



Long-term low dose rate irradiation facilities

Scientific basis for the effect of low dose radiation

— Integrated research promotion and information initiation —

Close relationship with radiation since the birth of life

Sophisticated response of living organisms to low dose radiation

Toward proper understanding on the radiation

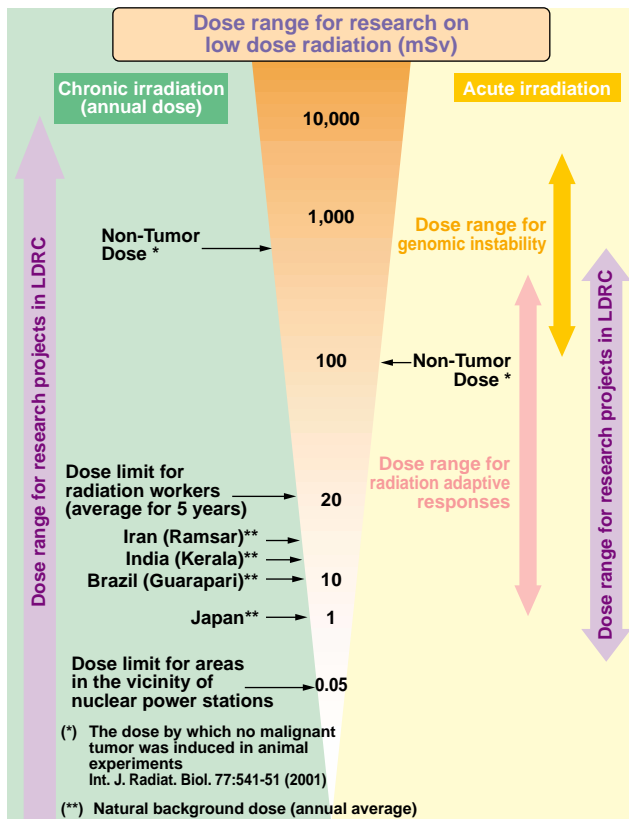
Brief Note: Nobuyoshi Yanagi, Director, Information and Public Relations, Low dose Radiation Research Center

Close relationship with radiation since the birth of life

Radiation from radioactive isotopes in the ground and cosmic rays from the cosmos has been a constant presence on the earth's surface ever since the planet came into existence approximately 4.6 billion years ago.

It is believed that life originated about 3.6 billion years ago under these conditions. Living organisms have lived and evolved consistently to the present. Upon reviewing the history of life, it is not inconceivable that living organisms possess the ability to accept a tiny amount of radiation as a stimulus and adapt itself to the stimulation.

Low dose Radiation Research Center (LDRC), at Central Research Institute of Electric Power Industry (CRIEPI), is making efforts to further the research on the responses of living organisms to low dose radiation with the aim of contributing to the integration of this knowledge into more rational radiation protection standards and the pursuit of possible application to medical therapy.



Dose range for research on low dose radiation

The effect of radiation on living organisms for the same dose differs widely between cases of exposure over a short time (acute irradiation) and those of slow but steady irradiation extended period of time (chronic irradiation). Ranges of radiation dose such as that designated by radiation protection standards, background level, and doses ranges for carcinogenic risk are summarized in the illustration on the left.

Prior research has mainly dealt with acute irradiation. The research at LDRC covers the single exposure doses up to about 500 mSv. LDRC is also conducting research on the effect of chronic irradiation and has installed 'long-term low dose rate irradiation facilities' (photograph on the cover) to investigate the effect of long term exposures. Since the effect of chronic irradiation (low dose rate) is smaller than that of acute irradiation of the equal dose, the investigated dose range becomes much higher.

* Units of radiation

"Gray" (Gy) is the unit that represents the amount of energy absorbed by a substance from radiation. Derived from this, "Sievert" (Sv) is the unit that indicates the effect of radiation on human body. Milli-Sievert (mSv) is the unit that represents one thousandth of 1 Sv.

Sophisticated response of living organisms to low dose radiation

Three major areas of study

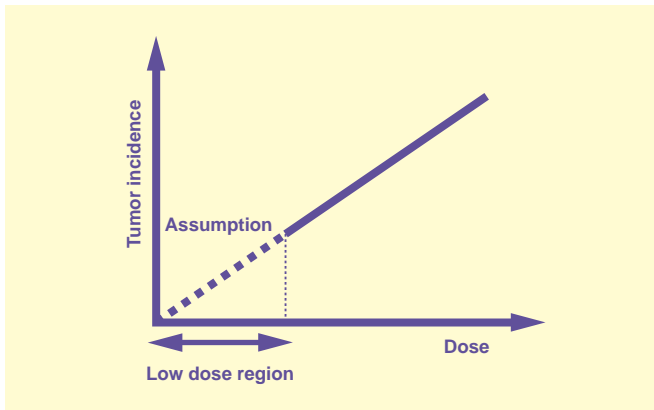
Proper understanding of the biological effect of low dose radiation

We are attempting to understand the dose and dose-rate dependency of the biological response and mechanisms which are specific to low dose radiation. A low dose radiation response model for living organisms is being developed.

The results of this research are intended to contribute to the alleviation of the psychological uneasiness of general public about radiation.

Review and rationalization of radiation protection standards

Placing the focus on "carcinogenesis", the most significant radiation risk, we are verifying the suppressive effect of low dose radiation on carcinogenesis to review and rationalize the current radiation protection standards based upon the "linear non threshold hypothesis" which states that risk is increased by radiation no matter how low the level.



Linear non threshold hypothesis

Search of applicability to medical use

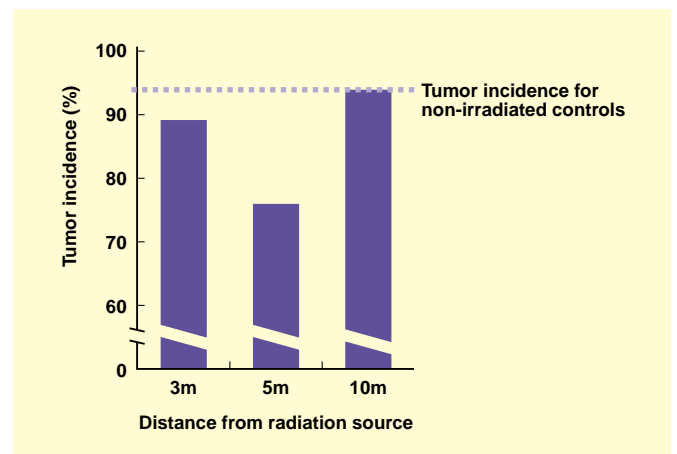
We are in looking at the possibility of using the response of living organisms to low dose radiation to the control of cancer or alleviating diseases related to reactive oxygen species.

Confirmation of suppressive effect on carcinogenesis

Reported biological effects of low dose radiation include: Activation of immune function, improved resistance to diseases and acquisition of resistance to high dose radiation. An example of researches on the suppression of carcinogenesis by low dose radiation is described below.

We established the conditions for the formation of skin cancer in mice by injecting them with a carcinogen. The effect of chronic irradiation (gamma-ray) on tumor incidence was investigated. The figure shown below gives the cumulative tumor incidence on the 216th day after injection of the carcinogen. While no difference between the group at a distance of 10m from the radiation source (0.3mGy/hr) and the controlled group, reduction of tumor incidence was observed for groups at distances of 3m (2.6 mGy/hr) and 5m (1 mGy/hr).

It is well known that the radiation promotes the carcinogenesis when the dose is high. However, the results of this experiment confirmed that the low dose radiation reduces the tumor incidence in certain cases. We are now investigating irradiation conditions for a suppressive effect on carcinogenesis and to attempting to clarify the mechanisms for this effect.



Toward proper understanding on the radiation

Active promotion of information origination activity

L DRC is introducing research on low dose radiation mainly to employees of electric power companies, employees of related industries, and medical workers around nuclear power facility sites throughout the country.

We have held two meetings to introduce our research projects to nuclear power station workers, and four seminars on the biological effects of low dose radiation directed primarily to audiences comprised of staff from local medical institutions. The total number of the participants has exceeded 400.

Similar meetings and seminars will be continued in the future. The construction of databases for professionals containing data on low dose radiation research is ongoing. We intend to provide the database with a library-like function to answer any questions on the biological effects of low dose radiation. We will also transmit the latest information for the general public using a Web site.

It is possible to access the "Low Dose Radiation Research Center" from the URL shown below.

<http://criepi.denken.or.jp/CRIEPI/ldrc/ldrc-j.html>



Seminar for medical workers from the area around a nuclear power station site

Brief Note



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Although nuclear power and radiation are becoming somewhat more familiar, they are difficult to understand because of the technical terminology and difficult expressions used in the specialized scientific fields.

LDRC is working to disseminate the latest information from abroad and Japan on the biological effects of low dose radiation and in order to build proper understanding on both the dangers and the benefits of radiation.