# D. Internal Radiation Dose and Biology

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ASSESMENT OF Kr-81m CONCENTRATION IN BLOOD FOR INHALATION AND I.V. INJECTION : EVALUATION IN ANIMAL MODELS AND CALCULATION OF INTERNAL RADIATION DOSE IN HUMANS.

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A Kr-81m generator can be applied to the evaluation of pulmonary function with two different methods (inhalation and i.v.injection). Currently, we have measured the blood concentration of Kr-81m during and after administration with each method in animals(rats and guinea pigs). The partition coefficient of Kr-81m between the inhaled air and blood was obtained for equilibrium rebreathing, and the resultant value[( $3.2 \pm 0.3) \times 10^{-3}$] was identical between the two animal species. The clearance curves of activity in blood after inhalation or i.v. injection could be fitted with binominal exponential curves with an initial effective half-life of about 9 and 7 sec, respectively.

For the calculation of internal radiation dose in humans, we have set up two breathing models(single breath and equil. rebreathing) and two i.v.injection models(bolus and ordinary inj.) to simulate the actual conditions and techniques of clinical diagnosis. Our experimental data and the report on metabolism in humans were used for the calculation.

Absorbed Dose Estimation (mRad/mCi)

| | Inhalation | | I.V. injection | |
|---|---|---|---|---|
| Organs | Single B. | Eq. Reb. | Bolus | Ordinary |
| Lungs | 0.49 | 1.70 | 0.46 | 1.69 |
| T.Body | 0.001 | 0.004 | 0.001 | 0.004 |

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A CASE STUDY ON THE METABOLISM OF $^{75}$SELENOMETHIONINE AND ITS COMPARISON TO THAT IN MIRD PAMPH. No.9.

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A follow-up study on the remaining activity,distribution pattern and organ doses of $^{75}$Se in a male worker has been made,who was intravenously injected 250 μCi of $^{75}$Selenomthionine for the test of pancreas. The measurings were conducted 5 times from his 43rd day of injection to 245th day for his whole body, abdominal part and 12 points at every 10 cm from the head top, by using the whole body counter with 5"Ø x 4" NaI(Tl) Scintillation detector having 1" lead collimeter in an iron chamber of the P.N.C.# The results were then compared to those of the MIRD Pamph.No.9. $^{75}$Se in the body was apparently translocated from liver part on 40th day to great muscular regions on 200th day. Remaining activities in the whole body, liver part and great muscular regions seemed to have biological half lives of 190d,113d, and 122d respectively and those in the whole body decreased in 2 phasic exponential function, A(t)=44.4 exp(-0.693/43.3 x t)+ 62.5 exp(-0.693/190 x t) [t=day], The results agrees fairly well with those of metabolism of $^{75}$Se indicated by the MIRD. Accordingly the doses in main organs of the man were estimated by using parameters of the MIRD Pamph.No.9

Urine analysis also showed that the excretion of $^{75}$Se was simulated as 2 phasic exponential function, having half lives of 15d and 79d respectively until 245th day. The calculation of doses in main organs reveals that liver, kidney and spleen receive greater doses, ca.6 - 4 rem per 250 μCi injection, but it should be noted that the testis receives 2.8 rem and blood 2.3 rem respectively.

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PROBLEMS OF RADIATION MONITORING SYSTEM.

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Based on our 4year experieence(Nov.,1975 ~ June,1979) with radiation monitouring system(Fuji elec.),problems in the performance and manegement of the system were analysed. In order to monitor the radiationin total of 1160m$^2$ including 3 separate division,i.e. nuclear medicine (780m$^2$), RI therapy(230m$^2$) and RI laboratory(150m$^2$),the following facilities have been used: 1) γ-ray area monitor 18 2) γ-ray water monitor 1 3) β-ray water monitor 1 4) Dust monitor 2 5)Gas monitor 3 6)Portable gas monitor 1 7) Hand foot cross monitor 3 8)Central guard board 1 9) Local guard board 2 10) Drainnage manegement Tank and equipment controlling them 11)and others. specially speaking, problems mentioned below was investigated mainly. 1) stability and detecting sensitivity of the equipments 2)method and intervals for calibrating detectors 3) radiation level for alarm 4) maintenance such as exchange of filter and drainnage. Alarms were most frequently caused by the overflow of the critical water level in the drainage tanks. Exist of patient under treatment from the division of RI therapy was notified by alarm. In addition there were 11 cases notified by the alarm, which were useful from the stand point of radiation protection. Other occasion notified by the alarm include troubles in the system ( 11 times), unknown causes(12 times) and other miscelaneous causes(14 times).

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SURFACE CONTAMINATION ON FLOOR INSIDE CONTROLLED AREA.

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Surface contamination of radionuclides on floor inside the controlled area was measured using a pulse-height spectra with a Ge (Li) spectrometer. Whereas the smear test was negative, contamination of Tc-99m, I-131 and In-111 was detected on the plastic floor mat made by polypropyren and polyethylene located at boundary and workplace inside the controlled area. The maximum density of surface contamination of Tc-99m, I-131 and In-111 on boundary of the controlled area was below the figures limited by the law and $3.2 \times 10^{-6}$, $1.2 \times 10^{-7}$, $8.5 \times 10^{-6}$ μCi/cm$^2$, respectively. Although the present law has some contradiction and must be corrected, our results suggest that we must change the slippers at boundary of the controlled area.