CONCLUSIONS AND RECOMMENDATIONS

International Scientific Conference
"Twenty-Five Years after the Chernobyl Accident. Safety for the Future”

Kyiv, Ukraine, April, 20-22, 2011

1. Introduction

These conclusions and recommendations of the International Scientific Conference "Twenty-Five Years after the Chernobyl Accident. Safety for the Future", held in Kyiv during 20-22 April 2011, are based on material presented in the participants' reports and take into account proposals submitted during the discussions. These have also been influenced by conclusions of the previous International Conference "Twenty Years after the Chernobyl Accident. Future Outlook", held in Kyiv during 24-26 April 2006.

725 participants from 43 countries took a part in the conference, also high level leaders: Prime Minister of Ukraine Nikolay Azarov, UN Secretary-General Ban Ki-moon, Secretary-General of the Council of Europe Thorbjørn Jagland, IAEA Director General Yukiya Amano, UNESCO Director-General Irina Bokova and others.

UN Secretary-General Ban Ki-moon in his Statement for Conference said: "To many, nuclear energy looks to be a relatively clean and logical choice in an era of increasing resource scarcity. Yet the record requires us to ask painful questions: have we correctly calculated its risks and costs? Are we doing all we can to keep the world's people safe? …Looking to the future, we need international standards for construction, agreed guarantees of public safety, full transparency and information-sharing, among others. Let us make that the enduring legacy of Chernobyl."

The Conference participants recommend taking into account these conclusions and recommendations when making decisions in the future.

This conference is timed to coincide with the 25th anniversary of the Chernobyl disaster - the worst radiation accident ever known. This large-scale nuclear catastrophe led to serious human health, environmental and social consequences, affected the lives of many millions of people, and for the Ukraine and Belarus became a national disaster. Its consequences and the lessons learnt have changed the perception of nuclear power across the globe. International instruments and standards for nuclear and radiation safety, national strategies for safe nuclear energy production and radioactive waste management have been substantially revised.

The Chernobyl disaster actually triggered the establishing of a comprehensive international safety regime and measures to intensify international cooperation in the nuclear and radiation safety.

Since then, the entire system of international agreements (like that: Convention on Early Notification of a Nuclear Accident, Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, Convention on Nuclear Safety, Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, Convention on Supplementary Compensation for Nuclear Damage etc.) has been established.

The development of comprehensive safety culture, harmonization of safety standards and security requirements, internationally assisted self-assessments in many fields as well as a continuously advancing exchange of information and knowledge via diverse networks have become important elements of the global safety and security regime.

Despite the fact that a quarter of a century has passed, significant resources are still being channeled into minimizing and dealing with the consequences of the accident; for example the ongoing monitoring of settlements located within contaminated areas - their social and economic recovery, also measures to assure the long-term safety of the destroyed reactor. From a positive perspective, the accident was a strong inducement for further improvements in nuclear safety and radiation protection, especially improving national and international preparedness for dealing with such emergencies.

Scientists, designers, vendors, operating staff - anyone who are involved in the nuclear energy production, should analyze the effectiveness of measures taken since the Chernobyl tragedy,

evaluate the work that's been performed over the last decade and pose the question: Has enough has been done to assure our future safety?
The purpose of the Conference was an analysis of twenty-five years of lessons learnt since Chernobyl, the results of which can be used in future to ensure the safety of nuclear power and other dangerous technologies, and technological safety in general, by preventing accidents and disasters and hence improving our future safety.

2. Radiation-Ecological, Economic and Social Consequences of the Chernobyl Disaster

Twenty-five years after the Chernobyl accident, its causes, consequences and the effectiveness of countermeasures that were instituted can be reasonably explained and estimated.
During these years there have been many different opinions about the extent of (radionuclide) contamination of territories, food, bodies of water and forests, the state of the destroyed reactor, the number of dead and injured and the consequences to human health. But it is clear that this disaster has radically changed the lives of millions of people, especially those in Belarus, Russia and Ukraine, living in the most contaminated areas. Putting aside for a moment the damage to people's health caused by the "Chernobyl" radionuclides, events related to the accident such as resettlement, restrictions on the production of agricultural and industrial products, and even just the contradictory information about the consequences of the accident have significantly changed these people's lives.
Because of the lack of specialized knowledge in radiology, people could not independently assess the veracity of information given by the press, radio or television. As a result, their subjective perception of the potential danger of the disaster in many cases exceeded the real state of affairs.
The Chernobyl disaster has caused serious damage to the economy and the social sphere. The impact has been especially large in many regions of the Belarus, Russia and Ukraine, where the disaster has drastically affected domestic and commercial activities as well as the environment. Examples of the detrimental effects observed are: reduced production of electricity (to meet industrial, commercial and domestic needs); agricultural and industrial facilities have been significantly damaged and significant financial and technical resources were used to support the affected regions - assisting people to resume their livelihoods, resumption of production, decontamination of the environment, and social support to the population still living within contaminated areas, their provision with clean food and medical care.
The scale of material losses and the financial cost to liquidate the consequences of the Chernobyl accident clearly shows the high penalty paid for errors and omissions in the nuclear power plant's safety features and the future need for strict compliance, during their design, construction and operation, with international safety requirements.
Dealing with the consequences of the Chernobyl disaster continues to this day, diverting significant resources from the Government budget.
The accident has convincingly demonstrated that the cost of providing safety measures at nuclear power plants is significantly less than the cost of dealing with an accident's consequences. Major technological disasters cause enormous social and economic damage to countries. In accordance with the scientists' estimations, the direct and indirect damages incurred as a result of the Chernobyl accident only in Ukraine, have cost more than USD 200 billion over the past 25 years.
The Chernobyl accident led some people to have an almost obsessive perception of radiation risk; leading to psychological discomfort, and, as a consequence, to a deterioration of their health and quality of life. The accident showed the importance of a strict adherence to basic

technical safety principles in nuclear power plants, and the continuous, ongoing analysis of safety factors and measures. The modernization of nuclear power plants is necessary to prevent deviations from ‘best practice’; active learning, exposure to international expertise and experience, and careful consideration of human factors will also reduce the chance and impact of accidents.
The accident demonstrated the need to create and maintain a well-established national response plan for such technological accidents.
The accident demonstrated the danger of ‘hiding’ nuclear power from the public and demonstrated the need for open and objective dialogue with the public on all aspects of nuclear energy safety.
The creation of the Chernobyl Exclusion Zone was justified not only because of the need to evacuate people from the most contaminated areas, but also because of the follow-up tasks necessary to minimize the consequences of the accident. The Exclusion Zone is the most contaminated territorial complex and contains the highest radiation risk to the surrounding populated territories. Along with this, it performs at present, and will continue to perform in the future, an important protective function – preventing the spread of radionuclides beyond the zone, owing to natural and man-made barriers. Continuation of research, to support and strengthen the barrier function of the Exclusion Zone is a major focus of efforts.
The currently established system of radio-ecological monitoring within the Exclusion Zone, including the Object "Shelter", allows monitoring of the existing situation, but it needs upgrading, as it does not provide a reliable prediction of the radio-ecological and environmental situation as a whole, nor for individual facilities in the Zone.
Experience gathered over the past 25 years shows that a complete cessation of economic activity within the Exclusion Zone is not possible, since it does not lead to a spontaneous recovery of the contaminated ecosystems to their original state. But at the same time this creates an additional risk of radionuclide release outside the zone.
The problem of radioactive waste (RAW) management, of waste produced after the accident, is becoming more acute and urgent over the course of time. Despite the many national programs and international projects on radioactive waste management, there is still a lack of an integrated ‘end-to-end’ scheme for RAW management that is realistic, balanced and justifiable. Such a system needs to encompass all activities starting from the RAW collection and processing to final disposal needs and include ways to deal with the fuel containing materials of the Object "Shelter" and activities like the decommissioning of the Chernobyl Nuclear Power Plant.

3. Implications on Human Health

The effects of the Chernobyl disaster on people’s health are multidimensional and stem not only from their direct exposure to radiation but also from factors that aren’t radiation related.
At the time of the accident, acute radiation sickness (ARS) was diagnosed in 237 persons, after a retrospective analysis in 1989 it was verified only 134 persons, which have been exposed during the early period of the accident to doses equal to 0,8-16 Gy (under the condition of a relatively uniform whole-body irradiation). The medical care, provided to these individuals, contributed to their survival. 28 patients died during the first three months after the accident. In subsequent years, 23 deaths were registered among patients with the verified ARS and 17 deaths among those where ARS has not been confirmed. The main causes of these deaths were cancers and cardiovascular diseases.
Cataracts typically associated with radiation developed in 24 patients during the post-accident years: in 10 people with ARS of severity III, in 8 patients with ARS of severity II, in 3 persons with the ARS of severity I and 3 persons with unconfirmed ARS (ARS UN).

Virtually all cases of radiation cataracts (96%) developed during the first 15 years after exposure.
Since 4-5 years after the accident, a dramatic increase of thyroid cancer rates has been demonstrated among those exposed as children to radionuclides of iodine, mainly iodine-131. The UN Chernobyl Forum has reported in 2005 more than 5,000 thyroid cancer cases in those exposed as children. According to the later Ukrainian data about 6000 thyroid cancer patients exposed at age of 0-18 years were operated during 1986-2008. The relation between the increase in thyroid cancer incidence in those exposed as children and adolescents at the time of the accident and absorbed dose in the thyroid gland has been clearly demonstrated. Increased incidences of thyroid cancer were registered in the Ukrainian, Belarusian, Baltic and Russian 'liquidators' of the accident, who were exposed to iodine radioisotopes and external radiation. Radiation risks for each of these factors have to be studied in future. The increased incidence of thyroid cancer among persons exposed to ^{131}I in adulthood has been also reported in Ukraine and Belarus and need further research.
Due to the unprecedented increase of thyroid cancers in the three countries, an effective system of early diagnosis, treatment and rehabilitation has been established, which led to the successful treatment. However, despite the effectiveness of immediate treatment, their long-term quality of life is still reduced and they require long-term follow-up. The unique experience of treatment and rehabilitation of thyroid cancer patients could be used in the case of other radiation accidents.
An increased risk of radiation-induced leukemia among Chernobyl "liquidators" has been established in several recent international studies. Risk levels are similar to those previously noted following the nuclear bombing in Japan. Contradictory to the findings in the A-bomb survivors, the studies conducted on Russian, Baltic and Ukrainian liquidators, demonstrated an increased risk in chronic lymphocytic leukemia but it merits further investigation.
Over the past 25 years the incidence increase of leukemia among those exposed as children has not been identified. There are some recent indications of the increased incidence of solid cancer among the accident's liquidators in Belarus, Russia and Ukraine that need further investigation. Those include risks of radiation induced breast cancer among female liquidators during 1986-1987 as well as among the women, living in the most contaminated districts of Belarus and Ukraine. The radiation risks of solid cancers in such groups as liquidators and evacuees have to be further studied and evaluated. In general population exposed to Chernobyl fallout the assessments for solid cancers other than thyroid haven't demonstrated till nowadays a detectable increase.
Results of cytogenetic studies of the affected population of Ukraine, Belarus and Russia indicate a persisting high frequency of somatic mutations in peripheral blood lymphocytes.
International studies revealed long-term mental health disorders in populations affected by the Chernobyl accident, including depression, anxiety, and posttraumatic stress disorders. Within affected territories, the demographic situation is reported to differ from the rest of the country. Due to evacuation and resettlement activities, the age and gender composition of the remaining population is affected. Due to the decreased birth rate (mostly by women of the 20-29 age group) and aging of the population in these areas, the demographic losses are above the national indicators. The highest over-all mortality rates are reported among the residents of contaminated territories and Chernobyl liquidators, followed by the mortality rates among evacuees. Child mortality after the disaster has kept at the low levels and tended to decline within recent years.

4. Conversion of the Object "Shelter" Into an Environmentally Safe System

The most important activity, aimed at minimizing the consequences of the accident at the fourth Power Unit of Chernobyl NPP, was the construction of the Object “Shelter” (OS). The OS design and construction was done in record-breaking time (six months) and under extremely adverse conditions due to the radiation hazard. This did not allow construction of the object in accordance with the usual rules and regulations applicable to the nuclear industry and to radioactive waste management. Its construction did not meet the normal safety standards in terms of structural integrity and reliability and having an indefinite operating life.
These shortcomings lead to the fact that safety of the OS reduces as time passes. The main source of danger is the accumulation of fuel-containing materials (FCM), and the ongoing question of their nuclear safety. The potential danger of FCM increases with time due to spontaneous surface fracturing of the lava-like FCM, with the accompanying formation of a highly radioactive dust. The formation of such dust is a significant radioecological hazard. There is a probability of the building structures collapse, which could lead to a significant release of radioactive dust into the environment.
Thus, the OS can not be regarded as an object whose present condition guarantees an acceptable level of long term safety, both for personnel and the environment.
Therefore, research, experimental design, design, construction and installation work have been initiated and continue to the present day, aimed at enhancing the safety of the OS and ultimately converting it into an environmentally safe system.
Since 1998, the research of the OS condition and the implementation of priority projects to convert it to an environmentally safe system have been implemented in accordance with the Shelter Implementation Plan (SIP), created under the European Community Commission and the U.S. Department of Energy support. This activity is carried out by specialists from Ukraine and many foreign countries.
At present, stabilization measures have been introduced: an upgraded dust suppression system was installed; fire protection, physical protection and integrated automated monitoring systems are to be completed in the near future as part of the SIP implementation. At the moment, design of the first starting complex (CS-1) of the New Safe Confinement (NSC) is being carried out.
The stabilization measures, completed in 2008, helped to ensure an acceptable level of the OS safety on the basis of a 15-year operating period and subject to completion of the NSC construction during this time. However, taking into account the pace of the NSC design and various preparation activities needed for its construction, there are some doubts about the adequacy of the time allowance factored in the stabilization measures. It should be noted that the design documentation for the CS-1 NSC is being developed at present. The design activities for the second starting complex of NSC (CS-2 NSC), which targets dismantling of the unstable OS structures, has not yet begun. This may lead to the fact that development of CS-1 NSC does not take fully into account requirements for dismantling the unstable OS structures.
An equally serious problem is that the design work for the new structures and the strengthening of existing ones during the 2nd Chernobyl NPP construction stage, which must be integrated into the NSC, are not being performed at present.
The NSC design is being carried out with the absence of a clear strategy for the future FCM removal and radioactive waste management. The only requirement for the NSC within the framework of the CS-1 design is the reservation of an area for the disposal and usage of the FCM and/or other RAW removal technologies. This creates certain risks - the FMC removal using NSC established systems may be difficult or even impossible for certain FCM concentrations. In addition, the creation of technologies and infrastructure for the FCM management takes a lot of time, yet all activities related to the FMC removal should be completed before the NSC technological systems become operationally or physically

outdated. The tasks associated with the FMC removal technologies, including a demonstration experiment, are excluded from the SIP objectives. Also, the work on monitoring the status of FMC is indefinitely postponed, until more is learnt about their possible long-term degradation.

A mandatory condition for the safe storage of spent nuclear fuel is the creation of several leak proof barriers to prevent an impact on environment. The NSC is not a leak proof construction, so the risks of nuclear fuel residues from the 4th Power Unit leaking into the environment will persist as long as they are separate from the OS.

Therefore, the development of fundamental technological solutions for the FCM removal using the NSC systems and the safety justification in the process of their implementation, which should be performed together with the NSC design and construction which take into account the future needs for FCM removal is extremely important and relevant now. The main strategic objective after the NSC construction should be the development of technologies and techniques for FMC management.

Implementation of the final stage of the “Strategies for the Object “Shelter” conversion”, involves the establishment of a nationwide complex of geological storage areas for the FMC and other long-lived RAW disposal. It is recommended that the prospecting, appraisal, scientific and methodical research and design activities associated with this start without delay.

The OS has no analogues elsewhere in the world; therefore the problem of its conversion into an environmentally safe system is a unique challenge, which needs the efforts of both Ukraine and the world community.

5. Social and Economic Development of the Radioactively Contaminated Territories

The main existing problem for the rural population, who live within the territories contaminated after the Chernobyl accident, is that biologically dangerous radionuclides penetrated and still penetrate the body via milk and cows’ meat.

Because of the late notification of the accident, a ban on the animals’ pasture within the contaminated territories was delayed. Only in Kyiv, where due to normal operational monitoring of milk, milk from contaminated farms was relatively quickly segregated from that coming from ‘clean’ farms. This produced a reduction of some 7-10 times the exposure dose to the thyroid gland of the population within the Kyiv area (suburban population ~4 million people). Within two weeks of the accident, the mass processing of milk into butter with subsequent holding in refrigerators until the complete collapse of iodine radionuclides had started.

Even 25 years after the accident, 75-90% of the internal exposure doses on a human by ^{137}Cs are due to its penetration from milk and dairy products that are produced locally. Within the first few years after the accident, the radionuclide content in milk was several hundred times over the norm and was observed in more than 1000 settlements. As a result of natural processes and under the influence countermeasures, the milk contamination levels have been significantly decreased. A strict (conservative) criterion for milk (100 Bq /l ^{137}Cs) was established. The combined countermeasures in agricultural, cattle breeding and food processing has provided the possibility to obtain appropriate agricultural products that meet the national standards in practically all contaminated territories of Belarus, Russia and Ukraine after the Chernobyl accident, where the external exposure dose allows a resident population.

Since the Chernobyl NPP accident, the radioactive contamination levels of the soil have decreased almost twice due to radioactive decay, but due to the ^{137}Cs fixation process in soil, the transfer factor from soil to plants has decreased as follows relative to 1986: in the peat and turf podzolic soil 20 times and in the black soil 30-40 times. The transfer factor of ^{90}Sr has decreased by 6 times in soils of all types. In the future the rate of the ^{137}Cs fixation in soil will be comparable to the rate of radioactive decay. Countermeasures should be carried out, where they are necessary, to improve the radiation situation.

The intensive countermeasures, simultaneously with radioecological effect have a significant economic impact. For example, in Belarus, where the agricultural countermeasures are allocated about 20% of the total funding for minimization of the accident's consequences, not only is a significant improvement in the radiation environment achieved, but the level of farm profitability was increased by 40%.

The solution for clean (from ^{90}Sr) food production in Belarus and within the limited number of settlements in the Ivankov district of Kyiv, Ukraine, is possibly through using different types of cultivated plants and the targeted use of end products based on the prediction of crop contamination.

The effectiveness of agrochemical measures, estimated by a relative decrease of ^{137}Cs and ^{90}Sr penetration compared with the control options, does not decrease with time; however large amounts of countermeasures in Belarus were accompanied by a more rapid rate of radiation improvement.

The spatial distribution of internal dose is determined more by the environmental factors than by the density of the ^{137}Cs fallout. The dose of internal exposure due to consumption of cows' milk with equal contamination density of pastures varies by tens of times due to the differences in the ^{137}Cs transfer factor from soil to sown and natural plants and herbs. Currently, in about 100 settlements in which pastures are located on peat soils, the State standard on the ^{137}Cs content in milk is exceeded several times. The countermeasures should be continued within these settlements. The effectiveness of existing countermeasures is sufficient to reduce the content of ^{137}Cs in milk below the norm in all settlements. The countermeasures with highest priority for the near future are two-fold: For livestock - the use of feed additives and sorbents, feeding animals with "clean" feed (decreases products radioactive contamination from 2 to 10 times for each measure). And agricultural countermeasures - conducting surface and more extensive meadow improvements (improves economic yield 3 - 5 times) and changing land use.

The certificate dose, calculated from the ^{137}Cs content in milk and potatoes, is several times higher than the values of dose calculated from the monitoring data carried out using a whole body counter. This indicates the high conservatism of methods for assessing population exposure doses during the first period, and discounts people's ability to limit their consumption of contaminated products, as well as the reduction in the consumption of milk and milk products by the population over the last decade. Malnutrition can pose a more significant health risk than the low exposure doses here. The question deserves a detailed examination and study. It is necessary to develop models that are more accurate and less conservative in the long term.

6. General Conclusions and Recommendations

1. The Chernobyl disaster showed the need for improved emergency prevention and response system, and this need was justified by the severe accident at Fukushima-I. The safety approach related to the impact of natural factors on the safety of Nuclear Power Plants has to be reconsidered. Omissions have not been identified and eliminated over all the years, and the gained international experience was not overall used during the acute phase of the Fukushima-I accident, including experience of liquidation of the Chernobyl accident.
2. An international nuclear safety regime must be based on mutual agreement by the States that commit to observe the common safety objectives. Global character of nuclear

power requires safety standards that are developed and agreed together. National nuclear safety authorities who verify compliance with those standards must report on their decisions and be accountable to the society. In addition, there must be full international transparency of NPP safety assessments and inspections. The quality of operations and adequacy of regulatory oversight conducted in each State must be confirmed by foreign peers on missions organized by the IAEA.

3. First preliminary analysis of events' course in Japan shows that it is extremely important to ensure the improvement of accident management and emergency response and, above all, the level of preparedness for emergencies, particularly taking account the possibility of much larger natural disasters and acts of terrorism. Emergency plans should be designed for all kinds of the accident, including least probable scenarios, and they should have clearly defined and easily measurable levels of intervention and action procedures. Emergency plans, adapted for the understanding by the non-experts, should be available to the public through the Internet, and consultation centers.

4. The activity aimed at better awareness and knowledge of population on the nature of radiation hazards and protective actions in case of an accident should be improved. This work should be implemented directly to the public and via teachers, doctors and other population groups who will be able to disseminate this knowledge. The international collaboration on all aspects of better radiological protection of people should be strengthening.

5. Despite the fact that a lot have been done over the past quarter of century for the purposes of the accidents prevention in nuclear power engineering, preparedness for any accidents should be maintained at the highest level. Countries that have and develop the nuclear power should have the developed system of radiation monitoring, extensive well-equipped dosimetry service, and sufficient number of qualified doctors, who are well-aware about the symptoms and effects of radiation damages, preventive measures and are able to provide qualified medical assistance. Establishment and equipping with modern medical equipment, clear coordination of specialized medical centers, should be the priority tasks of such countries in the nearest future.

6. The gained experience of the accidents at nuclear facilities brings to the agenda the issue on the need to toughen the international instruments and to agree on binding standards as well as review and appraisal tools for Governments and companies that operate or schedule to construct and operate nuclear power plants. These requirements must assess and compare the achieved and the needed level of safety culture within their respective governments and companies that should be evaluated on the basis of international audit data.

7. The territories of potential radiation exposure during the accidents at various levels (including the most severe) at nuclear power plants and other nuclear facilities should be thoughtfully studied with respect of the geo-chemical and radio-ecological items. These territories should be covered by the certification and zoning in terms of potential risks, development of a complex of proposed immediate rehabilitation measures, economic costs and recommended preliminary efforts to ensure the preparedness for such events. All this should not be implemented during and after the accident, but beforehand, starting from the design, construction, and especially before the NPP operation.

8. For successful implementation of the Chernobyl NPP decommissioning tasks, the following is required:

- Solve the problem of damaged nuclear fuel cladding handling;
- Ensure the Cooling Pond safe decommissioning;
- Complete the construction of facilities designed for the radioactive waste management, which will be generated in the process of the Chernobyl NPP decommissioning and conversion of the Object "Shelter" into an environmentally safe system;

- To construct within the Chernobyl NPP Industrial Site a complex of engineering systems and structures, including integrated system of radioactive waste and spent nuclear fuel management, in order to ensure the work implementation on the Chernobyl NPP decommissioning and conversion of the Object “Shelter” into an environmentally safe system.

9. The Chernobyl NPP decommissioning should be integrated into the general strategy of activities at the Exclusion Zone and other projects aimed at the RAW management and ecological conditions improvement. The Chernobyl NPP shutdown has created significant social problems for the personnel and residents of Slavutich. The solution of these problems requires adequate and urgent actions by the Government, the private sector, participation of the business and financial structures, and international cooperation.

10. Work on the construction of new safe confinement (NSC) and conversion of the Object “Shelter” into an environmentally safe system requires comprehensive scientific support for the entire period of construction and operation. It is necessary to continue the nuclear fuel studies contained in the Object "Shelter", physical and chemical processes which change the FCM properties, migration of radionuclides in order to select the optimal strategy for fuel-containing materials management. The choice of technologies for the latter and timing for their implementation should in a mandatory manner be coordinated with the plans and capabilities of national infrastructure for managing high-radioactive waste, including their final disposal.

11. It is necessary to coordinate the efforts on the programs’ implementation designed for the radioactive waste management, and projects related to conversion of the Object “Shelter” into an environmentally safe system, as well as the Chernobyl NPP decommissioning at the national and international levels.

12. An adequate attention should be paid to the problems of financing the works and projects related to the Chernobyl NPP decommissioning and conversion of the Object “Shelter” into an environmentally safe system, both on the part of the Government of Ukraine and on the part of the other countries.

13. The main strategic objectives for conversion of the Object “Shelter” into an environmentally safe system are as follows:

- Completion of the NSC detailed design and construction;
- The Object “Shelter” unstable structures dismantling;
- Monitoring of the FCM condition for the purposes of their behavior prediction;
- Development of technologies and technical means for the FCM and long-lived RAW removal and further management (including containerization);
- Establishment of geologic storage for the FCM and long-lived RAW disposal within the framework of the National Program.

14. The Chernobyl Exclusion Zone establishment was forced and justified measure associated with a very high level of radioactive contamination of the territories. The existence of this zone was appropriate during twenty-five years and it will be necessary for many future decades. The territory of the Zone remains the epicenter of the major efforts to minimize the consequences of the accident via the Chernobyl NPP decommissioning, construction of corresponding facilities (NSC, various storages of radioactive waste, spent nuclear fuel, geological disposal of radioactive waste, the liquidation of the Cooling Pond, etc), which ensure nuclear and radiation safety, and significantly enhance the man-made barriers of the Zone. The Exclusion Zone is an effective natural barrier, the properties and processes of which shall be systematically studied and strengthened, if necessary. It is useful for the international community to consider this experience due to the potential accidents in the future.

15. Evaluation of the Chernobyl Exclusion Zone barrier function, its reliability, the natural recovery processes and justification of possible additional protection measures as well as their implementation should be an important complex task of national and international researches and applications now and in the future.

16. Rehabilitation of the contaminated territories of the Chernobyl Exclusion Zone and the Zone of Obligatory (Mandatory) Resettlement should be based on the natural recovery processes with a limited, focused human intervention. Return of lands to economic use should include the establishment of the specialized enterprises on the territory of Chernobyl NPP site and the Exclusion Zone which would ensure the employment of released ChNPP personnel and constructive use of the territory, buildings, and facilities in the country's economic activity.

17. So-called “auto rehabilitative” processes are the main ones regarding the normalization of radioecological situation within the large part of the Zone. They should be systematically studied, scientifically updated, and improved by special measures, carried out by the forest management and reclamation services with appropriate scientific support.

18. Along with strengthening of the Zone barrier function in relation to the radioactive contamination migration beyond its boundaries, more attention and effort should be made to prevent the negative impact of the Zone on the adjacent territories in the epidemiological, phytosanitary, epizootic, hydrochemical and other respects.

19. Monitoring the barrier function of the Exclusion Zone for radionuclides and the possible negative impact of the Zones on the adjacent territories in the epidemiological and other respects, generates a need to maintain the required level of functioning of an integrated radiological monitoring. The existing monitoring elements are not sufficient in respect of their completeness and coverage of the necessary observation elements, hence it is necessary to improve the system of radio-ecological monitoring of the Chernobyl Exclusion Zone, and other contaminated areas, via strengthening its predictive function needed to make effective management decisions.

20. Implementation of the activities aimed at the safe maintenance of the Zone causes the need for a permanent presence of qualified personnel there. Therefore, problem of a reliable radiation protection of the workers, which requires an appropriate institutional, social, and regulatory support, is still very topical.

21. In accordance with the adopted strategy for radioactive waste management, it is necessary to reopen the fund created for the radioactive waste management and begin the orderly implementation of tasks set by the Strategy and Program of work. Further delay with the full inventory and the elimination of items of the RAW temporary localization, construction of modern facilities for sorting, preparation and disposal of radioactive waste, carrying out an exploration work on the choice of places to construct a storage in a stable geological formations for high-level and long-lived wastes, all these, taking into account the changing climatic conditions and growth of natural accidents and emergencies, can lead to the deterioration of the Zone barrier function and to increase of its dangerous impact on populated areas, as well as to implementation disrupt and delay of the full range of measures on ecological rehabilitation of the territory.

22. The Exclusion Zone is a unique object of research, which is of a considerable interest to the international scientific community in many scientific fields, but primarily for Radiobiology and Radioecology. However, so far the conditions for a full-fledged research by foreign scientists have not been created there. Scientists from all around the world regularly come to the Exclusion Zone for the field observations, and they constantly face many inconveniences, such as unsuitability of local structures to full-fledged research and tolerating the forced episodic character of these trips. National experts almost ceased active research because of the lack of national research funding for the most part of the Chernobyl problems.

Within these circumstances, it is highly desirable to improve the situation significantly through the establishment of the International Scientific Center of the Chernobyl studies, which would be financed through a special international fund. The experts from different states and Ukraine would be able to work fully in such Centre, taking part in the development of joint research programs that are of fundamental and important applied nature. The already obtained research results show a high promise of such endeavors, both for international cooperation, and for Ukraine.

23. As a result of 25 year efforts in studying the health effects of Chernobyl disaster, our knowledge on health effects of ionizing radiation have been significantly expanded, as well as on the radiation risks of exposure with lower doses. Still there is controversy over many health consequences of the accident to date, and considerable variability in the assessment of the potential consequences in the future, which merits careful, well-designed direct studies of various health outcomes.

24. It is necessary to expand research of long-term effects of the acute radiation sickness taking into account the organ doses, and also to support survivors follow-up and medical care. This will provide a unique possibility to understand the biological relationship between cancer and non-cancer diseases and ionizing radiation.

25. It is necessary to monitor the incidence of leukemia among exposed due to the Chernobyl NPP disaster, especially the children, for timely patient identification and treatment.

26. The development of retrospective dose reconstruction techniques on the thyroid gland from incorporated radioiodine, as well as restoration of doses to critical organs should be considered as priorities in the field of dosimetry. The hard lessons of failed iodine prophylaxis in 1986, timely unrealized emergency action plans, mismanagement and concealing of information, still need the practical digestion and rigorous correction of the situation.

27. In the coming years, examinations for detection of thyroid cancer among particularly vulnerable subgroup of populations (children, adolescents and adults living in 1986 in the areas affected by radioactive fallout, and especially the children, exposed to high doses of radioactive iodine), who are subject to considerably higher risk than the general population, should be continued.

28. Hematological studies aimed at early diagnosis of leukemia, should cover all the liquidators who received the radiation doses above 100 mGy.

29. The further study of the possible link between non-tumor diseases, especially circulatory , with the exposure quantitative determination of the potential risks should be carried on.

30. It is necessary to expand research on biological markers of radiation, radiosensitivity, and radiation induced diseases to use them for the validation of the diagnoses and analytical studies.

31. The work in the field of risk communication, providing the public and decision-makers accurate information about the medical consequences of this disaster should be improved. The UN ICRIN (International Chernobyl Research and Information Network) program in Belarus, the Russian Federation and Ukraine and the network of UNESCO centers for psychological rehabilitation have shown their efficiency for public communication.

32. The recent researches demonstrate the need for paying more attention to the problem of protection from low dose exposure. The radiation protection should become one of the most important tasks of governments, international organizations and the international community at both local and global levels with prevention of the accidents such as Chernobyl or Fukushima-1 in Japan.

33. Despite the quarter-century distance that separates us from the time of the accident, the health effects prevention in the population living within contaminated areas is still

relevant. Medical and social care to the population living within the affected areas must be more interconnected. The presence of critical areas (tens of villages), where the local foods are still contaminated with radioactive cesium during the decades, should be the subject of a special radiation monitoring, higher social support and assistance, medical analysis and correction. It is necessary, in particular, to explicate an explanatory work with respect to the need for blanket distribution of preventive nutrition. The diet should be based on available products, but with extensive use of natural anticancerogenic, antioxidant, antimutagenic components.

34. The lessons of Chernobyl have to be specifically and (including medical measures) in full accounted for extension of operation time, design and construction of new NPPs. In particular, these designs should take into account the establishment and functioning of medical care system in case of great accidents as well as a system of prospective dose risk assessment, taking into account the possible levels of radiation damage and landscape-geochemical conditions of radionuclides migration in the system "soil - plant – food", etc.

35. Agricultural countermeasures ensured the decrease of ^{137}Cs content level in milk and meat in 4 -12 times and allowed preventing a large collective dose in each of the three affected countries. Non-compliance with priorities should be acknowledged as a serious drawback during the last stage of liquidation of the consequences of the Chernobyl accident. Very often, the work was carried out simultaneously on all fronts, despite the lack of funds. But the main lesson is that the Programs provided for a certain amount of work within the allocated funds, rather than achievement of a specific goal. In the subsequent period, it is necessary to provide the targeted financing and implementation of countermeasures. It is also necessary to make the measures implementation an absolute priority in settlements, where they continue consuming milk and some other products containing ^{137}Cs exceeding the norms.

36. Taking into account the significant improvements of radiation situation, it is reasonably to do the following: to revise the system of radiation monitoring of products' quality, concentrating the attention mainly in the most critical regions; to take measures for preservation of the experienced radiologists stuff and working capacity of veterinary and agronomic and radiological services throughout the zone of radioactive contamination; to provide for the work implementation on the storage, and centralized management of database and all the gathered information about the radiation situation. It is necessary to develop a program of scientific support work for the next period and to ensure its funding. Within the framework of the National program, it is reasonable to organize small-targeted programs and to control their progress strictly.

37. Economic development is a path to rehabilitation of the radioactively contaminated territories. The solution of a comprehensive rehabilitation problem of contaminated areas after the Chernobyl accident outside the Chernobyl Exclusion Zone, is possible in the long term via the following: development of agricultural production, a priority decision about the children nutrition, obtaining of a competitive and guaranteed clean agricultural products containing radionuclides below the state standards, economic development of the regions and improvement of living conditions for the population. Intensive countermeasures simultaneously with radioecological effects shall provide for a significant economic effect.

38. The development of territories removed from land-use must be justified by the conducting of radiation monitoring and agrochemical survey. It is necessary to create a program of scientific work support for the next period, including the performance of works on the databases centralized storage and management. During many years, the scientific support program included only the most pressing issues. Since 1998 – 2000, a reduction in funding of scientific support program was especially rapid. Targeted funding of scientific programs on the Chernobyl issues was discontinued. Many research teams and units specialized on the Chernobyl problems have been disintegrated. This is an irretrievable loss. It is also important

to keep the gained experience and knowledge on a reduction of the accident's impact. A list of urgent and obligatory for implementation topics should be established and adopted.

39. An atmosphere of trust and fellowship of scientists from Belarus, Russia, and Ukraine (all the information and development, knowledge and experience immediately become common property) contributed to the successful work on the radiation monitoring of agricultural areas, the development of criteria for assessing the radiation situation, the development and implementation of countermeasures during 25 years after the accident. It would be useful to establish an international project with participation of Belarus, Russia, Ukraine, and the European Community on the generalization of lessons learned, development of criteria, methodologies, and rehabilitation technologies of the territories removed from the land-use and removal of all restrictions from the affected areas.

40. The obtained new knowledge about the various effects of radiation impact on human being and biota indicate the vital importance of their further extension and development to protect life on Earth as a whole and to preserve the health of present and future generations of people in particular. Therefore, the creation and development of relevant international and national research programs based on already acquired knowledge is of the same priority as 10 or 20 years ago. The Conference's participants consider it necessary to discontinue the practice of the Chernobyl scientific research folding which unfortunately took place in the last time in countries such as Ukraine, which is the epicenter of the Chernobyl lesions and is in the most need of the results of these studies.

41. Complexity, importance, and diversity of problems originated as a result of the accident and that existed for a long time; make it necessary to maintain a high level of scientific research at present and in the future. International cooperation and commitment on improvement of the emergency preparedness system should be strengthened. It is advisable to improve the national and international coordination of such researches.