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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 27, 1999

MEMORANDUM TO: Chairman Dicus
Commissioner Diaz
Commissioner McGaffigan
Commissioner Merrifield

FROM: William D. Travers
Executive Director for Operations

SUBJECT: RULEMAKING ON DISCRETE RADIOACTIVE PARTICLE DOSE CONSTRAINT

The purpose of this memorandum is to inform the Commission of a change in direction on the subject rulemaking that is needed as a result of new information obtained by the staff.

BACKGROUND:

In the early 1980s, health physicists noted increasing numbers of discrete radioactive particles (DRPs) on or near the skin of workers in nuclear power plants. These small (< 2 mm) particles have high specific activity (beta), and when on or very near the skin produce a very localized high dose to a small volume of skin tissue that may result in a transient break in the skin with little health consequence.

The existing Part 20 skin dose limit of 50 rem averaged over 1 cm^2 is intended to apply to relatively uniform dose to a larger area of skin, and was selected to prevent deterministic damage to the skin that might compromise skin function or appearance. Because this limit did not seem to apply to DRPs on or very near the skin, the NRC established an interim enforcement discretion policy in Information Notice No. 90-48, "Enforcement Policy for Hot Particle Exposures," that would require only reporting and mitigation if a DRP dose exceeded the existing "50 rem over 1-cm^2" limit, and enforcement action would be taken if the DRP beta emission exceeded 75 μCi-hrs (~300 rad). In order to avoid DRP doses greater than 50 rem and the resulting reporting requirement, licensees with DRP problems monitor workers frequently during the work shift, thus incurring additional external dose to the workers and the monitors.

In 1988 the staff contracted with Brookhaven National Laboratory (BNL) to study the health effects of DRPs on the skin and initiated a contract with the National Council on Radiation Protection and Measurement (NCRP) to develop guidance on controlling DRP doses. BNL provided definitive data on the probability of producing breaks in the skin from irradiation of the skin by DRPs in contact with the skin and that these effects did not pose any serious health

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provided definitive data on the probability of producing breaks in the skin from irradiation of the skin by DRPs in contact with the skin and that these effects did not pose any serious health problems to workers. Based on the BNL data, and similar experiments done by the Electric Power Research Institute (EPRI), the NCRP recommended a dose limiting guideline of 50 Rads averaged over ten square centimeters (or, 500 Rads averaged over one square centimeter). The BNL and NCRP work looked only at the nonuniform, highly concentrated dose to one square centimeter from DRPs in contact with the skin, and not at dose that would be delivered to the next nearest square centimeter.

In October 1998, the staff submitted a rulemaking plan (SECY-98-245) titled "Protection Against Discrete Radioactive Particle (DRP) Exposures (10 CFR Part 20)." The staff proposed establishing a "300 rad per 1 cm^2" constraint as a program design guideline or action level, and a "1000 rad per 1 cm^2" capping limit. The intent of the proposed amendments was to reduce the additional external dose incurred by workers in monitoring for DRPs during work shifts, and to reduce unnecessary burden by adopting more realistic thresholds for DRP dose control and reporting requirements. The staff requirements memorandum (SRM) dated December 23, 1998, directed the staff to proceed with rulemaking as proposed but to use 500 rad per 1 cm^2 as the capping dose limit to be consistent with NCRP recommendations. The staff began writing a proposed rule package; the draft FR Notice and Regulatory Analysis are already prepared consistent with the SRM.

DISCUSSION:

In March of 1999, several industry experts who had reviewed the now public rule plan and SRM, suggested that the planned action would not accomplish the intent of the proposed rulemaking. Because these experts were knowledgeable DRP dosimetry experts, and had served on the NCRP committee, the staff requested Dr. John Baum, the BNL researcher and NRC contractor to review their concerns. Dr. Baum concurred with their concerns and raised some additional issues. The NRC technical working group is in agreement that the following issues are valid and that they argue to a revision in staff plans:

- Of all DRP events, fewer than 10 percent are on (or near enough to) the skin to produce a unique, localized beta dose having no large area health implications. Most DRP events (>90%) are DRPs on clothing, or hair, or are far enough away from the skin (and most likely moving), so that the dose to the skin is more uniform, is spread over a larger area, and is more likely to be controlled by the existing 50-rem skin dose limit. This suggests that a reduction in monitoring frequency, and the associated external dose, cannot be realized with the existing skin dose limit.

- A revision to the VARSKIN code, which calculates dose to the skin, and new calculations performed by an NRC consultant, show that a DRP as close as 0.4 mm from the skin can deliver a concentrated DRP dose to a small volume of skin that is less than the proposed 500 rad to 1cm^2 DRP dose limit, and still deliver more than 50 rem to the next 1cm^2 area, thus exceeding the existing skin dose limit. This suggests that many of the DRP incidents where the particle remains fixed on the skin, would still be controlled by the existing skin dose limit and thus no reduction in monitoring would occur.

- An industry representative has observed that many licensees use 10-20 percent of any limit as an administrative guideline to avoid exceeding the limit. If the DRP dose limit were set at 500 rads over $1cm^2$, the actual operating limit could be as low as 50-100 rad, thus losing the value of the 300-rad constraint to reduce the unnecessary monitoring dose.

The justification for proposing a 300 rad over $1cm^2$ constraint, or action level, was in large part to reduce the additional external dose incurred by the plant staff from frequent monitoring to avoid having to report a DRP dose that exceeded the existing 50-rem skin dose limit. If more than 90 percent of DRPs are off the skin, and irradiating a relatively large area, the existing skin dose limit is in effect, and the constraint would only rarely be used. Little relief from monitoring dose would result from implementing the constraint.

For particles on the skin, it now appears that in some cases a DRP dose could be within the 300-rad DRP constraint and still exceed the existing 50-rem skin dose limit in the next annular square centimeter. For these reasons, it is likely that creating a DRP constraint of 300-rad would reduce monitoring for DRPs only slightly, if at all. Consequently the staff no longer believes that a DRP dose constraint is useful or justifiable, and the staff is considering several possible approaches to establishing an effective DRP dose limit. The staff is reviewing worker safety and health implications of the possible alternatives. The staff is considering whether there is justification for changing the area over which the existing skin dose limit is averaged and whether a single limit could apply to large area skin doses as well as DRP doses. The staff believes that the technical and regulatory issues can be resolved and a staff consensus reached so that recommendations can be made to the Commission for revised regulatory action. The staff will inform the Commission by December 22, 1999 of a revised schedule to complete the technical work and develop the rulemaking.

Attachments:
1. Rulemaking Plan
2. SRM

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Thanks, Susan

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