U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REGULATORY RESEARCH

DRAFT REGULATORY GUIDE

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Division 8
Task DG-8016

Contact: C. Raddatz (301)415-6215

DRAFT REGULATORY GUIDE DG-8016
(Proposed Revision 1 to Regulatory Guide 8.37)

CONSTRAINTS FOR AIR EFFLUENTS FOR LICENSEES OTHER THAN POWER REACTORS

A. INTRODUCTION

In 10 CFR Part 20, "Standards for Protection Against Radiation," § 20.1301 requires that each licensee conduct operations so that "The total effective dose equivalent to individual members of the public from the licensed operation does not exceed 0.1 rem (1 mSv) in a year, exclusive of the dose contribution from the licensee's disposal of radioactive material into sanitary sewerage. . . ."

To ensure that doses to members of the public are as low as is reasonably achievable, 10 CFR 20.1101(b) requires that "The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA)."

In addition, the NRC has proposed a new Section 20.1101(d) that would require:

> To implement the ALARA requirements of § 20.1101(b), and notwithstanding the requirements in § 20.1301 of this part, licensees other than those subject to §§ 50.34a or 50.36b, shall constrain air emissions of radioactive materials other than radon-222 so that the individual member of the public likely to receive the highest dose will not be expected to receive a dose in excess of 10 mrem/yr TEDE from these emissions. If a licensee subject to this requirement exceeds this dose constraint, the licensee shall report the exceedence as provided in § 20.2203 and promptly take appropriate corrective action to ensure against recurrence.

This regulatory guide provides guidance on demonstrating compliance with the proposed constraint for air effluents. Licensees other than power reactors are those facilities at which the possession or use of source, byproduct, or special nuclear material is licensed under 10 CFR Parts 30 through 39, 40, 50 (other than power reactors), 60, 61, 70, 72, and 76.

Regulatory guides are issued to describe and make available to the public such information as methods acceptable to the NRC staff for implementing specific parts of the Commission's regulations, techniques used by the NRC staff in evaluating specific problems or postulated accidents, and guidance to applicants. Regulatory guides are not substitutes for regulations, and compliance with regulatory guides is not required. Regulatory guides are issued in draft form for public comment to involve the public in the early stages of developing the regulatory positions. Draft regulatory guides have not received complete staff review and do not represent official NRC staff positions.

Any information collection activities mentioned in this regulatory guide are covered by the requirements of 10 CFR Part 20, which were approved by the Office of Management and Budget, Approval No. 3150-0014. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

B. DISCUSSION

NRC licensees have consistently reduced doses from air effluents to small fractions of the dose limits using the ALARA process. In 1992, the Environmental Protection Agency (EPA) reported the results of two studies of materials facilities [57 FR 43173; September 18, 1992]. The first was a survey of 367 randomly selected nuclear materials licensees, and the highest estimated dose to a member of the public from effluents was 8 mrem/yr, based on conservative modeling. In addition, 98% of the facilities examined had doses to members of the public resulting from effluents less than 1 mrem/yr. The second study evaluated effluents from 43 additional facilities that were selected because of their potential for effluent releases that could result in significant public exposures. Of these 43 facilities, none exceeded 10 mrem/yr to a member of the public, and 75% of them reported less than 1 mrem/yr to a member of the public. Based on this information and on the ongoing NRC program

of licensing and inspection, the NRC believes that the constraint level for dose to members of the public from air emissions of radionuclides in the proposed Section 20.1101(d) is easily achievable by all NRC materials licensees.

Constraints and Limits

This guide deals with controlling doses resulting from the release of air effluents to levels below the constraint proposed for 10 CFR Part 20. A constraint is not a limit. A limit is the upper permissible bound of radiation dose; this value is not to be exceeded. Limits are set with the assumption that licensees will routinely operate at dose levels substantially below that value. Limits are to be approached only under unusual circumstances, and only for a small fraction of the exposed population. A constraint is a dose value above which specified licensee actions are required. It is understood that the constraint dose could be approached routinely. Enforcement action would only be expected if a licensee fails to report an exceedence of the constraint or fails to take appropriate and timely corrective actions.

Many NRC licensees possess source, byproduct, or special nuclear material in a form that would not cause doses to members of the public from airborne releases. These licensees include radiographers, well loggers, and other sealed source users.

C. REGULATORY POSITION

1. DETERMINING THE NEED FOR DOSE CALCULATIONS

Licensees who (1) operate a nuclear power reactor subject to 10 CFR 50.34(a) or 50.36(b), (2) possess licensed material only in the form of intact sealed sources, or (3) possess licensed material only in the form of radon-222 from uranium mill tailings piles that have been disposed of in accordance with 40 CFR Part 192 are not required to demonstrate compliance with this proposed Section 20.1101(d).

2. CALCULATION OF DOSE TO THE MEMBER OF THE PUBLIC LIKELY TO RECEIVE THE HIGHEST DOSE FROM AIR EFFLUENTS

Licensees should use one of the following three methods to demonstrate compliance with the constraints on air emissions.

In recent years, mathematical models developed for estimating exposures to members of the public from radionuclides released to the environment have become increasingly sophisticated. However, when applying mathematical models to assess radionuclide releases, the simplest model that will adequately address the problem should be applied first (NCRP Report No. 76, March 15, 1984).[1]

2.1 Column 1 of Table 2 in Appendix B to 10 CFR Part 20

The simplest screening technique is to assume that the air concentration at the receptor is equal to the air concentration measured at the point of release. This is similar to using Appendix B to 10 CFR Part 20 to demonstrate compliance with the dose limits in Part 20. To demonstrate compliance with the constraint on air emissions, the licensee should demonstrate, by measurement or calculation, that the annual average concentration of gaseous radioactive material released does not exceed 20% of the values in Column 1 of Table 2 in Appendix B to 10 CFR Part 20. The following formula demonstrates this technique.

$$C = \frac{f\,Q}{V}$$

Where

C = average air concentration at the receptor (Ci/m^3 or μCi/ml)

f = fraction of the time the wind blows toward the receptor of interest (dimensionless). (For a single "puff" release, the appropriate value is 1.)

Q = effluent release rate (Ci/s)

V = volumetric flow rate at the point of release (m^3/s).

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[1]"Radiological Assessment: Predicting the Transport, Bioaccumulation, and Uptake by Man of Radionuclides Released to the Environment." Copies may be obtained from the National Council on Radiation Protection and Measurements, 7910 Woodmont Avenue, Bethesda, MD 20814.

The "sum of the fractions" technique should be used to assess compliance for effluents containing multiple radionuclides. With this technique if radionuclides "a," "b," and "c" are present in concentrations $C_a + C_b + C_c$, and if the applicable effluent concentration values in Column 1 of Table 2 in Appendix B to 10 CFR Part 20 are EC_a, EC_b, and EC_c respectively, satisfying the following inequality is sufficient to demonstrate compliance with the air effluent constraint proposed in 10 CFR 20.1101(d):

$$\frac{C_a}{EC_a} + \frac{C_b}{EC_b} + \frac{C_c}{EC_c} < 0.2$$

2.2 Computer Codes

Another acceptable method for demonstrating compliance with the air effluent constraint in the proposed Section 20.1101(d) is through the use of computer codes. An example of a computer code that may be used to demonstrate compliance with the proposed Section 20.1101(d) is the COMPLY software program. The COMPLY code has four screening levels. In Level 1, the simplest level, only the possession limit on the license need be entered, and the calculations are based on generic parameters. Level 4 is highly facility-specific and requires the input of data that is much more specific. It is expected that all NRC licensees will be able to demonstrate compliance at one of the four levels.

COMPLY was developed by the EPA to assess doses by using site-specific information in the determination of dose. Copies of the COMPLY computer code with its User's Guide may be obtained by writing to the Center for Federal Guidance and Air Standards (6602J), Office of Radiation and Indoor Air, Environmental Protection Agency, Washington, DC 20460. It can also be downloaded from the Technology Transfer Network (TTN) Electronic Bulletin Board under the Office of Radiation and Indoor Air technical information area. The number for the TTN is (919)541-5742.

If a computer code other than COMPLY is used to demonstrate compliance with the constraint, the licensee should be prepared to demonstrate that the code has been validated against one of the other approved methods for demonstrating compliance. The licensee should verify that each calculation performed by the code is being done correctly.

2.3 NCRP Commentary No. 3

Another acceptable method for demonstrating compliance with the proposed Section 20.1101(d) is to use NCRP Commentary No. 3, "Screening Techniques for Determining Compliance with Environmental Standards,"[2] which provides acceptable methods for calculating dose from airborne radioactive effluents. The licensee should be prepared to show how the techniques were used to determine compliance.

3. REPORTS TO NRC IF CONSTRAINT HAS BEEN EXCEEDED

If the constraint of 10 mrem/yr to the member of the public likely to receive the highest dose has been exceeded as determined by measurement or calculation, the proposed Section 20.2203(a)(2)(vi) would require licensees to report to the NRC within 30 days after learning of the dose in excess of the constraint. However, 10 CFR 20.2203(b)(1) requires licensees to describe the extent of exposure. The report should include the following.

- The estimate of dose to actual or modeled individuals (if actual individual doses are calculated, include the name, social security number, and date of birth for each individual exposed to concentrations in excess of the constraint);
- The concentrations of radioactive material involved;
- The cause of the elevated concentrations in effluents;
- The corrective steps taken or planned to ensure against a recurrence; and
- A schedule for completing the corrective steps.

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[2]NCRP Commentary No. 3 was published in January 1989 and the addendum was published in October 1989. Copies may be purchased from the National Council on Radiation Protection and Measurements, NCRP Publications, 7910 Woodmont Avenue, Bethesda, MD 20814.

In addition, the report should contain enough information to allow NRC staff to verify the calculations. An example of a report is included as Appendix A to this guide.

The report should be sent to the U.S. Nuclear Regulatory Commission, Document Control Desk, Washington, DC 20555-0001, with a copy to the appropriate NRC Regional Office listed in Appendix D to 10 CFR Part 20.

D. IMPLEMENTATION

The purpose of this section is to provide information to applicants and licensees regarding the NRC staff's plans for using this guide.

This proposed revision is being issued in draft form to encourage public participation in its development. Except in those cases in which an applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the methods described in this guide will be used in the evaluation of applications for new licenses, license renewals, or license amendments and for evaluating compliance with 10 CFR Part 20.

APPENDIX A

Sample Report

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555-0001

Dear Sir:

The purpose of this report is to inform you, as required by Section 20.1101(d), that the calculated dose to the member of the public likely to receive the highest dose has exceeded 10 mrem in a year from exposure to air effluents.

Estimated Dose to an Individual

Using the calculational method prescribed in Regulatory Position 2 of Draft Regulatory Guide DG-8016, I have estimated that the calculated dose was 20 mrem/year to the member of the public likely to receive the highest dose (modeled).

Concentrations of Radioactive Material Released

Based on the total quantity of iodine-131 used by the researcher and the volume of the laboratory, an airborne concentration in the room was assumed. The release point was assumed to be the door to the laboratory, and the member of the public was assumed to be in the hallway outside the door. Assuming 24 hours to remove all of the iodine from the building on each of the three occasions, the average air concentration at the door for 1995 was 40% of the value in Column 1 of Table 2 in Appendix B to 10 CFR Part 20.

Period of time that I-131 filtration was not functional	June 1 - October 1, 1995
Uses of lab and quantities used during during each period	June 27 1.2 μCi July 13 0.8 μCi September 21 0.6 μCi TOTAL 2.6 μCi
Volume of room (3 m x 3 m x 3 m)	2.7 E+7 cm^3 (ml)
Average concentration during 24 hrs following use	9.6 E-8 μCi/ml
Average annual concentration	7.9 E-10 μCi/ml
Appendix B, Table 2, Column 1 limit	2.0 E-10 μCi/ml
Percent of Appendix B limit	40%
Estimated dose to maximally exposed individual	20 mrem/year

Cause of the Elevated Concentrations in Air Effluents

On October 1, 1995, a technician reported that the pump that maintains the negative pressure in one of the hoods was not functioning. Our records indicate that the pump was checked on June 1, 1995, and found to be functioning properly. During the period, the hood was used on three occasions. The researcher (an occupationally exposed individual) thought that the pump had been working on all three occasions, but could not be sure. Therefore, we are assuming that the pump was not functioning during any of the three uses of the hood. The incident was caused by a blown fuse in the exhaust hood pump. The length of time that the pump was not working is not known, but is at most 4 months.

Corrective Steps To Ensure There Is No Recurrence and Schedule for Completion

1. A procedure has been implemented whereby all researchers must sign a log indicating that the hood exhaust pump is working properly. All researchers have received training on this procedure and on methods for determining whether the pump is operating properly.

2. Effective immediately, technicians will check the pump and the filter monthly instead of quarterly.

3. Within 3 months, a green indicator will be installed on all exhaust hoods that will be illuminated when the hoods are operating normally. Researchers will be required to note in their log that the light was on when the fume hood was in use.

4. Within 2 months, all researchers will receive a briefing on the incident and the corrective actions.

Sincerely,

_____

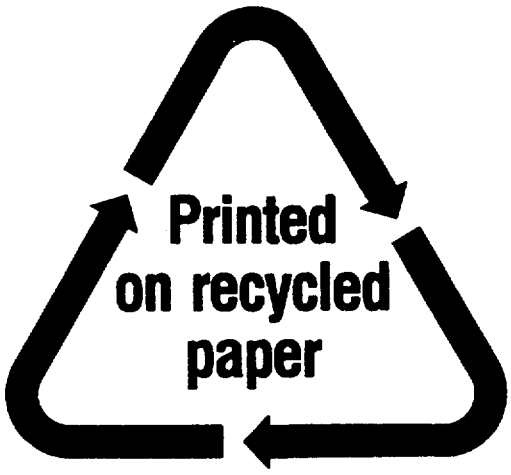
J. Licenze, President
Ajax Nuclear
123 Main St.
Breeze, East Dakota 12345

NRC License Number 0002255

cc:
USNRC Region IV
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011

REGULATORY ANALYSIS

A separate regulatory analysis was not prepared for this regulatory guide. The regulatory analysis prepared for the amendments to 10 CFR Part 20, "Standards for Protection Against Radiation," provides the regulatory basis for this guide. A copy of this regulatory analysis is available for inspection and copying for a fee at the NRC Public Document Room, 2120 L Street NW., Washington, DC, as an enclosure to SECY-95-133.



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