EARLY MEASUREMENTS IN URBAN AREAS AFTER THE CHERNOBYL ACCIDENT

XA0054873

I. LIKHTAREV, et al.
Scientific Center for Radiation Medicine,
Kiev, Ukraine

Abstract

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This paper summarises the experience on the radioactive monitoring of the environment and population dose assessment provided in urban areas, mainly in Kiev, after the Chernobyl accident. It emphasises the need of several radiological teams, of the support from several institutions and of preparedness for a consistent database, dose assessment and criteria for decision making. Main results of measurements of gamma exposure rates, air, grass and food radioactive contamination are presented.

1. INTRODUCTION

Kiev is the biggest city in Ukraine, which is located in a distance of about 120 km from the Chernobyl NPP. The population in Kiev consisted of more than 3 mln people in 1986.

The intensity and the type of radioactive monitoring were very dependent on the phase of the Chernobyl accident [1]: super-early, iodine, phase of alternative dose-rate and formed radioactive track, long-lived debris phase. Each of these phases themselves (because of different time-interval and radionuclide composition in depositions) have been characterised by a different structure of internal and external sources of exposure [2].

Organizations which provided the radioactive monitoring of environment, foodstuffs and exposure of inhabitancies are shown on Fig.1. Two Ministers had been mainly responsible for more important types of monitoring. The first one was the State Committee on Hydrometeorology which controlled the radionuclide depositions on the ground and gamma-

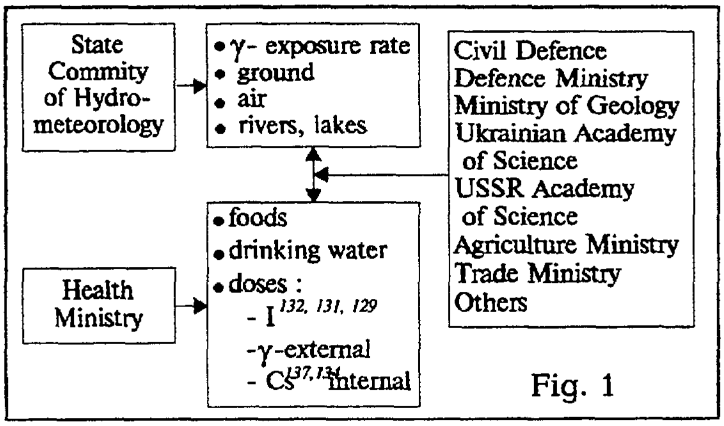

Fig. 1

exposure rate in the air. The second one was the Health Ministry which arranged the regulatory control on the exposure of members of the public, radioactive contamination of foodstuffs and drinking water.

Because of the very wide scale of the accident the radiological teams from Civil Defence and Defence Ministry as well as the radiological groups from the Ministry of

Geology and Scientific Institutes of Ukraine and former Soviet Union (Moscow, Leningrad, Cheljabinsk) also took part in providing the monitoring.

The **gamma-exposure rate** was measured by the groups from the State Committee of Hydrometeorology just after the accident. The results of daily gamma-exposure rate measurements at some meteorological areas in Kiev, nearest towns (Jagotin, Teterev) and in Chernobyl and Polesskoe (located at a distance of 40 km from Chernobyl) are presented at Fig.2. As it follows from these results the real increase of gamma-exposure rate in Kiev was registered not earlier than 30 April of 1986 (Southern track), but on the West track (Polesskoe) the exposure rate had been risen already on 26 April 1986. Besides, stationary investigation points for mass gamma-exposure rate monitoring had been created by the special radiological groups of "land control" and by the aerogamma-measurement's groups from

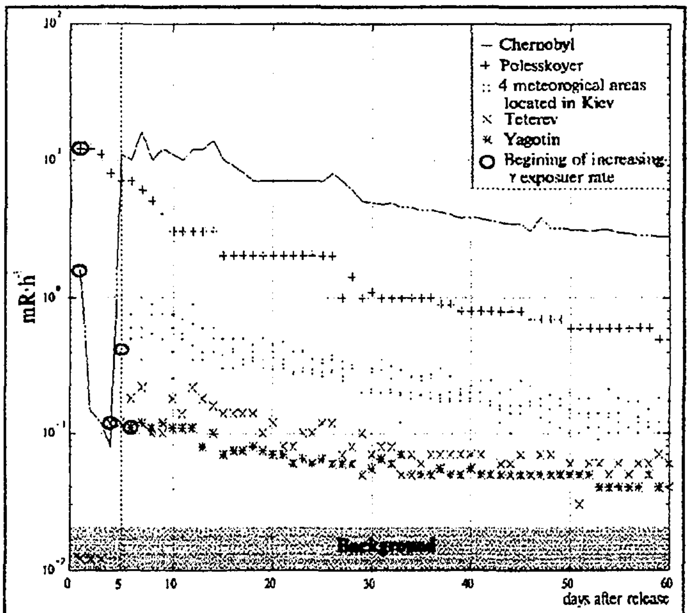

Fig.2.

Civil Defence and Chernobyl NPP on the whole territory of Ukraine including Pripjat town and the 30-km zone [3,4]. In Fig.3. the plan of Pripjat-town and the every hour gamma-exposure rate measurements points are shown. Those measure ments were made by two dosimetric teams (first one-o, second one-Δ). For some measurement points the time-dynamic of exposure rates are also presented. As it follows from the data the gamma-exposure rate in the Southeast areas of town at the time of evacuation rose 8 mGy h^{-1}.

β-emitters monitoring on the surface had been done mainly for the detection of small local radioactive spots. It was very important for the buildings which had been under the building (multiflats buildings, schools, kindergartens) and became very contaminated outside and inside. The discovered radioactive spots were than decontaminated by using special developed methods.

Permanent gamma-control of the tracks and cars which came in from the other territories had been provided at the special posts located just near the highways around Kiev and other big cities. At these posts the special wash-decontaminated systems were working. The main aim of those posts was the prevention of delivered radioactive contamination in the cities and towns.

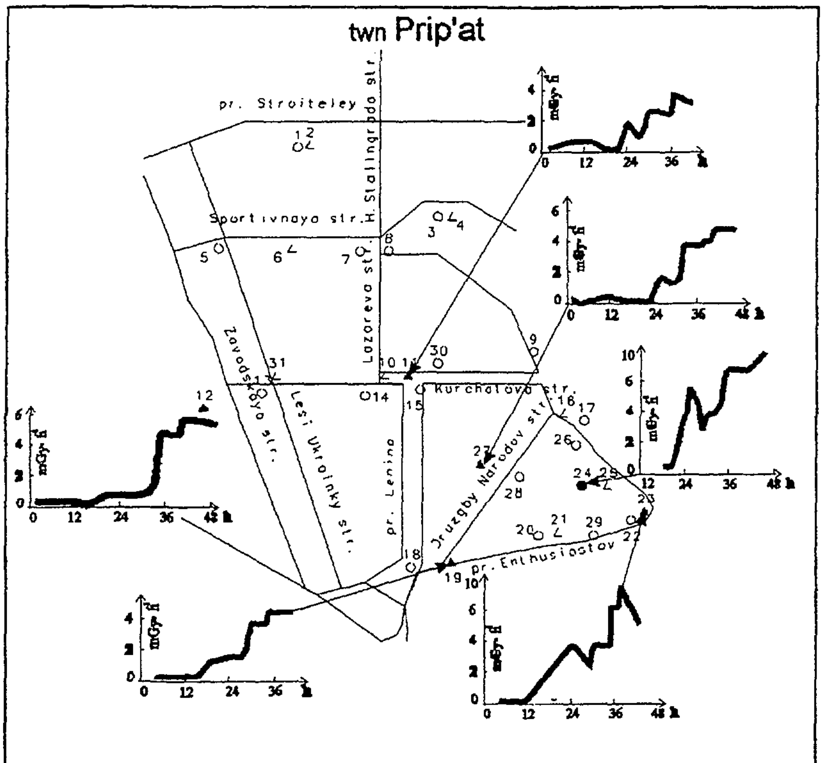

Fig.3.

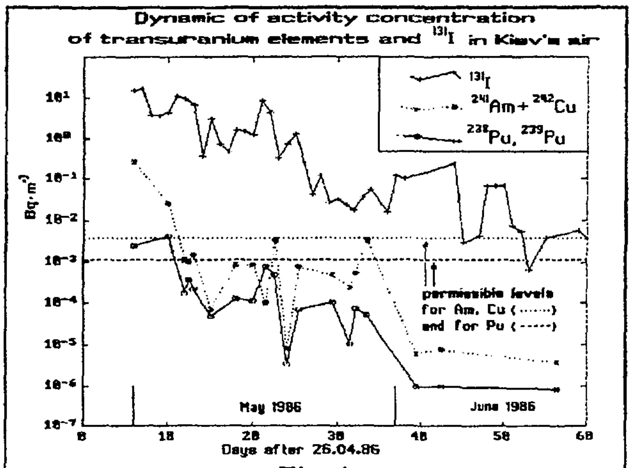

Fig.4.

Air radioactive contamination measurements which used sedimentation and aspiration methods had been provided at several points in Kiev. Some results of radioactive air measurements are presented on Fig.4. Specific activity in air for ^{131}I are presented without taking into account the retention coefficient of the filters. So the real concentration of ^{131}I in air may be in ten or more times higher.

The radioactive monitoring of leaves and grass in the green zones in Kiev made during the entire summer-time of 1986 (Fig.6.).

Foodstuffs and drinking water monitoring in Kiev had been organised by the Sanitary-Epidemiological stations which were under the Health Ministry and by the organizations which were responsible for the production and distribution of foodstuffs and drinking water. These were the Agriculture Ministry and the Trade Ministry.

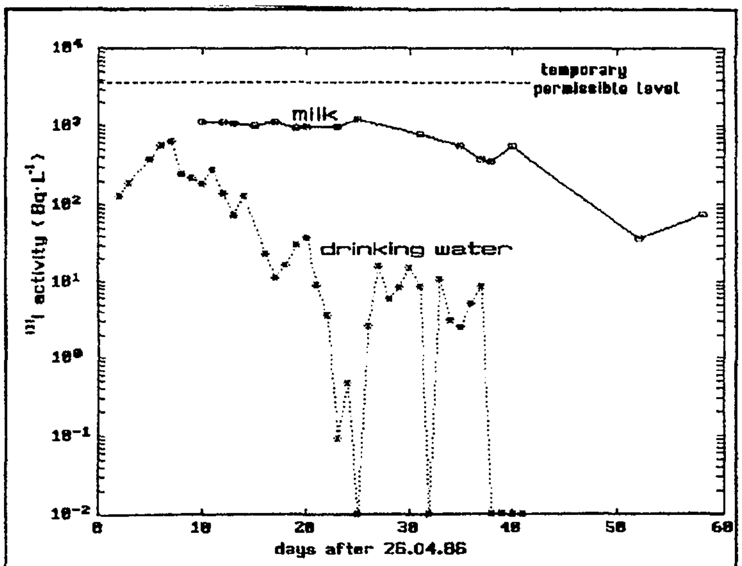

Fig.5.

The results of mass milk and drink water radioiodine monitoring in Kiev are shown on Fig.5. Two measurement systems were used, at that time, which were the energy- selected radiometers for mass screening and more precise gamma-spectrometry systems.

The special type of foodstuff control dealt with the permanent young bull radiocaesium body burden monitoring and monitoring of meat delivered to the province meat products plants. Besides, at all the agricultural food markets in Kiev and other towns the special groups, which provided the radioactive control of selling foods, had been organised. So only foodstuffs (vegetables, fruits, milk and meat products) which obtained the special radiological certificates could be sold.

The main results of the complex monitoring of air, water, soil, leaves, milk, meat and vegetables in Kiev at the early stage of the accident (May 1986) are presented in Fig.6. For all the soil and all the foods the ^{90}Sr. specific activity was at one-two powers low than the ^{137}Cs and ^{131}I specific activities.

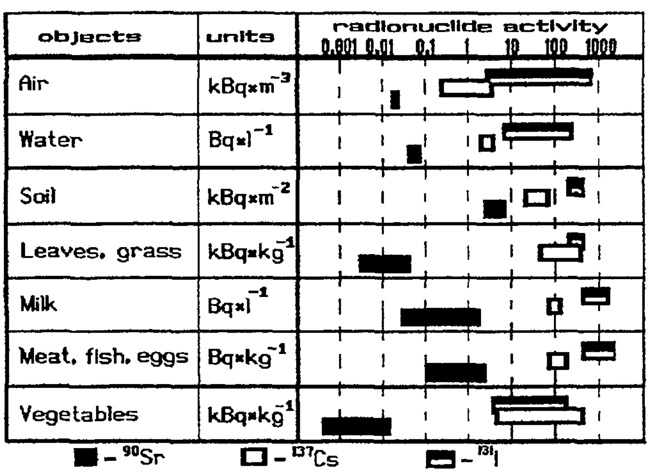

Fig.6.

Exposure of members of the public had been controlled by three types of permanent dosimetric monitoring.

• The assessment of external exposure of inhabitancies at the early stage (1986) made by calculation method, using the information on the gamma-exposure rate. (Fig.2.,3.) Later, those results had been used as the background for the evaluation of retrospective external exposure model parameters (behaviour coefficient, location and time factors [6]). First TLD measurements had been done among the inhabitancies of Polesskoe in September 1987.

• Thyroid exposure measurements were arranged by more than 100 dosimetric groups which provided the mass thyroid measurements among the inhabitancies of Kiev, another cities and settlements at the Ukraine during May–June 1986. [7,8]. As an example, the distribution of the results of those measurements for the children of Kiev are shown at Fig.7.

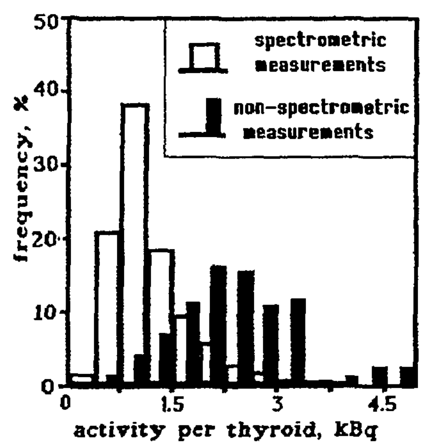

Fig.7.

• WBC-monitoring [4] of radiocaesium body burden among different population groups had been arranged just at the beginning of June 1986. Already in June 1986 the number of used WBC's (stationer, mobile and moving) exceeded the 54 units. The special system for their standardisation and intercalibration had been created. That system had four levels which were differentiated by the precision of WBC, their sensitivity and mobility. More than 140 thousand persons (90 thousands children) had been measured by February of 1987 at the contaminated territories.

2. CONCLUSIONS

It's very difficult to give a detailed description of the entire structure and all the equipment that has been used during the postaccidental monitoring after the Chernobyl accident. But now three very important conclusions may be drawn as a result of the Chernobyl experience.

• At the early stage of the accident thousands and millions of different types of measurements had been made. But a standardised common system for the selection of the more important types and the necessary scale of monitoring and control was absent. So, for instance, a lot of soil measurements had been examined, but at the same time extremely small measurements of air-samples were provided. That is why in cases where the main source of internal exposure was inhalation the dose reconstruction still left one very difficult problem.

• Absence of an automatic alarm-system made the quick reaction on the moving of radioactive cloud and changing the radioactive situation very difficult.

• At least, because of the absence of a good computer system for the fast estimation of the radiation and dosimetric situation, the main criterion for decision making was the qualification and skill of the experts (decision makers) who worked at different accidental centres.

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