

DIRECT AND INDIRECT RADIOTOXICOLOGICAL INVESTIGATIONS ON
PEOPLE COMING FROM EASTERN EUROPE AFTER THE CHERNOBYL ACCIDENT

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Starting from May 2, 1986 many Italian tourists and some Italian workers living in Eastern Europe during the Chernobyl accident were checked for internal radiocontamination at the Medical and Radiotoxicological Service of C.R.E. Casaccia, ENEA, Rome.

As the local W.B.C. was overloaded with many measures to be done within a few days, a simple equipment was installed for a rapid detection of I-131 in thyroid. This equipment consisted of a collimated and shielded 3"x3" NaI(Tl) detector having a sensitivity of 37 Bq for a 10' counting time (Fig.1); a counting efficiency of 3.7 % was calculated with a calibrated I-131 source having the thyroid geometry.

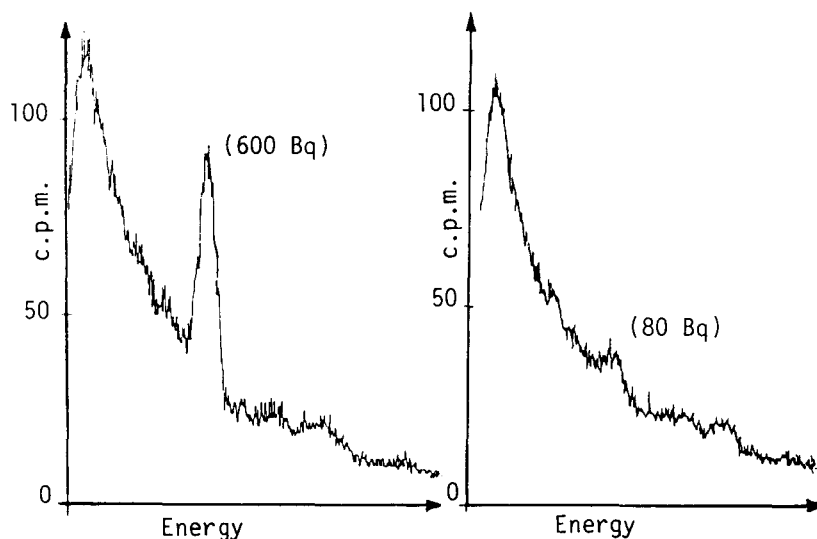


Fig. 1 Gamma spectra of I-131 in thyroid (600 and 80 Bq)

Only people showing a thyroid burden higher than 370 Bq were sent to the W.B.C. for longer and more accurate measurements. The thyroid burden ranged from 37 to 3330 Bq at the measurement time depending on the geographic region and on the winds direction.

DIRECT RADIOMETRIC RESULTS

As Table I shows, the checked people could be subdivided into four groups, namely : 1) Kiev region ; 2) Poland; 3) Hungary - Czechoslovakia - Austria - Rumania - Eastern Germany; 4) Moscow - Leningrad. To these groups a fifth group was added consisting of people living in Rome. Furthermore the I-131 burden at the moment of the probable acute contamination was calculated taking into account the cloud transit time on the region (1).

TABLE I
I-131 THYROID BURDEN (Bq) IN FIVE GROUPS OF
PEOPLE COMING FROM DIFFERENT GEOGRAPHIC REGION

Gr n.	Region and number of checked people	Measure date interval (May 1986)	Mean value at the measure date	Radioactive cloud transit date	Mean corrected value	Ratio Gr.n — Gr.4
1	Kiev (11)	8-12	1594	27/4/86	4972	26.1
2	Poland (46)	3-21	548	30/4/86	1266	6.7
3	Other East Countries (77)	3-19	229	30/4/86	502	2.6
4	Moscow Leningrad (37)	4-12	81	30/4/86	190	1.0
5	Rome (35)	6-21	135	1/5/86	350	1.8

As the winds direction was North-West from Chernobyl in a first time and South-West in a second time, it is not surprising that people living in Moscow-Leningrad were less contaminated than the ones living in Rome.

The I-131 burdens calculated by this simple device were found in good agreement with the ones obtained by some Italian W.B.C. systems located in Rome, Bologna, Bosco Marengo, Ispra (2-5).

The thyroid committed doses calculated for the five group were respectively : 7.96 ; 2.03 ; 0.80 ; 0.30 ; 0.56 mSv.

INDIRECT RADIOTOXICOLOGICAL RESULTS

Some indirect radiotoxicological analyses (urine and faeces) were carried out on people showing a sensible thyroid contamination, i.e. gamma spectrometry with Ge(Li), Sr-90 and Pu-239 (Pu-240). As table II shows the following gamma emitters were detected in the urine: I-131, Cs-137, Cs-134, Te-132, Ru-103, while Sr-90 and plutonium concentrations were found to be lower than the detection limits. The above said radionuclides, more Ba-140 and La-140, were found in group 1 faeces, while plutonium was ever lower than the detection limit (Table III).

TABLE II
URINARY EXCRETION MEAN VALUES (Bq)
(number of analyses)

Gr	Date May '86	I-131	Cs-137	Cs-134	Te-132	Ru-103	Sr-90	Pu-239 (240)	$\frac{\text{Cs-137}}{\text{Cs-134}}$
1	8-14	17.0 (10)	5.2 (10)	3.0 (2)	6.5 (10)	13.6 (3)	<4 E-2 (5)	<4 E-4 (4)	1.9 (2)
2	2-14	37.0 (29)	4.1 (29)	—	15.1 (29)	—	—	—	—
3	3-8	26.4 (11)	1.2 (11)	—	10.8 (11)	—	—	—	—

TABLE III

FAECAL EXCRETION MEAN VALUE (Bq) FOR GROUP 1 (DATE 9-14 MAY 1986)
(number of analyses)

I-131	Cs-137	Cs-134	Te-132	Ru-103	La-140	Ba-140	Pu-239 (240)
4.4 (2)	1.7 (4)	0.7 (4)	8.5 (2)	4.6 (4)	21.8 (1)	10.4 (1)	<2 E-3 (3)
RATIOS	$\frac{\text{Cs-137(F)}}{\text{Cs-134(F)}}$	$\frac{\text{I-131(U)}}{\text{I-131(F)}}$	$\frac{\text{Cs-137(U)}}{\text{Cs-137(F)}}$	$\frac{\text{Te-132(U)}}{\text{Te-132(F)}}$			
	2.1 (4)	8.5 (1)	1.6 (1)	0.8 (2)			

The ratio Cs-137 / Cs-134 in urines and faeces resulted to be about 2, as found in many other contaminated environmental samples. The ratios Urinary Excretion / Faecal Excretion for I-131, Cs-137 and Te-132, also reported in Table III, were found to be within the values reported in the literature (6).

In many cases it was possible to calculate the actual ratio : I-131 in thyroid / I-131 in the 24 hour urinary excretion (Table IV) obtaining a mean value equal to 62. However it was necessary to correct this value by subtracting the relevant activity found in thyroid and urine of the Roman population which also suffered a small internal contamination by inhalation and ingestion. As a matter of fact the direct and indirect checks were carried out after a some days staying in Rome. As an example Fig 2 shows the I-131 urinary excretion for the local population in the period 3-19 May 1986. The corrected ratio reaches the value of 116 which is quite similar to that (~150) reported in the literature (6).

TABLE IV

I-131 (THYROID)
 RATIO I-131 (URINE)

Group	n.	Date May '86	Uncorrected value	Value corrected by subtracting the Rome blanks
1	10	8-12	89	104
2	12	3-17	57	143
3	7	3-6	41	100
Mean (29)			62	116
Weighted Mean			64	119

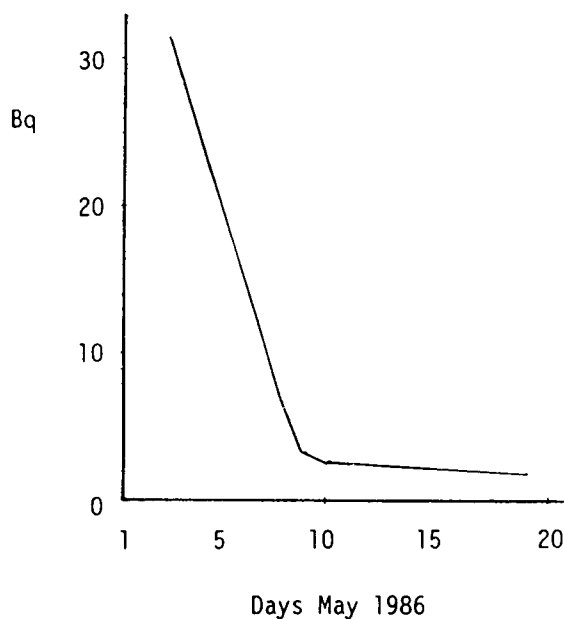


Fig.2 I-131 daily urinary excretion for people living in Rome

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