation measures and intensive agro-ameliorative measures (that reduce the internal dose from food products by a factor of up to 4), a dose of 35 roentgens can be provided on contaminated territories with up to 40 curies a sq.km. of caesium-137 (this depends on the soil as well). Here it is necessary to have strict geophysical and medical monitoring and, if necessary, the importation of clear products, and with contamination of more than 40 curies a sq.km. (this is observed at individual points), in addition to strict measures, here one cannot rule out the possibility of resettling the people from remote points where the levels of radiation are particularly high. For example, in Belorussia there are 20 of these villages where about 3,000 people live. Here there must be mandatory, constant provision of the population with clean (shipped in) food products – especially milk and meat; only then will the doses in these areas not exceed 35 roentgens.

Up to this point we have taken the path of trying to provide this population (on territories with contamination higher than 15 curies a sq.km.) with clean food and additional pay. This is the path that was selected on the territory of Mogilev, Gomel and Brest Oblasts (and others) and has produced positive results – people who observe the listed requirements (and they were the majority) did not receive doses in excess of the permitted levels. According to data of the newspaper 'Sovetskaya Belorussiya', only 48 people (less than 0.1% of the residents) received higher doses.

During the disaster at the Chernobyl AES there arose conditions whereby the radioactive products could also enter bodies of water, both by landing directly on the surface of the water and as a result of water flowing in from the contaminated area as well as from migration with underground water.

During the first weeks and months after the disaster it was most crucial to clarify the degree of contamination of the Pripyat river and the Kiev reservoir – Kiev's water source.

During the time of radioactive particle fallout a short-term increase was observed of established norms of water contamination in the Pripyat river. During the first two months after the disaster the total beta activity of the water in the Kiev water reservoir was 1-6 x 10 to the power of minus 9 curies/litre and was within the limits of the permitted norms (10 to the power of minus 3 curies/litre).

Incidentally, four aircraft of the USSR Goskomgidromet working on the cloud layer contributed to the rain that fell over a large area, but up until the middle of July it had not reached the radioactive trail.

Throughout the entire cascade of Dnepr water reservoirs the content of radioactive substances regularly dropped as the water proceeded downstream; in the Kremenchug reservoir the concentration of strontium-90 was about 5 x 10 to the power of minus 12 curies/litre (May 1986), which is considerably below the norm (by a factor of practically 100).

The estimate of the contamination of the bottom deposits in the Dnepr water reservoirs was done in the middle of May 1986 and showed that the most contaminated bottom samples were in the Kiev reservoir in the section adjacent to the mouth of the Pripyat river. In the southern part of the Kiev reservoir and also in the Kanevskoye water reservoir this contamination decreases by factors of tens and hundreds.

Radioactive contamination of the rivers on the territory of the RSFSR and Belorussia is constantly monitored, especially in those rivers whose water catchment areas have "pockets" of contamination with Caesium-137. During the first spring high water period (7th-12th April 1987) there were maximum levels of contamination of the water in terms of total beta activity, which amounted to 1-1.5 x 10 to the power of minus 10 curies/litre (the Iput and Besed rivers).

The contamination of fish, especially pike, was extremely low.

In order to prevent radioactive contamination of the Pripyat river we constructed:

solid dams and a wall in the ground that cuts off the flow of radioactivity from the nearby zone of Chernobyl AES (with the industrial site and the zone adjacent to it);

solid and filtering dams (131 structures) on small rivers to retain the radionuclides.

Additionally, after the disaster of Chernobyl AES the USSR Ministry of Land Reclamation and Water Resources drilled around the AES, at a distance of several hundred metres, dozens of wells for monitoring and protection (at the depth of the water table). Observations of the concentration of strontium-90 in the water of these wells for two years after the disaster confirmed that their concentrations did not exceed the background amounts. If necessary the water from these wells can be pumped into a cooling pond.

A check on the work of the protective structures showed the adequate effectiveness of the structures, especially those that separate the immediate zone of the Chernobyl AES, which stopped practically all of the flow of radionuclides from this territory.

According to prognoses prepared by specialists of the USSR Goskomgidromet (the first such prognosis was published as early as May 1986), no increase in the radioactivity in the rivers and water reservoirs in excess of the established norms is expected, which was confirmed by subsequent measurements.

The most important result of the prognostic calculations for the spring high-water period of 1987 was the fact that not one of the rivers of the zone was expected to exceed the permissible concentrations. The results of the measurements not only confirmed the basic conclusion of the prognosis, but also showed that the real movement of radionuclides into the Kiev reservoir was less than expected. During the spring high-water period of 1988 and the very early high-water period of 1989 the concentration of radioactivity was even lower.

Even lower concentrations of radionuclides were observed int he water of the Black Sea (in the zone where the Dnepr flows in), and in the future they will decrease even more.

Concern has been expressed about the migration of radionuclides in the soil. The horizontal migration turned out to be insignificant if one is to keep in mind the zones used as standards for contamination – the isolines remained practically unchanged as a result of the migration.

In general the coefficients for the wind-borne ascent of radioactivity was insignificant and therefore the concentrations of the various isotopes (including plutonium) in the air in the reserved zone was below permissible levels virtually everywhere even at wind velocities up to 10 metres a second.

Studies of contaminated territory, soils, the rivers flowing through this zone, and the plant cover continue.

The results of airborne and ground studies conducted in 1988 over an area of about 350,000 sq km mainly confirmed and augmented data obtained earlier.

No significant changes were found in the position of the isolines for density of local caesium-137 at 15 and 40 curies a sq.km. kilometre, strontium-90 at 3 curies a sq.km. and plutonium-239 and -240 at 1 curie a sq.km.

When constructuring the isolines for density of contamination of territory with a caesium-137, use was made of the results of analysis of soil samples taken from more than 3,600 populated points, data from airborne gamma-spectrometric reconnnaisance, and results from studies of radioactive contamination of forest and agricultural arable land.

The total area of zones contaminated with caesium-137 at 15 curies a sq.km. or more is about 10,000 sq.km. (2,000 sq.km in the RSFSR, 1,500 sq.km. in the Ukrainian SSR, including 500 sq.km. in the evacuated zone, and 7,000 sq.km. in the Belorussian SSR, including 3,000 sq.km. in the evacuated zone) (see map). A total of about 640 populated points with a population of more than 230,000 are located in this zone (outside the evacuated zone).

On the above territories contaminated with caesium-137 as a result of the accident, radiation levels are still elevated (however, they are still significantly below permissible levels). Thus, is Zlynka and Nikolayevka (in Bryansk Oblast), gamma radiation is 0.15 and 0.35 milliroentgens an hour respectively; in Vysokaya Borka and Selishche (Mogilev Oblast) 0.25 milliroentgens an hour, in Malyye Kleshchi and Malyye Minky (Zhitomir Oblast) 0.2 to 0.25 milliroentgens an hour, in the evacuated town of Chernobyl, (Kiev Oblast) 0.04 to 0.17 milliroentgens an hour, and in Pripyat town the radiation level is 0.1 to 1.6 milliroentgens an hour.

On the territory of Slavutich, built for the power workers at the Chernobyl AES, the radiation level is close to the background level at 0.015 to 0.03 milliroentgens an hour. In the forest adjacent to the town on the west and east there are "hot spots" of somewhat higher contamination (but with levels still below permissible levels) in which radiation levels stand at 0.18 to 0.20 milliroentgens an hour. This is not an obstacle to staying in the town or walking in the suburbs. Here it should be borne in mind that in the "hot spot" to the east decontamination has been carried out and the forest felled, while the "hot spot" to the west is fenced off.

Elevated levels of contamination (3 curies a sq km for strontium-90 and 0.1 curies a sq. km. for plutonium-239 and -240) are not found everywhere and these radionuclides are localised within the evacuated zone (a 30-km zone and certain sections locally, adjacent to it). During the first year a total of 186 populated points in the evacuated zone were evacuated (116,000 people), including 75 (90,000 people) on the territory of the Ukrainian SSR, 107 (25,000 people) in the Belorussian SSR, and four (1,000) people) in the RSFSR. At this time the populations of 14 populated points have been re-evacuated (122 in the Belorussian SSR and two in the Ukrainian SSR). From the radiation situation in the southern part of the 30-km zone there are still more than 10 villages where a safe return of the population may be possible (the villages of Kupovatoye), Gorodishche, Bychki, Glinka, Dibrovo, Zamoshnya and others).

Results of work conducted during 1988 have made it possible additionally to define the contours of "caesium hot spots" with a level of contamination of 5 to 15 curies a sq km., and also less contaminated "hot spots". The total area of territory contamined with caesium-137 at 5 to 15 curies a sq km. is about 21,000 sq.km. Work to monitor raidoactivity and agricultural measures will continue during 1989. More than 10,000 people will be involved in decontamination work.

In order to understand further the general physical picture in the formation of trace radioactivity and clarify the dynamics of change in the parameters of the source of emission of radionuclides carried beyond the territory of the USSR, and also in order to resolve tasks connected with the IAEA convention on early notification of nuclear accidents (ratified by the USSR), at the Institute of Applied Geophysics and the Tayfun scientific production association of the USSR State Committee for Hydrometeorology and Environmental Control mathematical models have been developed for migration and fall-out of radionuclides following ejection into the atmosphere during the accidents at nuclear power stations. The models are medium-scale and regional, and models for migration across borders cover spatial scales of tens to several thousand kilometres.

I note again and again that radioactive contamination will always be a cause for concern, but if the norms and instructions of the USSR Ministry of Public Health and the State Agro-Industrial Committee are observed it presents no danger to the health of the population.

Thus, given the significant scales of contamination locally as the result of the accident at the Chernobyl AES, energetic and expensive measures were necessary for the clean-up.

In the region of ceasium-137 contamination where a population lives, that is, beyond the evacuated regions (with a contamination level of more than 15 curies a sq km, in the zone of so-called "strict control", prolonged work is required to decontaminate the area and carry out agricultural land improvement work aimed at reducing doses (external and internal) down to established limits. Inadequacy in this work should be compensated for by substitution with pure products (particularly the import of milk). In this event life and farming is possible in these zones within the limits of permissible radiation limits as established by the USSR Ministry of Public Health. Of course, the accident at Chernobyl AES has raised many different problems, not only scientific and technical but also psychological.

It is quite understandable that attitudes towards the development of nuclear power engineering have noticeably cooled in some parts of the country. Under the influence of the scientific community, the Armenian AES, located in a zone of high seismicity, has been closed down, the question of halting construction at the Crimean AES is being discussed, and it has been decided not to permit a restart on work on construction of the third unity at Chernobyl AES.

The CPSU Central Committee and Soviet government have also repeatedly examined with great care questions concerning the fastest possible clean-up at the Chernobyl AES (this matter is under constant attention), and questions of raising safety levels significantly at nuclear power stations (both by the adoption of technical measures and by improving personnel training). A very great deal has been done here and Soviet power engineers reported on this to M.S. Gorbachev during his visit to the Chernobyl AES in February this year.

For it is common knowledge that given correct operation, nuclear power engineering is the cleanest source of energy: the volume of air needed to dilute the small amounts of emissions from a nuclear power station (mainly inert gases) in the atmosphere down to permissible concentrations is thousands of times smaller than the volume of air needed during the operation of conventional thermal power stations (calculated for every unit of energy generated).

It is also of great importance that during the operation of nuclear power stations there is no emission of gases that lead to global climate changes. In 1988 the scientific community throughout the world confirmed this at world conferences in Toronto (Canada) and Hamburg (the FRG) and raised the question of the need to reduce consumption of fossil fuels (coal, oil, gas) in order to reduce the "greenhouse" effect and prevent the exceptionally adverse consequences of changes in the global climate. This means that nuclear and hydroelectric power will become the main energy sources.

In many countries nuclear power engineering is already producing more than half of electrical power (in France the figure is about 75%, in Belgium about 65%), while here the figure is only 12%.

The lessons of Chernobyl have forced a significant (many times over) improvement in operational safety at nuclear power stations (and at new stations it is several orders of magnitude better), and taking into account the global ecological situation, nuclear power engineering must be regarded as the most promising.

PROVISION OF INFORMATION ON CHERNOBYL TO THE PUBLIC

Editorial report

On 1st February 'Radyanska Ukraina' published an interview with Kachura, member of the Politburo and Secretary of the CP of Ukraine Central Committee, following an examination in the republican Politburo of progress in eliminating the effects of the accident at Chernobyl AES in 1986. The Politburo session, he said, drew two main conclusions regarding the present situation: first, that since the accident people's confidence in doctors had been "noticeably shaken". Buryenkov, USSR Minister of Health, "took an inconsistent and indistinct position" and some Ukrainian health officials "also lacked initiative and sometimes went astray in their work". After examining nearly 450,000 people, the doctors had found the level of sickness in Kiev City, Kiev Oblast and Zhitomir Oblast no different from that elsewhere. As for the safety of the AES, a spontaneous chain reaction in the damaged reactor was "out of the question"; rumours in Kiev and elsewhere of "new accidents" were "absolutely groundless". As for future power generation, Kachura said "extreme" views that nuclear power was virtually the main way ahead, or that there should be no nuclear power stations at all, were both incorrect. It had already been decided not to construct a second Chernobyl AES, sets Nos 5 and 6 at Cherkassy AES, or the Kharkov and Odessa nuclear heat and power stations, and the Ukrainian government has spoken at all-union level of the inexpedience of continuing to build the Crimean and Chigirin AESs.

On 2nd February, Minsk radio reported (in Belorussian 1730 gmt), representatives of the public met the commission of the Buro of the CP of Belorussia Central Committee and the Belorussian SSR Council of Ministers charged with eliminating the consequences of the Chernobyl accident. Yevtukh, Deputy Chairman of the Council of Ministers and chairman of the commission, said that most of the problems had been solved, with R 1.15bn allocated so far. In response to people's doubts as to the prudence of developing agriculture in the polluted zone, the Chairman of Belorussia's State Agro-Industrial Committee said that caesium levels were on the wane and that stringent controls had been introduced; however, the radio said, questions on the existence of other nuclides and the continuing spread of radionuclides were "not answered". There was also argument on the acceptability of international norms on safe levels of radiation; the Deputy Health Minister confirmed that there existed a genetic risk concerning radiation but this would not manifest itself until the third or fourth generation. One participant told the meeting of his satisfaction that glasnost was making itself felt in this field, while noting that "we are still unable to obtain exact answers to many questions".

Moscow home service reported on 9th February that Belorussia's press had published maps of the radiation situation in the republic for the first time, showing the exclusion and evacuation zones as well as the areas where monitoring was continuing periodically or permanently – the latter were populated by over 300,000 people. The radio said Yevtukh had told Tass that thanks to safety measures, not a single case of illness had been caused by radiation in the republic. The total radiation dose of people in the monitored zone from 1986 to 1988 was 9 BER (biological equivalent of roentgen), with a level of 3.3 BER in other areas; the IAEA-permitted level was 15 BER.

Interviewed in the 11th February 'Pravda', M.V. Kovalev, Chairman of the Belorussian SSR Council of Ministers, described accusations – e.g. from readers – that the republic's government departments were indifferent to people's collective irradiation as "the fruit of an unbridled imagination", and gave statistics for evacuation and agricultural amelioration measures. Screening had shown that no evacuee had received increased radiation doses in excess of permissible norms, and the overall sickness rates in Gomel and Mogilev Oblasts had not changed in 1988. All authentic data on the radiation situation were without exception passed on to the government commission and thence to the IAEA. "These data have always been reported, without any cuts or exceptions, also to the inhabitants of the population centres which they concerned," he said. Because of rumours and "idle chatter", however, "we have now arrived at the firm conviction that we must more widely inform the republic's entire population and not just the inhabitants of the rayons which suffered". Asked about the recent extension of permanently monitored zones, Kovalev said the latest surveys revealed that "the republic's territory is contaminated with radioactive fall-out on a greater scale than was originally assumed. Almost one-fifth of agricultural land has been contaminated to varying degrees". The population of the permanently monitored zones were receiving an allowance of R 30 a month each and a 25% wage supplement to facilitate the acquisition of pure foods. Kovalev denied rumours that Belorussia had ever refused centralised assistance in eliminating the consequences of the