

Guide for Dose Objective Around Light Water Nuclear Power Reactor Facilities

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Protective measures have been taken to prevent the failure of components and the occurrence of abnormal events so as not to exceed the annual public dose limit of 500 mRem in the vicinity of a Light Water Nuclear Power Reactor Facility (hereinafter referred to as LWR facility) caused by the release of radioactive materials in gaseous and liquid effluents to the environment. Efforts have also been made to reduce the release of radioactive material to the environment during normal operation on the basis of the principle that the public dose be kept as low as easily attainable-- i.e. the "as low as practicable" principle.

Since the release of radioactive material to the environment is projected to become large due to the increase of the nuclear power capacity in the future, efforts are required to take action to keep the public dose low.

Furthermore, disclosure of the Dose Objective, to which the applicant makes every effort to keep the public dose low, is considered helpful to gain public understanding regarding nuclear power.

From these perspectives, the Nuclear Safety Commission (NSC) stipulated the guide to keep the public dose low regarding the release of radioactive material from LWR facilities as follows after studying the "Report to the Commission from the Subcommittee of Environment and Safety Regarding the Adoption of the ALAP Principles" (October 1974).

1. Dose Objective

Dose Objective to keep the public dose low regarding the release of radioactive material to the environment from an LWR facility during normal operation is set to an annual equivalent dose of 50 μ Sv. In the dose evaluation, the evaluation should be made on the dose equivalent of external exposure to gamma ray from radioactive noble gas, internal exposure to radioactive iodine due to inhalation, and internal exposure by ingestion of seafood when evaluating radioactive material in the liquid waste. Dose evaluation is conducted using a realistic calculation method and parameters for residents in the vicinity of the facility whose eating habits are average.

The Dose Objective established here does not substitute for the dose limits and the radioactivity concentration limits outside of the environmental monitoring area. Non-conformance to this limit is not construed as having safety implications which require plant shutdown or output limitation since the Dose Objective is the objective

which the applicant should make every effort to keep the public dose low based on the "as low as reasonably achievable" principle.

2. Applicability of the Dose Objective

(1) In designing an LWR facility, the applicant should evaluate the doses in the vicinity of the facility taking into account the future arrangements of residential areas and it should take every effort to attain the Dose Objective

(2) In controlling the release of radioactive material during normal operation of an LWR facility, the applicant should determine an Objective (hereinafter referred to as the "Release Control Objective") for an annual release or an average annual release rate that would give the attainable dose objective by evaluating the doses using the method used in (1) above, and it should make every effort to control the release so as not to exceed the Release Control Objective.

In the event that the release exceeded the Release Control Objective, the applicant should take the following measures:

- i) Evaluate the doses to the residents in the vicinity of the facility using meteorological data, habitation conditions and environmental sampling measurements supplemented by dose evaluation made for residents of an average eating habit in the vicinity of the facility using a more realistic method and parameters;
- ii) Make efforts to improve release methods and equipment so as to attain the Objective if the results evaluated for the average year with average meteorological conditions could exceed the Dose Objective and could possibly exceed them frequently thereafter.

Commentary on the Dose Objective

Subcommittee on Reactor Safety Standards

(1) Dose Objective does not replace Dose Limits which are legally specified limits.

Many identifiable causes and effects between radiological hazards and exposure to high doses are known. Causes and effects between radiological hazards and exposure to low doses are not clear since the exposure to low doses poses no hazards or the frequency of exposure is low. A strict principle is proposed that measures should be taken even for low doses with an assumption that a linear relationship exists between the dose and the frequency of hazard in the low dose region like in the high dose region in which a linear relationship exists between the doses and the frequency of hazard.

Dose limits specified by a law (i.e., 1mSv/year for dose effective outside of the environmental monitoring area) is based on the recommendations issued by the ICRP which takes a strict-principle position. Below this limit, the possibility of a radiological hazard is, even if it occurs, extremely low and considered to be a socially acceptable level.

(2) Dose Objective is a quantitative goal to make an applicant who establishes and operates a Light Water Nuclear Power Reactor every effort to limit the release of radioactive material to the environment as low as practicable.

The release of noise and other man-made phenomena to the environment, so-called pollution, is designed to be kept as low as possible. A smaller release of man-made radioactive materials to the environment is by far the better. In addition, the far smaller dose is desirable given that a strict position is taken to low-dose exposure from a radiological protection standpoint. In society today, given that there are many occasions to be exposed to various radiations such as in medical treatment, every effort should be made to attain the goal of exposure doses as low as possible without satisfying that the dose levels below the regulatory limits have been attained at nuclear facilities. This effort is to promote the implementation of reducing exposure not only by showing an abstract principle but by also showing a quantitative objective.

(3) The Dose specified as "Dose Objective" was not prescribed in the context of possible radioactive hazards. It was specified through assessing the difficulty of attaining the objective and judging the appropriateness of its value.

Several indicators are considered to express this objective quantitatively. Upon deciding the objective, the dose to which the public living in the vicinity is exposed to was employed as an indicator. Upon deciding the dose limit as an objective, the limit was decided upon based on the experiences of design and operation of power generating light water reactor facilities to date by evaluating the difficulty in achievability. It was not decided upon by considering the possible lowering of hazard occurrence based on a linear relationship between the dose and the hazard. This philosophy is based on the principle of "as low as reasonably achievable."

The dose limit was set adequately low compared to the dose limits recommended by the ICRP to the public or doses from natural radiations by assessing, in light of Japan's energy situation, in which Japan must promote nuclear power generation and in light of receiving public understanding and cooperation on nuclear power generation, the difficulty in achievability.

(4) If the Dose Objective is not attained, improvements in the release method and equipment are requested, but it is not of the nature that the reactor should be shut down immediately.

The dose objective does not alter limits for radiological hazard prevention and limits stipulated by law. It was not established based on the relationship between dose and radiological hazard. Therefore, even if the dose objective was not met this situation does not have the nature that could lead to safety implications. If the dose objective was not met, further effort for improvement is requested since it would be considered that there is room for improvement of the design, operation, or release control of radioactive materials of the facility. Thus, swift improvements are required to be made.

(5) Dose Objective established here is for nuclear power reactor facilities. Dose Objective for other nuclear reactor facilities should be established considering the difficulty to attain their Objective as required.

As described above, the difficulty in achievability played a large role upon deciding the Dose Objective. Since the Dose Objective was set based on the difficulty in achievability of power generating light water reactor facilities it is not applied to other nuclear facilities. Should the need arise to establish a respective dose objective its difficulty in achievability has to be studied respectively.