

**Health effects of radiation have deterministic effects and stochastic effects.**

- **Absorbed doses up to approx. 100 mGy are not judged to cause any clinically significant dysfunction in any tissues.**
- **In the range below approx. 100 mSv, the occurrence of stochastic effects is assumed to increase in proportion to increases in equivalent doses in organs and tissues. (Adoption of the linear non-threshold (LNT) model)**
- **The dose and dose-rate effectiveness factor for solid cancer is 2.**
- **Assuming a linear reaction at low doses, the fatality risks due to cancer and hereditary effects increase by approx. 5% per sievert.**

Source: ICRP Publication 103, "The 2007 Recommendations of the International Commission on Radiological Protection" (ICRP, 2007)

One of the aims of the ICRP Recommendations is to provide considerations and assumptions for building a radiological protection system, thereby preventing the occurrence of deterministic effects. The ICRP recommends the introduction of protection measures in cases where annual doses have increased close to 100 mGy ( $\approx$  100 mSv), which is the minimum threshold.

The probability of stochastic effects is very low in the case of annual doses below approx. 100 mSv, and the linear non-threshold (LNT) model, which is based on the assumption that the occurrence of stochastic effects increases in proportion to increases in radiation doses exceeding background doses, is considered to be practical for the management of radiological protection at low doses and low dose rates, and also preferable from the viewpoint of the precautionary principle.

While the ICRP uses, as the grounds for its recommendations, the data for atomic bomb survivors, which is the data concerning a single exposure, what should be controlled is mostly a long-term gradual exposure. Therefore, the ICRP makes adjustments to offset mitigated effects due to low doses and low dose rates. Various values have been reported as a result of animal testing and experiments using human cells to induce chromosomal abnormalities or mutations, but the dose and dose-rate effectiveness factor for radiological protection has been defined as 2. In other words, if the total exposure dose is the same, long-term low-dose exposure would cause half the effects as those caused by exposure at one time.

As a result of the abovementioned adjustments, risks of fatal cancer are considered to increase by approx. 5% per sievert at low doses and low dose rates.

(Related to p.80 of Vol. 1, "Deterministic Effects and Stochastic Effects")

Included in this reference material on March 31, 2013

Updated on March 31, 2015