

THE PROBLEMS OF DECONTAMINATION AND RADIOACTIVE WASTE DISPOSAL IN BYELORUSSIA

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ABSTRACT

The accident at Chernobyl NPP has led to the release of radioactive materials and the contamination of huge territories, where hundreds of thousands inhabitants are living. The liquidation of the accidents results includes enormous volume of decontamination work done and still being done at the NPP site, in the evacuation zone and in the contaminated regions from which the population was not relocated. In the last case decontamination is one of the protective measures activities undertaken to ensure safety of the population. The complex of decontamination work and associated with it radioactive waste treatment and waste disposal claims for solving a number of technical and managerial problems, part of which should still be worked out.

INTRODUCTION

The accident at Chernobyl Unit 4 Nuclear Power Plant and the associated with it release of radioactive materials resulted in the contamination of not only the NPP site, but the huge territories located far away from the damaged reactor. Rehabilitation and cleaning-up work on these territories, which was done by the special military troops and by civilian defense troops, aimed at reducing irradiation of the population living on these territories and of the emergency personnel working on some highly contaminated territories. This work includes:

- decontamination of roads and suppression of dust generation;
- decontamination of territories;
- decontamination of buildings and industrial facilities;
- decontamination of transport and vehicles;
- collection and disposal of radioactive wastes.

Extremely large sizes of contaminated territories, fine dispersion of radioactive particles and their high permeability, especially in porous materials, high adsorption and retention ability of the contaminated surfaces present the main problem associated with this work. All these special features required special techniques and methodologies of decontamination, which did not exist at the moment since there was no need of them. Nevertheless it was necessary to solve these problems urgently and it was done with the aid of available technical means.

Decontamination of different objects was done taking into account the level of contamination and the reasons for the further use of these objects. This work was not carried out in the evacuation zone since no agricultural activities were expected in these areas in the near future. In slightly contaminated agricultural areas decontamination of the soil was done by means of deep ploughing. This is quite effective since radionuclides are concentrated in the top thin layer of the soil due to its high retention ability. After that further ploughing and treatment of the soil could not be deep to avoid mixing of clean and contaminated soils. Grazing-grounds could be used again after deep ploughing and sowing new grass. Four years control of the areas, where decontamination of the soil was carried out this way and in time show that this method is quite

effective and non-contaminated agricultural products can be obtained on these territories. However, it would be pointed out that if it was not done in time and the original thin top layer of the soil was damaged by ploughing or by wrong treatment, the method would not be effective.

Decontamination of villages and settlements included decontamination of roads, buildings and land. Land decontamination in the settlements included cutting of 10 cm top layer of the soil, covering the contaminated ground with 10 cm of non-contaminated soil or asphalt/concrete. Decontamination of buildings and building constructions was done by putting special adhesive film or pasta on the contaminated surface which adsorbed radioactive particles, and then could be deleted together with adsorbed radionuclides. However, this method was not effective since the radionuclides were adsorbed in the fine pores of constructive materials and they could not be extracted from them this way. The use of different liquid based compositions was also not effective. Besides, this method associates with collection and utilization of liquid waste that was also not an easy task. The most effective way for decontamination of constructive materials of porous nature (concrete, bricks) is grinding out the surface layer (1mm) together with radionuclides sorbed in it. But the broad use of this method is limited by obvious practical reasons. The effectiveness of the above mentioned methods is not very high. Decontamination coefficient varies from 2 to 7. In spite of the above mentioned difficulties and limitations 266 settlements were decontaminated in 1986. As a result radiation exposure rate was put down to 0.03-02 mR/h (7.8-52 nC/kg.h). In 1987 decontamination work was done together with reparation and modernization. 132 settlements and 27,000 km of roads were decontaminated, that resulted in radioactive waste (contaminated soil, garbage and scrap) generation of 220,000 m³. In 1988 440 settlements were decontaminated. It is necessary to point out that as decontamination work in 1986-87 was carried out in relatively highly contaminated areas, the level of contamination in the treated settlements in 1988 was rather low, and thus the effectiveness of decontamination work was also very low. Recontamination of the objects through dust transfer from the contaminated land made decontamination work not effective and not reasonable. Nevertheless, this work was continued till 1989 in 415 settlements upon the request of local authorities and public. An in 1989 it was stopped because of enormous expenditures for it and its low effectiveness.

A lot of engineering, chemical and building machinery and vehicles were used for emergency work in the contaminated zone. Their decontamination was done periodically to prevent overexposure of the personnel working with those techniques. For this purpose special sites with necessary equipment were constructed. To prevent cross contamination and transfer of radioactivity from one area to another the movement of machinery between different zones was limited. In such cases when this movement was necessary decontamination was provided to prevent the transfer of radionuclides from more radioactive to less radioactive zone. The main part of this work was done by special military troops using military machinery and equipment. When the broad scale decontamination work was finished practically all decontamination sites and equipment were dismantled.

The analyses of the present situation has shown that the problem of machinery and vehicles decontamination does not practically exist. It goes along with the fact that emergency and managerial activities in the contaminated areas are now practically stopped. However, we have information that if some vehicles, for example, railway locomotives, are crossing the affected areas the contamination of cooling and ventilation systems of them can exceed the permitted level. In this connection the recommendations for protection, control and decontamination of such vehicles are being developed now.

As it was mentioned before in the process of decontamination a lot of radioactive waste was generated, which had to be properly treated and disposed of. However, the republic did not have and does not have special disposal facilities for radioactive waste now, except small repository for disposal of research institutional wastes. Therefore wastes generated during decontamination and rehabilitation work were collected in the so-called "temporary storage places". Usually for these purposes man-made or natural trenches of ravines were used. Radioactive waste (contaminated soil, scrap and garbage) was placed into these trenches without necessary hydroisolation, without inventory and characterization of waste, without appropriate records of basic control data. At present about 100 "temporary storage places" exist in the republic. There is no accurate information about these storage places, therefore it is difficult to evaluate their potential safety or danger for the environment and the people. The lack of necessary information and documentation the possible lack of protective barriers could be explained by the lack of technical regulations for this kind of work and the urgency of its organization and implementation. Besides, there was no official governmental structures to control this work. Additional analyses of these "storage places" is needed for the evaluation of their safety and for preparation of waste retrieval proposals or construction of additional protective barriers (2).

In spite of full scale decontamination activities in the republic during a number of years the necessity of additional work on decontamination still exists together with the work on waste treatment and waste disposal (3-5). First of all it deals with decontamination of industrial facilities, which still are contaminated or recontaminated. In many cases radioactive dust or other kinds of contamination could be collected in the ventilation or air conditioning systems, which cause increased radiation exposure of working personnel. To evaluate the real scale of this problem additional information and inventory of possible contaminated facilities are needed. This information will allow to estimate the problem, the volume and the char-

acter of wastes generated in the process of future decontamination work, to formulate proposals for their treatment, conditioning and disposal. So far there is no clear understanding of this problem.

Apart from decontamination of settlements, industrial facilities and inventory of "temporary storage places" a new problem has recently appeared in the republic. It deals with protection or destruction of evacuated villages and settlements in the contaminated areas in connection with the hiding of criminals, illegal production of drugs, alcohol, etc. in the evacuated areas. We have information about unauthorized disassembling of houses in evacuated areas and illegal trade of contaminated construction materials. There are two ways of preventing the illegal business on the contaminated territories: to establish police patrol and to guard these territories or to dismantle and dispose of all the houses, buildings and facilities in these zones. Both of these possibilities are quite expensive and before making final decisions this problem is under discussion and evaluation.

Another problem which finds understanding and support from the Government and specialists is decontamination of objects having high historical or art value, which should be preserved on the contaminated territories (architectural or historic monuments) or decontaminated without spoiling their art nature. Special committee was established to investigate and evaluate these objects and to prepare special catalogue of them. The Academy of Science together with restorers are now developing special decontamination compositions for pictures, icons and other specific objects (2).

Evaluating the problem of radioactive wastes management on the territory of Byelorussia it should be pointed out that in 5 years after the accident the clear understanding of the present and, especially, future situation on this problem does not still exist. The practice of decontamination has shown that radioactivity level of the generated waste is low and often it goes below the lowest level determined for the industrial low level wastes. At the same time the character of these wastes does not allow to treat them for volume reduction and radioactivity concentration by reasonable means. This deals mainly with contaminated soil, gravel, constructive materials, scrap and other non-combustible and non-compressible wastes. As for combustible waste, different techniques for incineration are under design, which will consider heat utilization and solidification of ashes. Final decision about the construction of these facilities will be taken after the inventory of all sources of combustible waste and economic evaluation of the process.

The organizing difficulties of decontamination work and radioactive waste management in the republic are dealing with the lack of special legislative acts, which could regulate all these activities. Not long ago preparation of legislative package was started, which may include Radiation Protection Act, Radioactive Waste Treatment and Disposal Act, Nuclear Energy Development Act. At the same time some documents for the regulation of practical work including the concept for management of radioactive waste, recommendations for dismantling of the relocated settlements and for disposal of radioactive wastes are under preparation. This work needs time to be completed, time is also needed for the education and training of the personnel and for establishing appropriate control bodies on the government level. Since the republic has not much experience in this field any help and assistance on the subject will be appreciated.

CONCLUSIONS

Intensive efforts were undertaken to minimize the consequences of the Chernobyl accident and its impact on health conditions of the population. Decontamination of the affected areas was carried out during 1986-1989. Further work on decontamination will be concentrated on the specific local objects which could substantially reduce radiation exposure of the public and the personnel. The problem of waste disposal, dismantling of the relocated settlements, legal regulation of this work is now under evaluation and development.

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