

Departure from ICRP-60 in Japanese Radiation Protection Regulations

Masahito Kaneko

Tokyo Electric Power Company, 1-1-3 Uchisaiwai-cho, Chiyoda-ku, Tokyo 100-0011, Japan

INTRODUCTION

Japanese radiation protection regulations are based on the opinions of the Radiation Council* on how to incorporate the newly issued ICRP Recommendations. The current regulations based on the ICRP 1977 Recommendations (1) has been effective since April 1, 1989.

In 1991 the Radiation Council started reviewing the ICRP 1990 Recommendations (ICRP-60) (2) and discussing how to incorporate them into Japanese regulations. The author has been participating in the discussions since September 1992 as a Council member. The report of the Basics Committee of the Council was submitted to the General Assembly of the Council on March 26th, 1998, after having invited 1243 public comments of 520 persons. However, because of the discordant opinions among Council members on the dose limitation of female workers, the Council set up an ad hoc subcommittee and a little bit modified the Basics Committee's report, to be the final Council's opinions on the 10th of June, 1998.

The Radiation Council submitted its opinions on the incorporation of the ICRP 1990 Recommendations (Pub. 60) to seven regulatory agencies on the 18th of June, 1998 (3). The agencies prepared their gist of amended regulations and referred them to the Radiation Council in August 1999. The Basics Committee of the Council invited public comments on its draft review report of the agencies' gist of amended regulations for a period of one month starting from the 20th of December, 1999.

The amended regulations after receiving comments of the Council will be promulgated sometime in 2000 and become effective on April 1, 2001.

Major items of the Council's opinions on the incorporation of ICRP-60, possible difference of amended regulations among regulatory agencies and their potential problems in implementation will be discussed in this paper.

*The Secretariat of the Radiation Council has been established in the Science and Technology Agency (STA).

THE RADIATION COUNCIL'S OPINIONS AND AMENDED REGULATIONS

The Radiation Council's opinions will be written in italics in this chapter.

Some of the Council's opinions have been raising serious difficulties in incorporating into regulations and implementing them in practice. Discussions will follow after the Council's opinions.

(1) Change of terminology

Dose limits should be set in terms of "effective dose" and "equivalent dose" in order to clarify the difference of definitions from conventional "dose equivalent" quantities, in concordance with the ICRP 1990 recommendations. On the other hand the currently used terms such as "1 cm-dose equivalent" should not be changed for the purpose of monitoring for external radiation.

All seven agencies have adopted the above recommendation. However, the change of terminology will be a nuisance at workplaces and the international conformity of terminology and definitions used for environmental and personal monitoring will be desirable in the future.

(2) Occupational dose limits

Effective dose limits should be "100 mSv per 5 years and 50 mSv in any fiscal year".

A simple annual dose limit of 20 mSv was proposed in the early phase of the discussion. However, the need of the regulatory flexibility of five-year averaging was later acknowledged by the Council members.

The flexibility of five-year averaging is necessary for the adequate maintenance and safe operation of nuclear power plants, because the amount of jobs required may change year by year and individual and collective doses may change accordingly. The number of workers at Japanese nuclear power stations exceeding 100 mSv per five years has decreased remarkably since the publication of ICRP-60, although not a few workers receive annual doses greater than 20 mSv. Further efforts will be necessary to implement the new dose limits especially for nuclear power plants of older designs. Judging from the annual dose distribution of non-nuclear radiation workers, it will not be so easy to implement the new dose limit especially at hospitals.

(3) Occupational dose limits for women

1) Dose limit for female workers with reproductive capacity

Effective dose limit for female workers with reproductive capacity should be 5 mSv per 3 months. However, this special limit is not necessarily applied to those who are not willing to bear a child and/or unable to be pregnant.

The Council recommends to retain and lower the special dose limit for female workers with reproductive capacity contrary to the ICRP-60. A few Council members state that without such a special dose limit pregnant workers may receive up to 50 mSv while they are not aware of their pregnancy and fetuses may be exposed to radiation far above a standard of protection provided for members of the general public. The Council also maintains that the special precautions to protect 'maternity' are not sexual discrimination, although it now seems clear that the exposure of the mother below the occupational dose limits will not affect 'maternity'.

- Current Japanese regulatory limit: 13 mSv per 3 months to the abdomen of a female worker with reproductive capacity.
- ICRP-60: no special dose limit for female workers in general but the following statement may imply that the dose of any conceptus should be less than 5 mSv at the highest.
"It is the Commission's policy that the methods of protection for any conceptus broadly compatible with that provided for members of the general public"
(para. 177).
- ICRP-75: "The Commission now sees no need to make any distinction between the two sexes in the control of occupational exposure" (4).

If the recommended special dose limit is incorporated into regulations, it will be an unnecessary obstacle to equal employment opportunity for both sexes and international movement of work forces. The gist of amended regulations of the Ministry of Labor for employers specifies the effective dose limit of 5 mSv per 3 months but does not approve the exemption of the limit for female workers who declare unwillingness of pregnancy. Those of STA and MITI (Ministry of International Trade and Industry) for licensees of radioactive isotopes and nuclear reactors admit the exemption of the special dose limit for female workers with written declaration of their unwillingness of pregnancy.

<note>

- *The US NCRP no longer believes that specific controls are required for occupationally exposed women who are not known to be pregnant (5).
- *The revised International Basic Safety Standard (6) has deleted the special precaution for female workers with reproductive capacity set forth in its 1982 edition.
- *The EU Council directive has deleted its previous requirement of quarterly limit of 13 mSv for female workers(7).

2) Dose limits for female workers who declared pregnancy

Exposure limits should be as follows for the remainder of the pregnancy:

- *External exposure : 2 mSv to the surface of the abdomen*
- *Internal exposure : about 1/20 of ALI (annual limit on intake)*

The Council has adopted the recommendations of ICRP-60 faithfully.

The current Japanese regulations specify the dose equivalent limit of 10 mSv (abdomen) for the period from diagnosis to birth. More strict controls of pregnant workers will be required to comply with the new dose limits. However, the gist of amended regulations of the Ministry of Labor does not change the current starting date of 'diagnosis' of pregnancy because (according to the officials) the protection of embryo and fetus shall not be influenced by their mothers' choice whether to declare pregnancy or not.

(4) Designation of work areas

It is appropriate to set forth the numerical values for designating controlled areas in the regulations, based on the dose limit for members of the public.

- 1) *Areas likely to exceed 1.3 mSv per 3 months should be designated "controlled areas". (Operating times of facilities & equipments and occupancy shall be considered.)*
- 2) *Any places outside of controlled areas where resident persons are estimated to receive more than 1 mSv*

in a year should be demarcated in the management's judgment and their exposure doses shall be kept below the dose limit for members of the public by limiting the time spent there and/or by means of shielding, etc.

3) *Incorporation of "supervised areas" into regulations shall be discussed in the future.*

- Current regulations: areas likely to exceed 0.3 mSv per week shall be designated "controlled areas".
- ICRP-60: areas where workers are required to follow well-established procedures and practices aimed specifically at controlling radiation exposures. The definitions are best based on operational experience and judgement.

So far, the assumptions used for estimating the doses at the boundary of controlled areas are over-cautious. The overwhelming majority of the public comments are in the opinion that there is no need of changing criteria for the boundary of controlled areas because of the actual low dose rates.

Once new criteria is specified in the regulations, reasonable assumptions have to be introduced in estimating the doses at the boundary of controlled areas, particularly with respect to occupancy in order to avoid unnecessary precautions such as addition of shielding. Guidelines for designating controlled areas are now being prepared by working groups of several organizations. The Japan Health Physics Society requested all regulatory agencies to unconditionally admit at least an occupancy factor of 0.1 - 0.3 for non-residential places such as passages outside controlled areas in March, 1999.

- ICRP-75: the use of generically derived levels based on over-cautious assumptions should be avoided. Any criteria used for defining boundaries should be based on realistic assumptions, particularly with respect to occupancy. (para.104)

(5) Dose limits for public exposure

Annual effective dose limit shall be 1mSv, and annual dose limits for lens of the eye and skin shall be 15 mSv and 50 mSv respectively. Availability of the supplementary dose limits have to be discussed, in special circumstances provided that the annual effective dose does not exceed 1 mSv averaged over 5 years.

The new dose limits will not cause any problems in Japan because the current annual effective dose limit is already 1 mSv, based on the 1985 Paris Statement of the ICRP.

(6) Exposure to natural radiation sources

A. Occupational exposure

1) If the exposure levels exceed a certain value as the results of radon concentration measurements, precautions are necessary to be considered.

2) If the exposures of jet plane crew exceed a certain dose level, appropriate control shall be necessary.

B. Public exposure

Follow-up measurements of actual radon concentration levels have to be continued, and if significantly high levels are detected, it is appropriate to consider proper remedial actions with reference to the action levels shown in the ICRP Pub. 65.

The gists of amended regulations of all agencies do not include the above recommendations of the Radiation Council.

(7) Occupational health service

As special medical surveillance for radiation workers, the following medical tests should be done prior to engagement and normally at least once a year: questionnaire (evaluation of exposure history etc.), blood tests and examination of the skin and lens of the eye. In the periodical medical surveillance, blood tests and examination of the skin and lens of the eye should be obligatory only when medical doctors in charge acknowledge the need.

Currently omission of periodical medical tests is allowed only when doctors in charge acknowledge that the tests are unnecessary for individual workers. Officials of the Ministry of Labor are reluctant to amend the current regulations, partly because some representatives from labor unions maintain that the omission of special medical tests for radiation workers is an infringement of workers' vested rights.

The gist of amended regulations of the Ministry of Labor still does not allow the omission of

periodical medical tests for workers who are likely to receive annual doses greater than 5 mSv unless doctors in charge acknowledge that they are unnecessary.

(8) Limitation of occupational exposure in emergencies

It is unnecessary to amend the current regulatory effective dose equivalent limit of 100 mSv for emergency exposure. Dose limits of 300 mSv for lens of the eye and 1 Sv for the skin shall be added. Even in an emergency including life saving operations, it is necessary to make efforts to keep the exposure as low as possible, with reference to the Basic Safety Standards of IAEA and ICRP1990 Recommendations.

ICRP-60 recommends the upper dose levels to be allowed in the emergency situations: about 0.5 Sv of effective dose and about 5 Sv of equivalent dose to skin except for life saving. ICRP-75 states that it is not appropriate to recommend rigid dose limits for workers engaged in urgent emergency operations.

On the other hand current Japanese regulations specify the rigid effective dose equivalent limit of 100 mSv for emergency activities. There has been a concern that rigid legal dose limits may make people hesitate to take necessary actions in an emergency. In spite of the precious experiences in the remedial actions of the JCO Criticality Accident occurred on September 30, 1999, Japanese regulatory agencies still maintain that even emergency exposures shall be controlled within the emergency dose limit of 100 mSv.

CONCLUSION

The ICRP-60 recommends lower dose limits for workers, taking into consideration the risk estimates based on the follow-up studies of atomic bomb survivors and linear no-threshold hypothesis. On the other hand it also recommends several items of deregulation and flexibility based on the recent scientific findings and accumulated operating experiences. The author believes that the ICRP-60 can be said “reasonable” as a whole, and it should be incorporated into regulations as a whole. Therefore, it is unfortunate that amended Japanese radiation protection regulations will depart far from the ICRP-60 Recommendations in spite of the opposition by some members of the Radiation Council, an overwhelming majority of the invited public comments and some representatives of professional associations. Regardless of the Radiation Council’s comments on the need of uniformity there will be conflicting regulations among the agencies. We will have to abide by the most restrictive regulations of the agencies.

The author believes that national and international harmonization of radiation protection regulations is essential for the reassurance of workers and members of the public. In order to achieve harmonization, radiation protection will have to be based on the scientific principle other than the current assumption that all doses are harmful no matter how small they are, that means the smaller, the better.

REFERENCES

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5. NCRP Report No. 116, *Limitation of Exposure to Ionizing Radiation* (1993).
6. IAEA Safety Series No.115, *International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources* (1996).
7. Official Journal of the European Communities L159, *Council Directive 96/29/Euratom of 13 May 1996 laying down basic standards for the protection of workers and the general public against the dangers arising from ionizing radiation* (1996).