

## **Background Information on NRC Effluent and Environmental Monitoring Requirements**

This section identifies the NRC regulatory requirements for radiological effluent and environmental monitoring programs and radiation dose limits for protection of the public.

### **Regulatory Requirements**

Radiological environmental monitoring and effluent monitoring at nuclear power plants is required by U.S. Nuclear Regulatory Commission regulations. The monitoring of radioactive effluents and the environment around the nuclear power plant is important both for normal operations, as well as in the event of an accident. During normal operations, environmental monitoring verifies the effectiveness of in-plant measures for controlling the release of radioactive materials, and makes sure that the levels of radioactive materials in the environment do not exceed those originally anticipated prior to licensing the plant. For accidents, it allows an additional means for estimating doses to members of the general public.

The principal regulatory basis for requiring environmental monitoring and effluent monitoring at nuclear power plants is contained in General Design Criteria 60, 61, and 64 of Appendix A of Title 10 of the Code of Federal Regulations Part 50. The criteria require that a licensee control, monitor, perform radiological evaluations of all releases, document and report all radiological effluents discharged into the environment.

We also have specific criteria that requires power reactor licensees to keep the public dose from radioactive effluents as low as it reasonably achievable (ALARA). The ALARA criteria is contained in Appendix I of 10 CFR Part 50. This criteria is very clear what the NRC expects of power reactors concerning their effluent discharges.

The licensee shall establish an appropriate surveillance and monitoring program to:

1. Provide data on quantities of radioactive material released in liquid and gaseous effluents.
2. Provide data on measurable levels of radiation and radioactive materials in the environment to evaluate the relationship between quantities of radioactive material released in effluents and resultant radiation doses to individuals from principal pathways of exposure.
3. Identify changes in the use of unrestricted areas (e.g., for agricultural purposes) to permit modifications in monitoring programs for evaluating doses to individuals from principal pathways of exposure.

Results from the environmental and effluent monitoring programs are reviewed by the NRC during routine inspections, and if the data indicate that the relationship between the quantities of effluents and the calculated doses to individuals is significantly different than that assumed in the licensing calculations, then the NRC may modify the allowable quantities in the Technical Specifications for the nuclear power plant.

Prior to licensing a nuclear power plant, the NRC staff review the applicant's proposed radiological environmental program. The applicant conducts a pre-operational program at least two years prior to initial criticality of the reactor. The pre-operational program documents the background levels of direct radiation and concentrations of radionuclides that exist in the environment. It also provides an opportunity for the licensee to train personnel, and to evaluate procedures, equipment, and techniques.

A licensee's pre-operational environmental monitoring program is reviewed by NRC staff in regard to the criteria contained in the NRC's Radiological Assessment Branch Technical Position, Revision 1, November 1979, "An Acceptable Radiological Environmental Monitoring Program." The Branch Technical Position (BTP) contains an example of an acceptable minimum radiological monitoring program. Highlights of the BTP include: monitoring of air at the offsite locations where the highest concentrations of radionuclides are expected; placement

of dosimeters in two concentric rings around the plant; water samples (i.e., surface, ground, and drinking) upstream and downstream; milk samples at locations where the highest doses are expected; and various food samples. Lower limits of detection for the various types of samples and nuclides are specified.

The operational radiological environmental monitoring program is essentially a continuation of the pre-operational program. The minimum requirements of the program are specified in the Radiological Effluent Technical Specifications (RETS) that are required pursuant to 10 CFR 50.36a. In addition, more detailed information about the program is contained in the licensee's Offsite Dose Calculational Manual, which is referenced in the plant's RETS. The RETS also require that the licensee submit: (1) an annual radiological environmental monitoring report which is designed to assess the impact of radiological effluent releases into the environment; and (2) a Special Report within 30 days of discovery of the event if predetermined levels of radioactivity are exceeded. The NRC also requires that the licensee participate in an Interlaboratory Comparison Program to ensure the accuracy and precision of the licensee's data.

The results of licensee's radiological environmental monitoring and effluent release programs are required to be reported annually to the NRC, and are available to the public.

### **Radiation Dose Limits**

#### **10 CFR Part 20, STANDARDS FOR PROTECTION AGAINST RADIATION**

The regulations contained in 10 CFR Part 20, effective January 1, 1994, establish standards for protection against ionizing radiation resulting from activities conducted under licenses issued by the NRC. The purpose is to control the receipt, possession, use, transfer, and disposal of licensed material to ensure that the standards of radiation protection are not exceeded.

10 CFR 20.1301, Dose limits for individual members of the public. This regulation requires licensees to conduct operation of their facility so that the total effective dose equivalent to a member of the public does not exceed 0.1 rem (100 mrems) in a year. It should be noted that prior to January 1, 1994, 10 CFR Part 20 had an annual dose limit of 500 mrems to a member of the public.

10 CFR 20.1301 (e), imposes an additional requirement on nuclear power reactors to comply with the Environmental Protection Agency's radiation protection standard in 40 CFR Part 190. This standard limits the annual dose to a member of the public to less than or equal to 25 mrems to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems.

10 CFR 20.1501, requires a licensee to perform a radiological survey to evaluate the radiological hazard from radioactive material in the air, soil or water.

Appendix I of 10 CFR Part 50, the NRC imposes specific requirements for nuclear power reactors for airborne and waterborne effluent releases. These requirements are contained in 10 CFR 50.36a and detailed in Appendix I to 10 CFR Part 50 (hereafter called Appendix I). These requirements are structured to maintain the dose to members of the public from all radioactive effluent releases to levels that are as low as is reasonably achievable (ALARA). The controls imposed on licensees are not based on the quantity or concentration of radioactive material released, but are based on the calculated dose to members of the public. The licensee's RETS contain the dose values (obtained from Appendix I) to the maximally exposed member of the public living near a nuclear power plant. They are as follows:

1. Gaseous effluents shall not produce doses to offsite air of more than 10 mrad from gamma radiation and 20 mrad from beta radiation in a year.

2. Radioiodine, tritium, and particulate radiation in gaseous effluents shall not produce doses to a member of the public of more than 15 mrems to the thyroid (or other organ) in a year.
3. Liquid effluents shall not produce doses to any member of the public of more than 3 mrems to the total body or 10 mrems to any organ in a year.
4. The licensee shall take other measures to reduce offsite doses that cost less than \$1000 per person-rem saved.

In addition to the annual doses listed above, the Radiological Effluent Technical Specifications (RETS) impose controls on the dose to a member of the public in a calendar quarter. They are as follows:

1. Gaseous effluents, during any calendar quarter, shall be less than or equal to 5 mrad for gamma radiation and less than or equal to 10 mrad for beta radiation.
2. Radioiodine, tritium, and particulate radiation in gaseous effluents, during any calendar quarter, shall be less than or equal to 7.5 mrems to any organ.
3. Liquid effluents; during any calendar quarter, the dose shall be limited to less than or equal to 1.5 mrems to the total body and to less than or equal to 5 mrems to any organ.

In addition to the controls imposed by the RETS on the dose to members of the public from radioactive effluents, there are controls on the rate at which radioactive material can be released. These controls, imposed on liquid and gaseous effluents, represent a defense in depth approach to further ensure that radioactive effluents and the resulting doses are ALARA.