

## EARLY BIOLOGICAL DOSIMETRY IN CHERNOBYL GROUPS: LESSONS LEARNED FROM EMERGENCY PERIOD

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The Chernobyl NPP accident (1986) resulted in large numbers of the public being exposed to ionizing radiation over a wide range of doses. The necessity for biological dosimetry was obvious and this became a major task for cytogenetics, evaluating cohorts of liquidators and evacuees from the 30-km exclusion zone.

Cytogenetic investigations started in our institute clinic very early on, 2 days after the accident, as we commenced assessing some evacuees from Pripiat city and nearby villages and clean-up workers. The biodosimetry was based on unstable chromosome exchanges (dicentric plus centric rings) yields referred to an acute in vitro Co-60 dose-response curve, modified where appropriate to take account of individuals' exposure protraction.

In evacuees the elevated dicentric yield was more pronounced in persons who were departed from 3 to 11 days after the explosion compared with those who left earlier, at 2 days. In both groups, the distribution of chromosome aberration yields amongst the individuals conformed closely to a Poisson distribution which suggested that there were no heterogeneity in doses within the groups. The mean accumulated dose in the whole group of 60 evacuees was estimated to be 370 mGy<sup>1</sup>. This value was well in excess of calculations made by other researchers from modeling doses to the communities from which our subjects were drawn.

Amongst 156 liquidators examined cytogenetically within the first year, the formal irradiation doses were registered in documents of 100 persons (dose range 17-1030 mGy). The individuals' cytogenetic data were pooled according to the registered doses into narrow dose intervals. The average dicentric and centric ring yields in interval groups were converted into biological doses by reference to the gamma calibration curve and compared with the registered values. Using Poisson statistics a theoretical distribution of individual aberration yields expected from the registered doses was constructed, and these distributions appeared to be significantly different from the observed chromosomal data. A moderate positive correlation between the registered doses and mean aberration yields was shown. Biologically estimated doses exceeded the documented means in most of the dose interval groups. In total, for those 100 subjects where the comparison was possible, the average biological dose was 1.8 times higher than the average registered dose.

The average chromosome exchanges yield in the remaining 56 liquidators with no registered doses was the same as in the registered group and when data from all 156 subjects were combined, the mean biological dose estimate was 470 mGy.

For individual comparison of the documented and biological dose in liquidators a Bayesian analysis was used that permitted a quantitative assessment of the consistency between registered doses and biodosimetry estimates.

The problems that arose in the very early period concerning sampling, cytogenetic processing and data reporting will be discussed. The relative usefulness of different approaches to the data treatment for early individual and cohort biological dose assessment will be evaluated.

### References:

Maznyk N.A., Vinnikov V.A., Lloyd D.C., Edwards A.A. Chromosomal dosimetry for some groups of evacuees from Prypiat and ukrainian liquidators. *Radiation Protection Dosimetry*, 74, 5-11, 1997.