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Regulatory Guide for Reviewing Radiation Monitoring in Accidents of Light Water Nuclear Power Reactor Facilities

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Disclaimer

This is an unofficial translation of the official Nuclear Safety Commission Regulatory Guide for the benefit of interested readers. For all questions regarding meaning and phrasing, please refer to the official version in Japanese.

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Table of Contents **page**

Ⅰ. Introduction

Under the “Regulatory Guide for Reviewing Safety Design of Light Water Nuclear Power Reactor Facilities”, this Regulatory Guide provides recommendations and guidance on the review of the design of the radiation monitoring system required for radiation protection during and after accidents at nuclear facilities.

This Regulatory Guide is based on the monitoring technologies and experiences and should be revised embracing technological advancement and new knowledge upon due consideration. Provided that an application for license does not meet recommendations and guidance set out in this Regulatory Guide, the application would not be ruled out, if only it ensures the function and the performance equivalent to those required to meet this Regulatory Guide by adopting technological improvements and advancement.

In addition, this Regulatory Guide not only applies to light-water nuclear power reactor facilities but also serves as a good reference for the other nuclear reactor facilities.

Ⅱ. Fundamental ideas about radiation monitoring during and after accidents

In case of accidents at nuclear reactor facilities, it is essential to grasp accurate accident situation, including the scale of accident and its possible escalation, and take actions without delay.

Radiation monitoring during and after accidents provides information on radiation level and radio-activities to protect the public and the workers at nuclear reactor

facilities concerned, with the aim to grasp:
1. Integrity of radiation barriers,
2. Release of radioactive materials,
3. Radiation-related situation, such as radiation dose rate, in the environment around nuclear reactor facilities concerned and
4. Radiation dose rate necessary to judge whether to let workers enter facility buildings or not.

These pieces of information should be provided together with plant parameters, including temperature, pressure, water level and flow rate, in an effective way to grasp accident situation and conduct facility operation for accident mitigation.

Ⅲ. Design considerations for radiation monitoring system

In the design of radiation monitoring system, it is required to take into consideration the "accidents postulated in the light of the safety design of nuclear reactor facilities", defined in Regulatory Guide for Reviewing Safety Design of Light Water Nuclear Power Reactor Facilities. The design should have enough of margin in consideration of the expected role as radiation monitoring system.

1. Classification of radiation monitoring system

The functions of radiation monitoring system are grouped into three categories in accordance with its required functions.
- Category 1: Principal part of radiation monitoring system that provides information on the integrity of radiation barriers,
- Category 2: Principal part of radiation monitoring system that provides information on shifting status of an accident and on the estimation of affected area and
- Category 3: Radiation monitoring system that provides supplementary information to confirm the information given by Category 1&2 radiation monitoring systems.

2. Design conditions common to radiation monitoring systems in different categories

Regardless of the categories in the preceding section Ⅲ.1, the design of radiation monitoring system should give consideration to the followings:
(1) Radiation monitoring system should be designed to achieve high reliability and remain functional under postulated accident environmental conditions,

(2) Radiation monitoring system is allowed to share its individual systems between those used in normal operation and under postulated accidents. Nevertheless, if the shared systems threaten to disrupt expected functions under postulated accidents, those systems should be designed as independent systems,
(3) Radiation monitoring system should be designed to allow periodical testing and inspection,
(4) Radiation monitoring system should be designed to employ measures such as automatic and remote-controlled systems with the aim to keep occupational radiation exposure as low as reasonably achievable,
(5) The radiation monitoring system dedicated to monitor reactor coolant and containment atmosphere should be designed to ensure that the function of containment boundary is not disrupted by sampling operations.

3. Design conditions specific to each monitoring system in different categories

In addition to the design conditions set out in the preceding section Ⅲ.2, the design of radiation monitoring system in each category should give consideration to the followings:
(1) Category-1 radiation monitoring system should be designed in accordance with the seismic design criteria for S-class. It should be designed to have diversity and ensure independence between channels, which constitute the system, to the extent practically possible.
(2) Category-1 radiation monitoring system should be designed to be connected to on-site emergency power supply system. In principle, power supply for Category-2 radiation monitoring system should be equivalent to that for Category-1 radiation monitoring system.
(3) Both Category-1 and Category-2 radiation monitoring systems should be designed to display its monitoring parameter readings continuously in principle and record its results.

Radiation monitoring system need not be a permanent system, provided that it can afford to fulfill its intended functions and that it meets design conditions equivalent to the afore-mentioned design conditions.

4. Design variables and parameters of radiation monitoring system
In the design of radiation monitoring system, proper selection should be made of monitoring data, data elements, monitoring methods, upper limits on the range and

locations of monitoring equipment, taking into account their combination.