RADIOACTIVE HORMESIS: DEFINITIONS,MISCONCEPTIONS, DEBATES AND ITS RELEVANCE TO RISK ASSESMENT AND ENVIRONMENTAL SAFETY TECHNOLOGIES

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In whatfollow we discuss the issue of radiative hormesis as a concept of positive factor in radioactive safety strategy.Multiparametric and extremly complex nonlinear (and even probabilistic) character of these paradigma has been outlined. Being based on practical observations and theoretical estimations we too we adress some critical remarks to few quasi-statistical, semi-empirical approaches to determination of the criteria for radiative hormesis.
Key words: *radiative hormesis, low-dose radiative terapia, non-linear radiative destruction*
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A nuclear probabilistic risk or safety assessment (PRA or PSA) is a scientific calculation that uses very pessimistic assumptions and models to determine the likelihood of plant or fuel repository failures and the corresponding releases of radioactivity. Although PRAs demonstrate that nuclear power plants and fuel repositories are very safe compared with the risks of other generating options or other risks that people readily accept, frightening negative images are formed and exaggerated safety and health concerns are communicated. Large-scale tests and experience with nuclear accidents demonstrate that such incidents expose the public to low doses of radiation, and a century of research and experience have demonstrated that such exposures are beneficial to health. PRAs are valuable tools for improving plant designs, but if nuclear power is to play a significant role in meeting future energy needs, we must communicate its many real benefits and dispel the negative images formed by unscientific extrapolations of the harmful effects that occur at high radiation doses is no evidence of an increase in the incidence of adverse genetic effects, even among the Japanese atom bomb survivors. On the contrary, there is evidence of lower incidence of congenital malformations after exposure to low dose rate radiation. And there is evidence of a lower incidence of cancer mortality. Secondly, the probabilities for events and the corresponding radiation doses used in PRAs are unrealistically high. Recently, an evolutionrevolution has begun in safety analysis technology to examine the assumptions and the conservatisms in order to model reality more accurately [1].

Recent discoveries indicate that oxidative DNA damage occurs naturally to living cells at an enormous rate. Survival to old age depends on the performance of a very capable damage-control biosystem, which prevents, repairs, or removes almost all the DNA alterations [2]. Those DNA alterations not eliminated by this protective system are residual mutations, a very small fraction of which eventually develops into cancer. The rate of DNA mutations caused directly by background radiation compared with the rate produced by endogenous oxygen metabolism is extremely small. While high doses decrease biosystem activity, causing increased cancer mortality, low doses stimulate biosystem activity causing lower-than-normal cancer mortality. Stimulation of the immune system increases the attack and killing of cancer cells (including metastases) globally [3].

The evidence of hormetic effects of radiation exposure on cancer has lead to recent applications of whole-body, low-dose irradiation therapy for cancer, with no symptomatic side effects [4]. Research has demonstrated that a low dose increases cancer latency even in individuals who are radiation sensitive and cancer prone [5]. Even chronic exposures appear to prevent cancer and genetic defects, based on a study of 10,000 residents who lived 9-20 years in Co-60 contaminated apartments – a collective dose of 4000 person-Sv. About 230 cancer deaths were expected, plus 70 radiation-induced deaths, but only 7 were observed. Forty-six genetic defects plus 18 radiation-induced cases were expected, but only 3 were observed. In 1983, the average dose was about 74 mGy, and the maximum was 910 mGy – well within the range of biopositive effects.

We address to given upper overwiev the question: can we propose any bio-physical model where somewhat like hormesis (or simply positive criterium) could comes from more or less clear (even model) argumentation? Taking into account a defenitive nonlinear character of the phenomena (as in general all the problem of environmental safety technologies are) we preliminilarly conclude that the problem at the moment can be qualified just as a phenomena like stohastic resonance in the theory of dynamic systems [6]. We discuss also the problems of the existence (absence) of reproducable phenomenological basis (statistics) which can be trusted, observable reminiscences with physical phenomena (phase transitions and critical proccesses) and the ways of developing practical analytical models which can increase theoretical basis of environmental safety technologies and risk assesments related to issue of radiative instrument.

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