

Needs for the standardisation of biological dosimetry by cytogenetics for laboratories requested to provide expert dose assessment and population triage

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The wide use of radioactive sources and X-rays, for medical, industrial, agricultural, research and military purpose increases the risk of overexposure of occupationally exposed persons and individuals of the general population. The scoring of radio-induced chromosomal aberrations, mainly dicentrics, has become the "gold standard" of the accidental biodosimetry assessment. The technique is incorporated into radiation protection programmes of many countries to confirm or discount a suspected radiation exposure. Radiation accidents are fortunately few so that the number of laboratories performing biological dosimetry is generally one or two per country. By contrast, the absence of real concurrence reinforces the need for such a technique to rest on solid bases, to ensure its credibility. Therefore, it was justified to provide requirements criteria to all biodosimetry laboratories in order to perform the dicentric assay in the most standardised conditions. In supplement to the IAEA's Manual on "Cytogenetic Analysis for Radiation Dose Assessment" (Technical Report Series No. 405, IAEA, Vienna, 2001), an ISO standard was written by an expert panel within the ISO working group 18 "Biological Dosimetry" to address the critical needs of the dicentric assay for expertise purposes. This ISO 19238 standard, published in 2004, provides criteria for quality assurance and quality control, evaluation of performance and the accreditation of biological dosimetry by cytogenetics service laboratories. It introduces the formal comparison of the results from one laboratory to another, particularly in the case of an international collaboration or intercomparison. Clearly, each new laboratory may get the most useful information to perform the dicentric assay in the best experimental and reproducible conditions from this standard.

Potential for nuclear and radiological emergencies involving mass casualties from accidental or malicious acts is emerging from the worldwide situation. Cytogenetic triage, i.e. the use of chromosome damage for rapid approximation of radiation doses received by individuals, is also appropriate in order to supplement the early clinical categorization of casualties. However, these events can also exceed the resources from the locally involved biological dosimetry laboratory, requiring the intervention of other laboratories within the constitution of a network. Several biodosimetry laboratories have independently and successfully performed rapid dose assessment in mass casualty incidents or exercises. Their approach, essentially based on the dicentric assay, including pre-planning, reagent stockpiling, simplified sample processing, automation, scoring criteria, and networking with other expert laboratories, is derived but different from this described for expertise situations in the ISO 19238 standard. Building upon their experience, a new ISO 21243 standard, published in 2008, defines the "performance criteria for laboratories performing cytogenetic triage for assessment of mass casualties in radiological or nuclear emergencies".

Currently, WG18 is working on a new standard for improving the Cytokinesis Blocked Micronucleus test.