LONG-TERM INDOOR RADON MEASUREMENTS IN THE CHELYABINSK REGION

Albert M. Marennyy
radprog@rambler.ru
amarennyy@gruppa-rei.ru

MARENNYY A.M.[1,2], ANDREEV N.M.[3],GUBIN A.T.[1], SAKOVICH V.A.[1], DMITRIEV V.A.[2], KISELEV S.M.[4], MARENNYY M.A.[2], NEFEDOV N.A.[1], PENEZEV A.V.[1], SCHKUROPAT D.I.[2]

[1]*FEDERAL STATE UNITARY ENTERPRISE RESEARCH AND TECHNICAL CENTER OF RADIATION-CHEMICAL SAFETY AND HYGIENE (FSE RTC RCSH), MOSCOW;*
[2] *LLC «GROUP REI», MOSCOW;*
[3]*LLC «RADIOECOLOGICAL LABORATORY MGRT», MIASS;*
[4] *BURNASYAN FEDERAL MEDICAL BIOPHYSICAL CENTRE, FMBA RUSSIA, MOSCOW*

1. INTRODUCTION

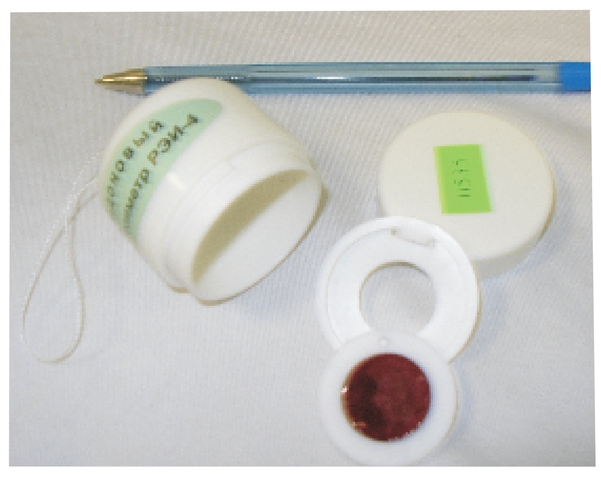
AT THE TERRITORY OF THE CHELYABINSK REGION (URAL MOUNTAINS) THE RAISED NATURAL RADIATION BACKGROUND IS OCCURED. RADON SURVEYS WERE CONDUCTED IN ACCORDANCE WITH SPECIAL PROGRAM IN THE FRAME OF FTP «NUCLEAR AND RADIATION SAFETY ASSURANCE».

2. OBJECTIVES

DEFINITION OF ANNUAL AVERAGED VALUES OF VOLUME RADON ACTIVITY WITH THE SUBSEQUENT ESTIMATION EEC (EQUILIBRIUM EQUIVALENT CONCENTRATION) AND THE ED (EFFECTIVE DOSE) ON RADON EXPOSURE OF THE POPULATION IN DWELLINGS AND PUBLIC BUILDINGS AT THE CHELYABINSK REGION.

3. METHODS

LONG TERM INDOOR RADON MEASUREMENTS USING THE INTEGRAL TRACK DETECTORS CHAMBERS REI-4 (FIGURE LEFT) AND TRACK-REI-1M EQUIPMENT KIT (LLC «GROUP REI», RUSSIA) WERE CARRIED OUT OVER TWO-FOUR MONTHS ACCOMPANIED WITH INSPECTIVE MEASUREMENTS OF RADON AND ITS PROGENIES. THE VALUE OF F=0.5 IS CONSIDERED AS TYPICAL VALUE FOR THE URALS REGION. IN CALCULATIONS DOSE CONVERSION COEFFICIENT TO = 0.1584 WAS USED. RESULTS OF ALL SURVEYS ARE ACCUMULATTED IN THE DATABASE ESTABLISHED BY THE FSE RTC RCSH.



4. RESULTS

RADON SURVEYS WERE CONDUCTED IN DWELLINGS OF ABOUT 100 SETTLEMENTS OVER FOUR SEASONS: SUMMER 2008 (700 DWELLINGS), WINTER 2008-2009 (800 DWELLINGS), SUMMER-AUTUMN 2009 (800 DWELLINGS), WINTER 2009-2010 (800 DWELLINGS).

IT WAS ESTIMATED, THAT THE MEAN EEC $_{WINTER}$ / EEC $_{SUMMER}$ RATIO FOR DIFFERENT SETTLEMENTS IS OVER THE RANGE 0.9-8. THIS RATIO FOR THE CITIES AND URBAN- TYPE SETTLEMENTS IS WITHIN THE RANGE 1.5-2.5 AND PROVED TO BE LOWER THAN IN RURAL COMMUNITIES. IT WAS SHOWN THAT IN CHELYABINSK REGION AS A WHOLE SEASONAL VALUES OF EEC VARIED OVER THE RANGE OF 10-2000 BQ/M^3. THE VALUES ABOVE 200 BQ/M^3 WERE OBSERVED IN 10% OF DWELLINGS, EXCEEDING THE GUIDELINE VALUES ESTABLISHED BY THE RUSSIAN SAFETY STANDARDS (NRB 99/2010). THE MEAN EEC VALUES EXCEED THE NATIONAL AND WORLD EEC REPORTED BY UNSCEAR AND ARE ESTIMATED AS 65, 94 AND 80 БК/M^3 FOR SUMMER, WINTER SEASONS AND AT ANNUAL AVERAGING, RESPECTIVELY. ACCORDING TO RESULTS OF THE SURVEY, THE PERCENTAGE OF HOMES IN DIFFERENT SETTLEMENTS WITH THE MEASURED EEC VALUES FROM 200 TO 400 BQ/M^3 AND ABOVE 400 BQ/M^3 WAS ESTIMATED AT THE RANGES OF SEVERAL TO 40 % AND 1-10%, RESPECTIVELY. THE EFFECTIVE DOSE OF RADON INDUCED ANNUAL EXPOSURE FOR THE PUBLIC IN DWELLINGS WAS DISTRIBUTED AS 75 % (LOWER 5 MSV), 16% (5-10 MSV), 9% (ABOVE 10 MSV) ACCORDING TO THE FINDINGS OF AT LEAST TWO SEASON MEASUREMENTS. IN THE TABLE RIGHT VALUES OF RADON EEC AND ED IN SOME SETTLEMENTS, CALCULATED ON MEASUREMENTS IN DWELLINGS NOT LESS THAN DURING TWO SEASONS ARE PRESENTED.

Settlement	EEC, Bq/m^3		ED, mSv/year	
	Range	Arithmeti-cal mean	Range	Arithmeti-cal mean
Bredi	10 -1084	240	1.9 - 73	15
Zlatoust	15 - 707	75	1.1 - 45	4,8
Miass	8 - 1100	151	0.6 - 70	9,7
Plast	35 -1900	210	2.3 - 75	13
Tchebarkul	16 - 1100	141	1.1 - 67	9
Tchelyabinsk	9 - 944	69	0.7 - 63	4,5

5. CONCLUSIONS

RADON SURVEYS WERE CONDUCTED IN DWELLINGS OF ABOUT 100 SETTLEMENTS OF CHELYABINSK REGION OVER FOUR SEASONS. THE EVIDENCE ON THE HEAVY RADON SITUATION IN A NUMBER OF SETTLEMENTS OF THE CHELYABINSK REGION IS RECEIVED.
RADON INDUCED ANNUAL EXPOSURE FOR THE POPULATION VARIED OVER THE WIDE RANGE 0.6-75 MSV. HAVING IN MIND THE DATA OBTAINED THE CONSIDERABLE AMOUNT OF DWELLINGS NEED TO BE REMEDIED .