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INFORMATION ON ECONOMIC AND SOCIAL CONSEQUENCES OF THE CHERNOBYL ACCIDENT

The attached "Information on economic and social consequences of the Chernobyl accident", which was presented to the July 1990 session of the Economic and Social Council of the United Nations, is being circulated at the request of the Resident Representatives of the Union of Soviet Socialist Republics, the Byelorussian Soviet Socialist Republic and the Ukrainian Soviet Socialist Republic.

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INFORMATION

ON THE ECONOMIC AND SOCIAL CONSEQUENCES OF THE ACCIDENT AT THE CHERNOBYL NUCLEAR POWER PLANT, SUBMITTED BY THE DELEGATIONS OF THE UNION OF SOVIET SOCIALIST REPUBLICS, THE BYELORUSSIAN SOVIET SOCIALIST REPUBLIC AND THE UKRAINIAN SOVIET SOCIALIST REPUBLIC

INTRODUCTION

In terms of its scale and the damage caused, the accident at the Chernobyl nuclear power plant on 26 April 1986 was one of the most serious accidents to have occurred in the entire history of the utilization of atomic energy. From the viewpoint of radioactive contamination of the biosphere, it can be ranked as a global disaster.

The accident involved the discharge of substantial quantities of radioactive substances into the environment. In the area affected (including the evacuation zone), 76,100 km^2 were contaminated with caesium-137 at a level of between 1 and 5 Ci/km^2, and 28,100 km^2 at a level of above 5 Ci/km^2. These areas have a population of some 4 million, more than 800,000 of whom live in regions where the contamination level is above 5 Ci/km^2.

The accident disrupted the previous way of life and economic activity in various parts of the RSFSR, Ukrainian SSR and Byelorussian SSR. In just the first year after the accident, 144,000 hectares of farm land were taken out o use, forestry work was stopped on an area of 492,000 hectares, and many industrial and agricultural enterprises ceased operations.

In the spring and summer of 1986, 116,000 people were evacuated from the danger zone.

As a result of the accident or of their work in dealing with its immediate consequences, 30 people were killed or died from acute radiation sickness and many received high doses of radiation.

Work was carried out to protect reservoirs from radioactive contamination and a series of special hydraulic installations and traps were built to prevent the shifting of radioactive silt.

Three periods can be distinguished in the efforts to deal with the after-effects of the accident:

The first period, from April to May 1986, involved making initial estimates of the scale of the disaster and the radiation situation, taking action to prevent a spontaneous chain reaction and radioactive emissions from the damaged reactor, identifying areas exposed to radioactive contamination, and evacuating the population and farm animals from a 30-kilometre zone. At this stage, the main danger to personnel and the public at large was from external exposure, as well as from internal irradiation due mainly to ingesting or inhaling iodine-131 and 132;

The second period, from summer 1986 to 1987, involved mapping out the contaminated areas, construction of the "Encasement" ("Sarcophagus"), decontamination of the working area of the nuclear power plant, restarting of the No. 1, No. 2 and No. 3 reactors, measures to protect water resources from radioactivity, decontamination of settlements, scientific investigations and special measures on agricultural land. The main sources of radioactive contamination during this period were ruthenium-106, cerium-141 and 144, caesium-137 and 134;

The third period, from 1988 to the present day, has involved stabilising the radiation situation in the 30-kilometre zone and other areas, getting the organization of work and dosimetric monitoring set up properly, carrying out operations to make the "Encasement" more secure, decontaminating of settlements, relocating inhabitants away from contaminated areas, taking measures to reduce contamination of agricultural produce and reorganizing agricultural activities, collating material relating to the accident, and developing and launching of a long-term programme for dealing with the after-effects of the accident. The main sources of radiation were by this time long-lived radionuclides of caesium-137 (for the most part) and strontium-90.

Notwithstanding the enormous efforts - unprecedented anywhere else in the world - to deal with the after-effects of the accident at the Chernobyl nuclear power plant and despite the considerable financial, material and technical resources committed, a reliable system for ensuring the safety of people affected by radiation is still not in place.

A State Union-Republic programme of urgent measures has been drawn up in the USSR for the years 1990-1992 to deal with the after-effects in the RSFSR, Byelorussian SSR and Ukrainian SSR of the accident at the Chernobyl nuclear power plant. This programme was approved by the Supreme Soviet of the USSR on 25 April 1990.

On 26 October 1989, the Supreme Soviet of the Byelorussian SSR approved a State programme for dealing with the after-effects in the Byelorussian SSR of the accident at the Chernobyl nuclear power plant for the years 1990-1995. In the Ukrainian SSR, a similar long-term programme has been adopted for the period up to the year 2000. A corresponding programme for 1990-1995 has been adopted in the RSFSR.

The main urgent measures provided for in these programmes are:

Relocation of inhabitants away from settlements which were subjected to radioactive contamination as a result of the accident at the Chernobyl nuclear power plant and in which the population's safety from radiation cannot be ensured for long periods of residence, and the resettlement of people (especially families with children up to 14 years of age and pregnant women) who have expressed the desire to move out of areas where restrictions have been imposed on the consumption of local food products;

Implementation of a range of measures in the prohibited zone of the Chernobyl nuclear power plant to ensure the nuclear and radiation safety of installations in that zone, to treat and where necessary bury radioactive waste from the plant, and to prevent the spread of radioactivity beyond this zone;

Improvement of medical health services for the various population groups who suffered as a result of the Chernobyl accident;

Introduction of special measures with regard to agro-industrial production under conditions of radioactive contamination;

Supply of "clean" food products to people living in contaminated areas;

Provision of regular information to the population on work undertaken to deal with the after-effects of the accident, and action to educate the public with regard to radiation safety;

Scientific study of the problems involved in dealing with the after-effects of the accident and ensuring normal living conditions in the contaminated areas.

Radiation situation

The radioactivity released into the environment from the damaged Chernobyl reactor totals approximately 50 MCi (1.9×10^{18}Bq), or 3 to 4 per cent of the combined radioactivity of the fission products in reactor No. 4 of the Chernobyl nuclear power plant.

The long period of discharge of radionuclides from the damaged active zone of the reactor and the changing weather conditions (wind direction, precipitation) during that time in the European part of the country resulted in an extremely complex picture of radioactive contamination of a number of regions, and an uneven pattern of contamination both by area (spottiness) and by types of radionuclides.

The provinces subjected to radioactive contamination in the Russian Federation were Bryansk, Kaluga, Tula, Orel and to a lesser extent Kursk, Smolensk and Lipetsk; in the Ukrainian SSR - Zhitomir, Kiev, Rovno, Chernigov, Cherkassy and Vinnitsa; and in the Byelorussian SSR - Gomel, Mogilev, Brest, Minsk and Grodno.

The most widespread source of contamination giving a high background level of radiation is radionuclides of caesium-137.

The areas contaminated by caesium-137 are (in km^2):

	Density of radioactive contamination, Ci/km^2			
	from 5 to 15	from 15 to 40	above 40	Total
USSR	17 880 17 130	7 090 6 050	3 100 1 670	28 070 24 850
of which:				
RSFSR	5 760 5 760	2 060 2 060	310 310	8 130 8 130
Ukrainian SSR	1 960 1 540	820 350	640 200	3 420 2 090
Byelorussian SSR	10 160 9 830	4 210 3 640	2 150 1 160	16 520 14 630

Note: The numerator shows data inclusive of the 30-km evacuation zone; the denominator gives data for areas excluding the 30-km zone.

There are 2,224 settlements in the contaminated areas of the RSFSR, Ukrainian SSR and Byelorussian SSR. The total population of 824,000 living in these areas can be broken down as follows:

	Density of radioactive contamination, Ci/km^2			
	from 5 to 15	from 15 to 40	above 40	Total
USSR	1 542 584.5	564 206.3	119 33.5	2 225 824.3
of which:				
RSFSR	413 113.1	167 80.9	26 4.6	606 198.6
Ukrainian SSR	202 204.2	57 29.7	23 19.2	292 253.1
Byelorussian SSR	927 267.2	330 95.7	70 9.7	1 327 372.6

Note: The nominator shows the number of settlements; the denominator gives their population.

Contamination with strontium-90 at significant levels (from 2 to 3 Ci/km^2) is observed in some settlements in Gomel province, in the Byelorussian SSR, and in Zhitomir province, in the Ukrainian SSR. Soil contamination with plutonium-239 and 240 outside the evacuation zone is relatively low, mostly no greater than 0.1 Ci/km^2.

Accurate knowledge about the radiation situation is especially important in protecting the health of people living in the areas subjected to radioactive contamination.

The boundaries of the contaminated areas have remained virtually unchanged since radiation monitoring began in 1986. However, detailed investigations on occasion reveal previously unidentified local areas of contamination. Precise and detailed measurements therefore need to be made of the radiation conditions, taking into account the "spottiness" of the contamination, including a survey of each household in rural areas and of each building and structure.

The State Union-Republic programme of urgent measures calls for special operations to be carried out in two stages between 1990 and 1993 to determine radiation conditions with precision.

The first stage of work, being undertaken in 1990, involves an investigation of radiation conditions (estimate of the strength of the gamma-ray dose) by means of a house-to-house survey of settlements in Kiev, Zhitomir and parts of Rovno and Chernigov provinces in the Ukrainian SSR,

Gomel and Mogilev provinces in the Byelorussian SSR, and Bryansk province in the RSFSR, and also by means of wide-scale collection and analysis of soil samples to test for caesium-137, strontium-90 and plutonium-239 and 240 in these provinces.

The second stage of work, scheduled for 1991-1992, involves a house-to-house survey of settlements in a number of other provinces. It is planned to compile an atlas of the radiation situation in the European part of the USSR, which will be completed in 1993.

The comprehensive set of measures to establish the precise radiation situation, study the migration of radioactive substances, compile forecasts of changes in radioactive contamination in the different environments and formulate appropriate recommendations will require advice and co-operation from the World Meteorological Organization (WMO) and the International Atomic Energy Agency (IAEA). Assistance will also be required from the international organizations to carry out expert appraisals of the radiation situation using modern highly-sensitive radiation monitoring facilities, including mobile equipment.

Medical aspects of the accident

The accident at the Chernobyl nuclear power plant has required major reorganization of the whole system of health care. Both Soviet and foreign experience in radiation medicine was called upon in dealing with the after-effects of the accident.

The fact that the country had a specialized medical service, set up long before the Chernobyl accident to meet the needs of the nuclear industry and atomic power engineering, made it possible to organize medical assistance rapidly for the victims.

Faced with the complex radiation conditions in the European part of the country, agencies of the USSR Ministry of Health in co-operation with the USSR State Committee for Hydrometeorology and the agricultural authorities determined by what routes and at what levels the most dangerous radionuclides were entering the food chain, and drew up time-limited standards and recommendations to protect the population.

In the light of changing radiation conditions, the USSR Ministry of Health set the following time-limited radiation dose levels (internal and external) for the population: 10 rem for the first year after the accident, 3 rem for the second, 2.5 rem for the third and 2.5 rem for the fourth. The prompt introduction of emergency standards and implementation of a range of protective measures made it possible to reduce the total radiation doses received by the population by a factor of 2.5 compared with the doses predicted, and also to reduce the dose of internal radiation by a factor of 2-4.

According to available data, the average individual doses of radiation received by the population in contaminated areas over the period 1986-1989 were 6 rem in the RSFSR and 5.6 rem in the Ukrainian and Byelorussian SSRs.

Of this population 62.1 per cent received radiation doses of between 1 and 5 rem, 33.6 per cent between 5 and 10 rem, and 1.2 per cent between 15 and 17.3 rem. A dose of 17.3 rem was the maximum allowed for the period from April 1986 to 1 January 1990.

Among the 1.5 million people (including 160,000 children up to the age of seven at the time of the accident) living in the zone most heavily contaminated by iodine-131, the doses of radiation absorbed in the thyroid gland were as follows: up to 30 rad in 87 per cent of adults and 48 per cent of children; between 30 and 100 rad in 11 per cent of adults and 35 per cent of children; and more than 100 rad in 2 per cent of adults and 17 per cent of children.

Public health-clinic monitoring was organised and a State register set up to ensure regular checks on the state of health of people living in the contaminated areas and of those involved in dealing with the after-effects of the accident at the nuclear power plant. Scientific and methodological guidelines were established with regard to clinical treatment for persons affected by radiation as a result of the accident at the Chernobyl nuclear power plant.

In assessing the main demographic indicators (birth rate, mortality, natural growth rate) for the population in the monitored areas of the RSFSR, Ukrainian SSR and Byelorussian SSR, it must be noted that while they are for the most part comparable to those for the country as a whole, and although specially conducted surveys have not revealed specifically radiation-related changes in the state of health of children or adults, the natural growth rate of the population in the Byelorussian SSR, for example, fell from 7.4 per 1,000 in 1986 to 5.1 per 1,000 in 1989.

Clinical monitoring and thorough check-ups have, along with migration processes (departure of young persons from contaminated areas), helped to increase the rate of detection of diseases and functional disorders among the population. Many of these are indirect consequences of the accident, for example, inferior living conditions due to the safety restrictions imposed on the utilization of natural resources and the consumption of certain local food products.

According to data from clinical tests, the diseases most commonly found in children are respiratory diseases, chronic infections of the tonsils and digestive organs and disorders of the nervous system, cases of adenoids and dental caries.

An increase in the number of children with hyperplasia of the thyroid gland has been observed in clinical testing of people living in the forest-belt areas of the Byelorussian SSR, the Ukrainian SSR and the RSFSR, where levels of trace elements in the environment are low (and where goitre cases are endemic).

In the International Classification of Diseases, hyperplasia of the thyroid gland (first and second degree) is an unspecified goitre disease listed under functional disorders. It is found with the same or much greater frequency among children of other regions not affected by radioactive

contamination, and not only in those with a shortage of naturally occurring iodine. This may be related to the effects on the organism of various harmful factors (nitrites, perchlorates, thiocyanates, industrial poisons). Children in this category require constant medical monitoring with highly sensitive ultra-sound equipment.

Characteristic of the areas monitored has been the growing number of cases of iron-deficiency anaemia among children and the increased frequency of functional diseases of the nervous system (vegetovascular dystonia of various types, neuraothenic reactions, neuroses); in addition, some data on obstetrics show a downward trend.

It should be noted that negative socio-economic and psycho-emotional processes are being observed in areas subjected to radioactive contamination as a result of the prohibitions and restrictions applied in those areas, and the effects of adverse environmental factors other than those related to radiation are being felt.

Surveys have shown a definite reduction since the second quarter of 1986 in consumption of the main food products. The energy value of the diet has fallen and less fruit, berries and vegetables are being consumed. The supply of animal protein has declined.

Owing to restrictions on the consumption of local food products over a long period, the population has not been fully supplied with the nutrients that are physiologically necessary for metabolic processes and to increase the organism's resistance to the effects of adverse environmental factors.

The effects of shortages in the supply of food products (children's prepared foods, fermented-milk products, fruit and vegetables), much reduced periods of breast feeding, limited mobility and shorter time spent out-of-doors are apparent above all in the development of rachitis among children, an impairment of their defence mechanisms and adaptiveness, etc.

Thus, the clinical observations and selective expert evaluations suggest that the worsening public health situation in the monitored areas may be seen as a direct result of the combined effects of various adverse factors.

The major tasks in the area of public health are: determining the principal causes of the worsened state of health of people affected by radiation; finding ways and means to prevent harmful effects; and detecting various diseases in their early stages.

Efforts have been made since the accident to strengthen the material and technical resources of the treatment and prevention facilities in the provinces of Bryansk (RSFSR), Mogilev, Gomel (Byelorussian SSR), Kiev and Zhitomir (Ukrainian SSR), which have been supplied as a matter of priority with Soviet and imported medical equipment and drugs. In 1986 imported equipment was supplied mainly for the purposes of medical assistance to people suffering from acute radiation sickness. Between 1987 and 1989 the equipment purchased was mainly for diagnosis: ultra-sound apparatus and equipment for radioimmunoassay and immune-enzyme analysis.

The scale of the accident at the Chernobyl nuclear power plant called for fundamentally new approaches to the task of setting radiation levels for the population over the long term. A national commission on radiation protection has been drawing up a plan to ensure "safe" living conditions for the population in the contaminated areas.

The criterion proposed was the maximum dose beyond which there was a risk of developing such long-term effects as cancer and hereditary diseases.

On the basis of an analysis of research both in the USSR and abroad to estimate the biological effects of ionising radiation over various dose ranges, a dose of 35 rem was recommended as the maximum over a 70-year life span. This limit was adopted as the criterion for determining whether or not protective measures should be maintained in particular settlements, and also for decisions in future whether to move inhabitants from settlements in which it is not possible to ensure that the maximum will not be exceeded under normal living conditions. There is some disagreement among the country's scientists at present regarding the level of the maximum dose.

The Soviet Government accordingly has decided to give priority to moving inhabitants out of settlements where the dose limit cannot be complied with. In addition, it is planned to pay suitable compensation to citizens relocated away from settlements where restrictions on the consumption of local food products have been imposed, and to find them housing and employment.

Work is now continuing in the Soviet Union on a plan that would take into account the effects on man of various harmful factors, whether or not due to radiation. This work is expected to be completed in October 1990.

An important role in finalizing this plan can be played by the international organizations.

In this connection, it should be noted that in late 1989 the Soviet Union requested IAEA to co-ordinate efforts to organize and implement a project for an international expert appraisal of the plan drawn up by the USSR to provide safe living conditions in the areas subjected to radioactive contamination after the Chernobyl accident, and an evaluation of the effectiveness of measures taken in these areas to protect public health. The IAEA secretariat supported this request and the project to carry out an expert appraisal with the participation of WHO, other international organizations and a group of independent experts from a number of countries is now being implemented.

The State Union-Republic programme of urgent measures to deal with the after-effects of the accident at the Chernobyl nuclear power plant provides for further improvement of the entire health care system in the areas contaminated by radionuclides.

It is planned to equip medical research and health care institutions with modern diagnostic and therapeutic apparatus, which will make it possible to provide a higher quality of medical monitoring, to carry out a thorough analysis of the state of people's health and to develop effective methods and techniques for the prevention and treatment of diseases and functional disorders with standardization of research facilities and methods.

The programme calls for a substantial strengthening of the material resources of health care institutions and an expansion of the network of diagnostic centres, laboratories and special clinics. In addition to the already established All-Union Radiation Medicine Research Centre in Kiev and Radiation Medicine Research Institute in Minsk, it is planned to open branches of the latter institute in Gomel and Mogilev provinces, as well as an RSFSR radiation medicine research and training centre in the city of Bryansk.

A special system is being set up to monitor the state of health and rehabilitation of those people who took part in dealing with the after-effects of the accident at the Chernobyl nuclear power plant. This system includes a network of regional rehabilitation centres and involves the setting up of regional interdepartmental boards of experts to determine the causal relationship between disease or disablement and work in dealing with the after-effects of the accident. It is planned to equip those centres and boards with modern apparatus for diagnosis and treatment. Priority is being given to training and retraining medical staff for health centres caring for victims of the accident.

The programme for improving the health of the population affected by radiation as a result of the accident includes conversion of a number of existing sanitoriums and health resorts, the construction of special new convalescent homes and the issue of special passes for children and adults to sanitoriums, holiday homes and Pioneer camps.

One of the key policies in efforts to protect the health of the population and counteract the harmful consequences of the accident at the Chernobyl nuclear power station is to provide various groups of the population with nutritionally sound food products.

Under this programme there is to be an increase in the production of foodstuffs from natural raw materials, rich in natural protective ingredients, such as carotenoids, vitamin C, bioflavonoids, food fibres and trace elements, and people in contaminated areas are to be given vitamins regularly as a prophylactic measure.

Since there are some kinds of apparatus needed for diagnosis and treatment that are not made in the Soviet Union, the international community could give assistance in re-equipping health centres with modern medical facilities, computers, and dosimetric, radiometric and spectrometric instruments and supplying drugs (including radio protectors) and multi-vitamin complexes.

In view of the importance for the international community of the experience gained by the Soviet Union in dealing with the consequences of the disaster, and also the importance for the Soviet Union of being able to draw on international experience, it seems desirable to establish a comprehensive international programme of work in the following fields:

Training and retraining medical specialists, primary haematologists, endocrinologists, oncologists, immunologists, epidemiologists, geneticists, psychologists, paediatricians, obstetricians and gynaecologists, health administrators and specialists in the field of human reproduction and family planning;

Improving knowledge of radiation medicine and radiation security among medical workers and people living in contaminated areas. For this purpose it would be helpful to prepare international handbooks on radiation medicine and security, to set up an international data bank for these areas and to prepare pamphlets for the general public;

Arranging for international experts to review the plans for dealing with the consequences of the Chernobyl disaster and give advice on protecting the population against radiation;

Carrying out joint research on the health of different groups of people living in contaminated territories;

Developing ways and means of diagnosing, curing and preventing diseases and functional disorders;

Protecting the environment and working out the optimum principles for settlement of the population.

A definite contribution would be made to efforts to deal with these problems by implementation of the measures set forth in the memorandum signed in April this year between the USSR Ministry of Health and WHO on the establishment of a long-term global programme for monitoring and minimizing the medical consequences of the Chernobyl disaster and on the setting up of an international radiation medicine centre in Obnisk.

The international community could help by arranging long-term programmes for children from the areas affected by the Chernobyl disaster to go abroad for treatment and convalescence.

Evaluation of inhabitants from areas affected by radioactive contamination

One effective way of protecting people against the dangers of radiation is to evacuate them from heavily contaminated areas. In the spring and summer of 1986, some 116,000 people were evacuated from the danger area - including 92,000 from the Ukrainian SSR, over 24,000 from the Byelorussian SSR and about 200 from the RSFSR. The evacuees had new houses built for them in rural areas, or were given flats in towns, and they were paid compensation for the property they had lost.

Determination of the long-term limit for exposure to radiation led to further evacuations from areas contaminated by radionuclides beginning in 1989.

It was decided by the Governments of the USSR, the Byelorussian SSR and the Ukrainian SSR to resettle the inhabitants of various settlements contaminated by the Chernobyl disaster in Bryansk, Kiev, Zhitomir, Mogilev and Gomel provinces where it would not be possible through decontamination and soil improvement measures to keep the individual dose of radiation they received over the course of their lives within the established limit. In 1990-1991, because of the radiation factor, and also because of social

considerations, it is planned to evacuate a total of 395 settlements (73,000 inhabitants), including 306 in the Byelorussian SSR (38,600 inhabitants), 22 in the Ukrainian SSR (19,200 inhabitants) and 67 in Bryansk province in the RSFSR (15,200 inhabitants).

Decrees have been adopted by the Government fixing the procedure and conditions for the payment of financial compensation to certain groups of the population for the property they have lost, and also for the payment of expenses connected with moving to a new place of residence. They also lay down the procedure for providing the citizens with housing at their new places of residence and arranging for work to be found for them.

In areas where restrictions have been introduced on the consumption of food products from local farms or private plots, the Union Republics estimate that they will have to evacuate a further 146,000 people (families with children up to the age of 14 and pregnant women), including 69,000 from the RSFSR, 21,000 from the Ukrainian SSR and 56,000 from the Byelorussian SSR.

For these evacuees it will be necessary to build several million square metres of housing, cultural and service facilities, new estates and roads, and hence to expand the building and building materials industries.

The appropriate international organizations could help with this work by acting as intermediaries to arrange supplies of equipment for children's pre-school institutions, schools and cultural centres and for building enterprises.

Social welfare for people living in areas affected by radioactive contamination

In places where radioactive contamination is insignificant, and it is not intended to evacuate the population, measures are planned to reduce the amount of exposure to radiation still further and to improve social conditions and services.

For inhabitants of a number of places in areas affected by radioactive contamination, a decree was introduced by the Government of the USSR in 1986, and followed up by various decisions, which limited the consumption of food products from local farms and private plots because they contained more than the permissible levels of radio nuclides. Various privileges and benefits were introduced for these people, including cash benefits and free meals for children at schools and pre-school institutions. At the beginning of 1990, there were some 280,000 people living in such places, including 110,000 in the RSFSR, 50,000 in the Ukrainian SSR and 120,000 in the Byelorussian SSR.

In the light of the new data on the state of health of the population living in contaminated areas and the need to improve their diet and calorie intake, their medical services and their material conditions, the main attention will be concentrated in the next few years on measures to improve health care and material conditions for these people.

It is planned to pay cash benefits to people in less contaminated areas as well, in order to compensate them for the cost of obtaining extra food supplies because of the partial restrictions on the consumption of milk and, in some cases, other food products from local farms and private plots.

Among residents of contaminated areas, those who work have been given extra vacation, women have been allowed additional maternity and child-care leave, working pensioners receive full pensions regardless of what they earn, benefits for needy families and pensions for non-working pensioners and persons disabled from childhood have been increased, and the conditions for the payment of State pensions have been eased.

In order to ensure that the foodstuffs available to the population in contaminated areas meet the recommended standards, these areas are receiving additional supplies of meat and meat products, milk and milk products, vegetable oil, vegetables and melons, berries and fruit, particularly citrus fruit.

Acute problems are arising in finding work for different groups of the population, providing for their social and psychological rehabilitation and organising teaching in schools. The organizations belonging to the United Nations system could make a substantial contribution to efforts to deal with these problems.

The cultural ecology

The Chernobyl accident was not just a radiation disaster, but also a tragedy in the history of the national culture. It is impossible to make good all the damage done, because it is permanent. People are only just beginning to grasp the extent of it. The most that can be done is to adapt to the new post-Chernobyl situation, from which there is no going back. The transformation that has occurred affects not just individuals, but whole ethno-social groups.

The area affected by the Chernobyl disaster included districts inhabited by different national groups in which various and sometimes unique cultural traditions had been preserved and handed down. In the contaminated zone there were wide areas of a special natural landscape containing monuments of materials and spiritual culture, including archaeological, historical and architectural sites. Little centres of ancient popular culture - crafts, folklore - have also been preserved, particularly in rural areas, and there are also popular museums (Vetka in the Byelorussian SSR), which need to be treated with the greatest possible care. These things, which are priceless, have not yet been properly studied and described.

It seems important that a comprehensive international humanistic, ecological and cultural programme should be set up under the auspices of UNESCO to save the main cultural assets which have been handed down since time immemorial in the affected regions.

Agro-industrial production and forestry in areas contaminated by radioactivity

The Chernobyl disaster did serious damage to agriculture and forestry. About 1.3 million hectares of agricultural land were subjected to radioactive contamination with a caesium-137 density of 5 Ci/km^2 or more. Hundreds of thousands of hectares of contaminated land were taken out of production, and the working of large areas of forest was halted. The process of taking agricultural land out of production is continuing. In the Byelorussian SSR, for example, this has already been done with 257,000 hectares of agricultural land, and it is planned to cover about 500,000 hectares in all. The result is a decline in crop yields and the number of livestock, with an adverse effect on the output of food products.

On the basis of the experience gained in the USSR and elsewhere in the world in dealing with the consequences of radioactive contamination of large areas, the main tasks of agro-industry and forestry in the initial period after the Chernobyl disaster were to protect agro-industrial and forestry workers against radiation, and to organize and implement a system of measures to prevent food products containing radionuclides in quantities above the accepted temporary limits from entering the human organism. Where that cannot be done, food products are brought in from elsewhere to supply the rural population.

A system was promptly set up in May 1986 for multi-stage radiation monitoring of agricultural and forestry output during production, processing and sales. A range of measures were introduced to ensure the production of high-quality foodstuffs at farms in the contaminated area through the formulation and practical application of recommendations and guidelines on how agricultural activities should be carried on in the specific conditions of radioactive contamination.

Measures are being taken to reduce the caesium-137 content of milk below the established temporary limits.

Under the State programme of work for 1990-1992 a combination of measures are to be carried out which will permit rational and safe use to be made of the agricultural and forest land in the areas where the population will live.

It seems desirable to seek the co-operation of foreign organizations and institutions under the auspices of the United Nations in obtaining advisory services and technical expertise for the organization of agricultural production in contaminated areas, the establishment of the appropriate infrastructure in those areas, the organization of small-scale enterprises for local processing of the produce and the training and retraining of staff in agricultural radiology.

International co-operation can be of help in dealing with such problems as:

Development of methods of maintaining soil fertility (optimization of the micro-nutrient balance), together with measures to prevent radioactive substances from entering plants;

Development of technology for reducing the caesium-137 content of agricultural produce during processing. Manufacture of the technical equipment needed for this purpose and its installation at plants;

Development of means to reduce the amount of radionuclides entering the organisms of farm animals and to hasten their elimination;

Development of ways and means of day-to-day monitoring of low levels (10-100 Bq per kg) of radioactive contamination of produce (including strontium-90);

Organization of mass production of highly sensitive radiometric instruments and their installation at farms, collecting centres, processing plants and trading enterprises;

Production of high-output processing plants (units), including mobile ones, for utilizing large quantities of biological materials with a high content of radioactive substances, in order to reduce the volume of radioactive waste.

Decontamination

Decontamination operations on land, buildings and installations after the Chernobyl disaster were mainly carried out by units of the armed forces. In the period since the disaster, more than 24 million m^2 of indoor premises and more than 6 million m^2 of land have been decontaminated, and a large amount of radioactive waste has been taken away and buried.

Nine hundred and forty-four settlements have been decontaminated (some several times over), including 448 in Gomel province and 190 in Mogilev province in the Byelorussian SSR, 56 and 93 in Kiev and Zhitomir provinces in the Ukrainian SSR and 157 in Bryansk province in the RSFSR. These measures made it possible to improve the radiation situation in these settlements and to reduce the doses being received by the population.

In 1989 the decision was taken to evacuate a large number of residents from the area contaminated with radionuclides to clean areas (this operation is now being carried out on a large scale), which made it possible to limit the volume of decontamination work in 1990 and carry it out selectively at particular settlements.

An important area for international co-operation in this field would be the establishment of a comprehensive programme to develop ways and means of decontaminating equipment, machinery, buildings and installations and the implementation of such measures in settlements.

Scientific back-up for the work of dealing with the consequences of the Chernobyl disaster

After the Chernobyl disaster it was necessary to organize various lines of scientific research which would together ensure that future measures to deal with the after-effects of the disaster were scientifically based and monitored. The main part of the work was entrusted to organizations with appropriate experience and qualified staff. In the USSR research into the

effects of radiation on human beings, the environment, agricultural land and foodstuffs was pursued most vigorously in the mid-1940s, at the same time as nuclear weapons were being developed. The results of this research, in particular, provided the basis for the radiation safety standards for work with ionizing radiations and also the time-limited standards drawn up in connection with the Chernobyl disaster.

In the period since the Chernobyl disaster, the country's scientific organizations have carried out a wide range of scientific research on problems connected with the elimination of its after-effects.

The work programme for the coming period based on the main lines of research, including:

1. Study of the effect of radioactive contamination on the flora and fauna and forecasts of the environmental consequences of the disaster (ecology).

2. Monitoring of the level of contamination of environmental features with radionuclides and study of the processes of migration of fission products and trans-uranic elements (monitoring and forecasting of radioactive contamination).

3. Study of biological factors and remote consequences of radioactive effects on the population and development of measures to reduce the negative impact of these effects (radiation medicine).

4. Research into the effect of radioactive contamination on agricultural production and forestry, development of measures to reduce that effect and make use of foodstuffs contaminated with radionuclides (agricultural radiology).

5. Research into ways of preventing radioactivity from spreading outside the Chernobyl prohibited zone and reducing the doses received by staff, including measures to ensure the nuclear and radiation safety of the encasement and to develop ways and means of decontaminating environmental features, working and domestic premises and installations, equipment and transport facilities (decontamination).

6. Study of the social, psychological and legal aspects of dealing with the consequences of the disaster and preparation of appropriate recommendations.

7. Development of a plan for people to live and work permanently in safety in the areas affected by radioactive contamination as a result of the Chernobyl disaster.

8. Provision of the information and analytical material needed for the comprehensive programme of scientific research.

To make this research more effective it will be necessary to re-equip most scientific organizations with modern equipment and computers, some of which will have to be imported.

At the proposal of the Soviet Union, the Chernobyl International Scientific Centre is being set up near the Chernobyl power station under the auspices of IAEA. A research programme has been drawn up for the future centre, covering seven basic fields. They include problems connected with post-disaster reconstruction, radiation safety, development of new means of monitoring, decontamination of land and facilities, and radionuclide migration. Supplies of materials and equipment are being organized and arrangements made for accommodating foreign scientists. Twenty-five countries have provisionally indicated a desire to take part in the Centre's work. The appropriate international organizations could act as intermediaries in arranging for the Centre to be equipped with modern scientific apparatus.

Expenditure and losses resulting from the Chernobyl disaster

Direct losses of fixed assets and other material goods together with expenditure on action to deal with the consequences of the disaster amounted by themselves to 9.2 billion roubles in 1986-1989. They include: losses of productive and non-productive fixed assets amounting to 900 million roubles; lost output in agriculture and other sectors amounting to about 1.2 billion roubles; expenditure on the construction of housing, social and cultural facilities and services for the population affected by the Chernobyl disaster, road-building, measures to protect forests and water, decontamination operations and the provision of gas supplies to settlements amounting to 2.94 billion roubles; various kinds of compensation paid to the population amounting to 1.25 billion roubles; payment of cash benefits because of restrictions on the consumption of agricultural products from local farms and private plots amounting to 180 million roubles.

Indirect losses, however, represent an incomparably larger amount. The expenditure in question has been financed mainly from the State budget. Apart from budgetary allocations by the USSR State insurance agency, insurance payments have been made to individuals and agricultural and co-operative organizations in the amount of 274 million roubles. The total expenditure also included money contributed voluntarily by individuals and organizations to the assistance fund for dealing with the after-effects of the Chernobyl disaster in the amount of 532 million roubles.

The Supreme Soviet of the USSR has appealed to parliamentarians in all countries and to international organizations to provide assistance in dealing with the problems arising from the Chernobyl disaster.

The Presidium of the Supreme Soviet and the Council of Ministers of the Byelorussian SSR made a similar appeal on 20 February 1990.

The Council of Ministers of the Ukrainian SSR has appealed to Governments and public bodies in foreign countries and to international organizations for large-scale international co-operation in dealing with the consequences of the Chernobyl disaster.

A great contribution can be made to these efforts by United Nations organizations using the international machinery in order to further the economic and social progress of the peoples which have suffered from the disaster at the Chernobyl nuclear power station.
