

Doses of Chernobyl liquidators: Ukrainian prospective

**Vadim V. Chumak¹, André Bouville², Elena V. Bakhanova¹, Nickolas K. Luckyanov²,
Sergey V. Sholom¹, Paul G. Voillequé³, Yuri N.Skaletsky⁴, Viktor P. Kryuchkov⁵**

¹*Research Center for Radiation Medicine AMS Ukraine, 04050, Melnikova 53, Kyiv, Ukraine*

²*DHHS/NIH/NCI/Division of Cancer Epidemiology and Genetics, EPS-7094, Bethesda MD
20892, USA*

³*MJP Risk Assessment, Inc., P.O. Box 200937 Denver, CO 80220-0937, USA*

⁴*Institute for National Security Problems, 03186, Chokolivskyi blvd. 13, Kyiv Ukraine*

⁵*Federal Research Center Institute of Biophysics, 123182, Zhivovisnaya 46, Moscow, Russian
Federation*

The issue of doses received by Chernobyl clean-up workers (liquidators) remains controversial both in terms of dose values (individual and collective) and reliability of available data. This deficiency became particularly evident during preparation of the Ukrainian contribution to the UNSCEAR report. Analysis showed that available official dose records (ODR) are neither representative nor unbiased and, therefore, cannot be used to indicate the impact of Chernobyl exposure on this cohort (~230,000 individuals). Recent developments in the area of dosimetry for liquidators contributed to better understanding of this problem and added information regarding individual, group averaged, and collective doses to Ukrainian liquidators. It was established that majority (~95%) of existing ODR are related to one particular category of clean-up workers – military liquidators. All other categories of Ukrainian liquidators either do not have recorded doses or their doses are not presented in the Chernobyl State Registry of Ukraine (SRU).

The main sets of new doses were derived from reassessment of about 8,600 ODRs performed within Ukrainian-American Chernobyl Ocular Study (UACOS) and results of independent dose reconstructions using a time-and-motion method, called Realistic Analytical Dose Reconstruction with Uncertainty Estimation (RADRUE) for about 1,000 subjects in the Ukrainian-American study of leukemia and related disorders among cleanup workers from Ukraine. A third source of independent dose assessments is the set of individual doses obtained using EPR spectroscopy of tooth enamel; such estimates have been performed for about 800 Ukrainian liquidators.

Analysis of dosimetric information related to military liquidators, who comprise about the 48% of Ukrainian liquidators, showed that as a rule ODRs for persons in this category systematically overestimate actual doses. Quantification of this overestimation gives a clue to retrospective adjustment of doses, at least at group level. However, as anticipated, in about 10% of cases the dose records were artificially assigned. Analysis of such major discrepancies showed that the ratio of the number of overestimated doses to those that were underestimated is about 20:1. As a rule unrealistically high doses were assigned to some specific 'privileged' groups of military liquidators (i.e., commanders, logistics specialists, etc.). Such groups can, in principle, be isolated and excluded from analysis.

Analysis of doses retrospectively reconstructed using the RADRUE technique shows that the second numerous category (~28%) were civilians sent on mission to the 30-km zone (CSOM). These liquidators performed a broad variety of tasks at various times and places; as a result the dose distribution for this category is very broad. About 10% of Ukrainian liquidators took part in clean-up activities in April-May 1986 and generally received higher doses. Another 10% of

liquidators belong to 'mixed' category, which is characterized by several work sessions (missions) that were defined by differing roles (tasks) during Chernobyl clean-up. Other categories, like victims of the accident, early respondents, and professional atomic workers contribute $\leq 1\%$ of the total number of Ukrainian liquidators and their doses do not significantly affect the overall dose distribution.

The data collected in the aforementioned studies allows reevaluation of dose distribution for Ukrainian liquidators. The new distribution is quite different from the previously circulated dose distribution derived from incomplete and biased ODRs stored in the SRU.

KEYWORDS: Chernobyl, liquidators, doses, dose distributions