

# Seminarium Departamentu Eksploatacji Obiektów Jądrowych

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## *Evidence for synergistic interaction of low and high LET radiation - significance for radiation protection*

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The survivors of atomic bomb explosions in Hiroshima and Nagasaki represent the most important source of knowledge about cancer effects of ionising radiation and the results serve as basis for radiation protection recommendations of the ICRP. Several uncertainties exist in connection with the risk factors derived from these results and one of them is related to the problem of radiation quality. The atomic bomb explosions generated a mixed beam of gamma radiation and neutrons. Neutrons have a higher biological effectiveness than gamma radiation and this factor is taken into account by multiplying the physical dose by a radiation quality weighing factor. The thus weighted dose is used to predict the cancer risk in people exposed to pure gamma radiation, for example in consequence of  $^{137}\text{Cs}$  contamination. What is not taken into consideration is the problem of a possible interaction of high and low LET radiation in inducing biological effects. The existence of such interaction would suggest that the risk factors derived from Hiroshima and Nagasaki survivors must be corrected before being applied to pure gamma exposure scenarios. Without appropriate correction, the lifetime attributable risks calculated for residents of areas contaminated by  $^{137}\text{Cs}$  would be overestimated.

The occurrence and mechanisms of an interaction between radiations of different qualities can be studied in cells exposed to radiation of single and combined mixed beam components. To this end we have built a mixed beam exposure facility where cells can be separately and simultaneously exposed to alpha particles and X-rays. We have carried out a series of experiments with various cells lines and various endpoints, including cell survival, chromosomal aberrations, DNA repair foci and alkaline comet assay. Overall, the results suggest that exposure of cells to mixed beams of alpha particles and X-rays leads to cellular effects not predictable based on assuming simple additivity of the individual mixed beam components. An overview of the results will be given and the significance for radiation protection discussed.

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