RECORD #13

TITLE: Averaging of Radiation Levels Over The Detector Probe Area

FICHE: 03442-097

[redacted] 1 3 1978

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Central File (PRM-20-9 & PRM-34-1)

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Mr. John J. Munro, III
Tech/Ops, Radiation Products Division
40 South Avenue
Burlington, Massachusetts 01803

Dear Mr. Munro:

In reply to your letter of December 30, 1977, regarding your Petitions for Rulemaking PRM-20-9 and PRM-34-1, we are pleased to know that our description of surface measurements satisfies your needs.

As discussed in my letter of December 5, it is acceptable to average the radiation levels over a probe of reasonable size to demonstrate that the radiation levels at the surfaces of packages or radiographic exposure devices meet the requirements specified in 10 DFR 20.205(c)(2) and 10 CFR 34.21. By "a probe of reasonable size," we mean: (1) the sensitive volume of the probe is small compared to the volume of the package or device to be measured, and (2) the largest linear dimension of the sensitive volume of the probe is no greater than the smallest dimension of the package or device. For example, GM tubes may be used for both small and large packages or devices but ionization chambers should be used only for packages or devices with outside linear dimensions greater than ten (10) inches.

As far as making these views publicly known, our correspondence on this matter is public record and is on file in our Public Document Room. In addition we will include our position as stated in our letter in a regulatory guide at the earliest feasible time.

Sincerely,

Original signed by:
ROBERT B. MINOGUE

Robert B. Minogue, Director
Office of Standards Development

(SEE PREVIOUS YELLOW FOR CONCURRENCES)

cc: Al Grella, DOT

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PDR

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

MAR 23 1979

PRM-20-9

Mr. John J. Munro, III
Tech/Ops, Radiation Products
Division
40 South Avenue
Burlington, Massachusetts 01803

Dear Mr. Munro:

This is in reference to your letter of April 5, 1977 petitioning the Commission to amend 10 CFR Part 20.205(c)(2) with regard to surface radiation level limits of packages for transport. Your petition was docketed as PRM-20-9.

The NRC staff, after careful consideration of your petition and public comments thereon, has concluded that adoption of changes proposed in your petition would lead to cost increase without corresponding benefit of improving public health and safety. In fact, such a change would result in higher collective hand dose of package handlers. For these reasons and others set forth in the enclosed Federal Register Notice on PRM-20-9, your petition is hereby denied.

We stated in our letter to you of December 5, 1977 that it might be appropriate to issue a regulatory guide to explain the meaning of the regulation in 10 CFR 20.205(c)(2) and to propose a method of surface radiation level measurement that is acceptable to the NRC. The staff is now developing such a regulatory guide.

Sincerely,

Lee V. Gossick,
Executive Director for Operations

Enclosure:
Federal Register Notice
PRM-20-9

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NUCLEAR REGULATORY COMMISSION

[Docket No. PRM-20-9]

TECH/OPS

Denial of Petition for Rulemaking with Regard to Surface Radiation Level Limit of Packages Prepared for Transport

Notice is hereby given that the Nuclear Regulatory Commission (NRC) has denied a petition for rulemaking, submitted by letter dated April 5, 1977 by Tech/Ops, Radiation Products Division, 40 South Avenue, Burlington, Massachusetts, which requested the NRC to amend its regulations in 10 CFR Part 20, "Standards for Protection Against Radiation." This petition is being denied by the Executive Director for Operations in accordance with 10 CFR 1.40(o).

The petitioner requested the NRC to revise 10 CFR 20.205(c)(2) to read as follows:

> "If radiation levels are found at five centimeters from the external surface of the package in excess of 100 millirem per hour, or at three feet from the external surface of the package in excess of 10 millirem per hour, the Licensee shall immediately notify by telephone and telegraph, mailgram or facsimile, the Director of the appropriate NRC Regional Office listed in Appendix D, and the final delivering carrier. Radiation levels shall be determined by measurements averaged over a cross sectional area of ten square centimeters with no linear dimension greater than five centimeters."

The petitioner stated that specification of radiation level limits at a distance of 5 centimeters from the surface of the package

allows the level to be actually measured at the axis of a detector. The petitioner further stated that specification of the area over which the intensity may be averaged minimizes the inconsistencies in the radiation levels recorded for the same package by different persons. Such inconsistencies may occur because of the use of radiation detectors with different sensitive volumes in non-uniform radiation fields.

A notice of filing of petition, Docket No. PRM-20-9, was published in the FEDERAL REGISTER on May 19, 1977 (42 FR 25787). The comment period expired July 18, 1977.

Four persons submitted comments. Three recommended that the petition be denied. The main bases for this recommendation were (1) the present regulation is adequate and presents no difficulty to the commenter; (2) the practical difficulties involved in assuring and documenting compliance with the detailed requirement specified in the proposed change, when applied to thousands of measurements under all conditions, would outweigh any potential good from the increased measurement precision that might result from the use of such techniques; and (3) a lower reporting level would reduce the number of curies allowed in one package for waste shipments and substantially increase the cost of waste disposal by increasing the number of containers required without a corresponding beneficial effect of reducing the total "man-rem" exposure. The fourth commenter also opposed the petition but suggested the radiation level limit

proposed by the petitioner be reduced to 75 millirems per hour or, preferably, to 50 millirems per hour at 5 centimeters from the surface.

The regulation, 10 CFR 20.205(c)(2), requires a licensee who receives a package of radioactive material in excess of Type A quantity to monitor the external radiation levels both at the surface and at 3 feet from the surface of the package. If the radiation levels exceed the limits prescribed by the regulation of the Department of Transportation (DOT), 200 millirems per hour at the surface or 10 millirems per hour at 3 feet from the surface, the licensee is required to immediately report that fact to the NRC and to the final delivering carrier.

If the proposed change were adopted, a licensee would be required to report when the radiation level exceeded 100 millirems per hour at a distance of 5 centimeters from the surface of a package. Such a limit would correspond to different surface radiation levels depending on the package size: less than 200 millirems per hour for large packages (i.e., packages with all three dimensions greater than 10 inches) and greater than 200 millirems per hour for small packages (i.e., packages with at least one dimension equal to or less than 10 inches). Hence, licensees who received large packages would be required to report radiation levels to NRC and the carrier even when the surface radiation levels were below the DOT regulatory limit, but licensees who received small packages would not have to report although the surface radiation levels exceeded the DOT

regulatory limit. This inconsistency in reporting requirement, which would depend on package size, appears unjustified.

The petitioner also suggested that the radiation levels be determined by measurements averaged over a cross-sectional area of 10 square centimeters with no linear dimension greater than 5 centimeters. The staff believes that the averaging of radiation levels over the cross-sectional area of a probe of reasonable size is acceptable for demonstrating compliance with the requirements specified in 10 CFR 20.205(c)(2). By "a probe of reasonable size," we mean (1) the sensitive volume of the probe is small compared to the volume of the package to be measured and (2) the largest linear dimension of the sensitive volume of the probe is no greater than the smallest dimension of the package. For example, Geiger-Mueller tubes may be used for both small and large packages but ionization chambers should be used only for large packages. Hence, a more rigid requirement on averaging surface radiation levels to demonstrate compliance with 10 CFR 20.205(c)(2) is not warranted. However, it should be noted that such averaging is not acceptable for demonstrating that there are no cracks, pinholes, uncontrolled voids, or other defects prior to the first use of any packaging for the shipment of licensed materials as required by 10 CFR 71.53.

The staff has also considered the advantages and disadvantages in changing the radiation level limit from 200 millirems per hour at surface to 100 millirems per hour at a distance of 5 centimeters

from the surface of a package. It concluded that such change would not be in the public interest based on the following considerations:

(1) Although the proposed change would reduce the surface radiation level that would be permitted for larger packages, it would significantly increase the surface radiation level limit, up to 400 millirems per hour, permitted for smaller packages. Since by far the greatest number of packages shipped are the smaller packages and the smaller packages are handled by hand more frequently than larger ones, the proposed change would be expected to result in higher collective hand doses to handlers. Furthermore, it does not appear justified to restrict surface radiation levels of larger packages to lower values where direct exposures under contact or close to contact conditions are unlikely or to allow levels to be increased for smaller packages where contact exposures are frequent.

(2) The petitioner stated, "A package with a 2 inch source to surface distance would provide an exposure rate of only 1.1 millirem per hour at three feet from the surface under the proposed change whereas, under the current regulation, packages can have exposure rates of 10 millirem per hour at this distance." This statement is misleading. Under the current regulation, a package must meet both radiation level limits, 200 millirems per hour on the surface and 10 millirems per hour at 3 feet from the surface of the package. In fact, the current surface radiation level limit for a package

with a 2-inch source to surface distance would restrict the exposure rate to about 0.5 millirem per hour at three feet from the surface of the package.

(3) The staff believes the adoption of the proposed change would impose an unnecessary and increased burden on licensees without commensurate benefit to the public. The proposed change would require licensees to use specific types of radiation detection instrument with small diameters and limited sensitive volumes; e.g., it would eliminate the use of ionization-chamber instruments for surface radiation level measurements. In addition, it would require monitoring personnel to keep the center of the sensitive volume of the detector at 5 centimeters from the surface. The current practice is to place an instrument probe as close as possible to the package and pass the instrument over the entire package surface to assure the level at all points on the surface are within the limit. The elimination of ionization chamber type of instruments and the change of current practice of measuring surface radiation levels are unwarranted because no health and safety benefit would accrue from such change.

One commenter suggested that the radiation level limit be reduced to 75 or 50 millirems per hour at 5 centimeters from the surface of a package. Although this suggestion would reduce the surface radiation level limit of most packages (large and small) to less than the current surface radiation level limit, it again appears unjustified to restrict to lower values the surface radiation level

of large packages whose direct exposures under contact are unlikely or to allow higher surface radiation levels for smaller packages whose contact exposures are frequent.

However, the staff recognizes the potential difficulty certain licensees may have in interpreting the regulation in 10 CFR 20.205(c)(2) as to whether a precise determination of surface radiation level is required.

In a letter to the petitioner dated December 5, 1977, the staff stated, "As with any regulation, the (safety) limits must be given as exact, precise values. The methods of demonstrating compliance with these limits are usually left to the regulated person. Any method which provides a reasonable demonstration of compliance will be accepted. In most cases exact measured values are not required."

The staff indicated that precise measurements exactly on the surface of the packages are not necessary nor required under 10 CFR 20.205(c)(2). Measurements at some distance from the surface are acceptable if it can be shown from the measured value that the radiation level on the surface is likely to meet the regulatory limit.

In the same letter, the staff stated it might be appropriate to issue a regulatory guide to explain the regulation in 10 CFR 20.205(c)(2) and to propose a method of surface radiation level measurement that is acceptable to NRC. The staff is now developing such a regulatory guide.

After careful consideration of the petition and the public comments thereon, the staff concluded that the proposed change would lead to cost increase without corresponding benefit of improving public health and safety. In fact, such a change would result in higher collective hand dose of package handlers. However, the staff believes a regulatory guide should be issued promptly to clarify the meaning of the relevant regulation.

In view of the foregoing, the NRC hereby denies the petition for rulemaking filed by Tech/Ops on April 5, 1977. Copies of the petition for rulemaking, the comments thereon, and the NRC's letter of denial are available for public inspection in the NRC's Public Document Room at 1717 H Street NW., Washington, D.C.

Dated at Bethesda, Md. this 23rd day of March, 1979.

For the Nuclear Regulatory Commission.

Lee V. Gossick
Executive Director for Operations