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March 6, 2008
L-08-071

10 CFR 20

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

SUBJECT:

Beaver Valley Power Station Unit Nos. 1 and 2
Docket Nos. 50-334, 50-412; License Nos. DPR-66, NPF-73

Davis-Besse Nuclear Power Station Unit No. 1
Docket No. 50-346, License No. NPF-3

Perry Nuclear Power Plant Unit No. 1
Docket No. 50-440, License No. NPF-58

Application to Use Weighting Factors for External Exposure

Pursuant to Footnote 2 of 10 CFR 20.1003, "Weighting factor W_T," FirstEnergy Nuclear Operating Company (FENOC) hereby requests approval to use weighting factors provided in the American National Standard Institute (ANSI) Health Physics Society (HPS) N13.41-1997, "Criteria for Performing Multiple Dosimetry" (the Standard) for external radiation exposures when demonstrating compliance with the Total Effective Dose Equivalent (TEDE) requirements contained in 10 CFR 20.

This application applies to Beaver Valley Power Station Unit Nos. 1 and 2, Davis-Besse Nuclear Power Station Unit No. 1, and Perry Nuclear Power Plant Unit No. 1. The technical assessment of the application is contained in the Enclosure. As described in the Enclosure the technical basis for this application is the consensus Standard approved by the American National Standards Institute - Accredited HPS N13 Committee. The Standard is practical and consistent with the organ or tissue weighting factors in 10 CFR 20.1003. Furthermore, the use of these weighting factors would improve assessment of occupational dose to individuals from exposure to highly non-uniform radiation fields.

IE56
IE71
NRR

The application includes commitments as summarized in the Attachment.

FENOC requests approval of this change by January 5, 2009 to support a planned spring refueling outage for Perry Nuclear Power Plant, Unit No. 1. Once approved, the request will be implemented within 30 days.

If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager – Fleet Licensing, at (330) 761-6071.

Sincerely,

Attachment:
Regulatory Commitment List

Enclosure:
Application to Use Weighting Factors for External Exposure

cc: NRC Region I Administrator
NRC Region III Administrator
NRR Project Manager - Beaver Valley Power Station
NRC Resident Inspector - Beaver Valley Power Station
NRR Project Manager - Davis-Besse Nuclear Power Station and Perry Nuclear Power Plant
NRC Resident Inspector - Davis-Besse Nuclear Power Station
NRC Resident Inspector - Perry Nuclear Power Plant
Director BRP/DEP
Site Representative BRP/DEP
Executive Director, Ohio Emergency Management Agency, State of Ohio (NRC Liaison)
Utility Radiological Safety Board

APPLICATION TO USE WEIGHTING FACTORS FOR EXTERNAL EXPOSURE

1.0 INTRODUCTION

Pursuant to Footnote 2 of 10 CFR 20.1003, "Weighting factor W_T," FirstEnergy Nuclear Operating Company (FENOC) hereby requests approval to use weighting factors provided in the American National Standard Institute (ANSI) Health Physics Society (HPS) N13.41-1997, "Criteria for Performing Multiple Dosimetry," (the Standard) for external radiation exposures when demonstrating compliance with Total Effective Dose Equivalent (TEDE) requirements in 10 CFR 20 for Beaver Valley Power Station Unit Nos. 1 and 2, Davis-Besse Nuclear Power Station Unit No. 1, and Perry Nuclear Power Plant Unit No. 1. Specifically, FENOC requests approval to calculate the external dose quantity Effective Dose Equivalent (EDE) using the compartments, compartment factors, and method of summation specified in ANSI/HPS N13.41-1997. The assigned EDE is the sum of each dosimeter measurement modified by its appropriate weighting factor. This request does not seek approval to use Section 4, "Criteria for When to Use Multiple Dosimeters," or Section 5.5, "Alternatives to the Use of Multiple Dosimeters" of the Standard. The NRC has approved similar requests for the calculation of EDE using the compartments, compartment factors, and method of summation specified in ANSI/HPS N13.41-1997 for Southern California Edison (TAC NOS. MC5476, MC5477, and MC5478) and Entergy (TAC NOS. MD1736, MD1739, MD1740, MD1741, MD1742, MD1743, MD1744, and MD1745).

2.0 REGULATORY EVALUATION

The radiation protection approach and dose limits contained in 10 CFR 20 are based on the recommendations of the International Commission on Radiation Protection (ICRP) in its1977 Publication No. 26 (ICRP 26). For stochastic effects, the ICRP recommended dose limitation is based on the principle that the risk should be equal, whether the whole body is irradiated uniformly or there is non-uniform irradiation (such as when radioactive materials are taken into the body and, depending on their physical and chemical properties, concentrate in certain tissues and organs). Therefore, the ICRP 26 recommendations are based on controlling the sum of the risk weighted doses to selected organs.

Effective Dose Equivalent (EDE or H_E) as defined in 10 CFR 20.1003 is:

> The sum of the products of the dose equivalent to the organ or tissue (H_T) and the weighting factors (W_T) applicable to each of the body organs or tissues that are irradiated ($H_E = \Sigma W_T H_T$).

For the purposes of implementing workplace controls, and due to the difference in dosimetry, 10 CFR 20 breaks this EDE (H_E) into two components: (1) dose resulting from radioactive sources internal to the body, and (2) dose resulting from sources external to the body. Dose limits and other requirements in 10 CFR 20 are based on

the sum of these external and internal exposures. For radioactive material taken into the body, the occupational dose limit is based on the resulting dose equivalent integrated over 50 years, or Committed Effective Dose Equivalent (CEDE).

The TEDE is defined in 10 CFR 20.1003 as:

> The sum of the effective dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).

The organ or tissue weighting factor is the proportion of the risk of stochastic effects resulting from the dose to that organ or tissue to the total risk of stochastic effects when the whole body is irradiated uniformly. The weighting factors are applicable to the organs and tissues whether the dose results from radiation sources internal or external to the body. However, measuring the dose to the various organs and tissues with a dosimeter worn outside the body presents some practical difficulties.

If the body is irradiated uniformly, the external component of TEDE can be determined with a single dose measurement on any part of the whole body. This conservative approach to determining TEDE can be overly conservative for extremely non-uniform-irradiations (that is, when only a small portion of the whole body is irradiated). As discussed in NRC Regulatory Issue Summaries 2002-06, "Evaluating Occupational Dose For Individuals Exposed To NRC-Licensed Material And Medical X-Rays," 2003-04, "Use Of The Effective Dose Equivalent In Place Of The Deep Dose Equivalent In Dose Assessments," and 2004-01, "Method For Estimating Effective Dose Equivalent From External Radiation Sources Using Two Dosimeters," the NRC has approved several methods for determining external EDE (EDE_{ex}).

To ensure a conservative determination of TEDE, 10 CFR 20.1201(c) requires that the external whole body exposure component be determined from the part of the body receiving the highest exposure. Thus, if the body is not irradiated uniformly, a single dose measurement cannot determine the dose to the various organs and tissues for an accurate determination of the EDE_{ex}.

Footnote 2 to the "Organ Dose Weighting Factors" table in 10 CFR 20.1003 states that:

> For the purpose of weighting the external whole body dose (for adding it to the internal dose), a single weighting factor, $W_T = 1.0$, has been specified. The use of other weighting factors for external exposure will be approved on a case-by-case basis until such time as specific guidance is issued.

ANSI/HPS N13.41 provides weighting factors that can be utilized when multiple dosimeters are used to measure the external dose received by an individual.

3.0 TECHNICAL ANALYSIS

3.1 IMPROVED ASSESSMENT OF DOSE

In uniform radiation fields, the dosimeter used to measure whole body dose is typically worn on the chest. When the radiation field is highly non-uniform, either the chest dosimeter is moved to the part of the whole body expected to receive the highest dose or additional dosimeters are worn so that the highest whole body dose can be measured.

Difficulties arise because the annual occupational dose limit is based on the stochastic risk from whole body exposure. While the external component of TEDE can be determined with a single dose measurement on any part of the whole body in uniform radiation fields, in highly non-uniform radiation fields, a more accurate estimate of EDE is needed to improve the assessment of occupational dose.

3.2 COMPARTMENT FACTORS

ANSI/HPS N13.41 provides a method for estimating EDE_{ex} based on using multiple dosimeters at specific areas of the body. The whole body is divided into seven areas called "compartments." Each compartment, or composite compartment, is monitored separately. The results of the dose measurements for each compartment are weighted with an associated "compartment factor." A compartment factor relates "the fractional risk to the organs underlying the dosimeters to the total risk from uniform irradiation of the whole body." The resulting weighted doses are then summed to determine the EDE_{ex} for the whole body.

ANSI/HPS N13.41, Appendix A describes how the 10 CFR 20 organ or tissue weighting factors are apportioned to each compartment based on the associated underlying organs and tissues. The resulting compartment factors used to calculate EDE_{ex} are listed in the following chart.

ANSI HPS N13.41 COMPARTMENT FACTORS

Compartment Name	Compartment Factor
Head and neck	0.10
Thorax, above the diaphragm	0.38
Abdomen, including the pelvis	0.50
Upper right arm	0.005

Compartment Name (continued)	Compartment Factor (continued)
Upper left arm	0.005
Right thigh	0.005
Left thigh	0.005

3.3 DOSIMETER SELECTION AND PLACEMENT

NRC Inspection Procedure 71121.01, "Access Control to Radiologically Significant Areas," dated March 6, 2002, Section 03.04(c) "Dosimeter selection and placement criteria," provides suitable criteria for assuring compliance with Part 20.1201(c). These criteria provide for monitoring the part of the body expected to receive the highest dose. FENOC is developing a fleet-wide procedure for determining dosimeter selection and placement. This procedure guidance will be consistent with NRC Inspection Procedure 71121.01. FENOC will monitor the part of the whole body within each compartment (and/or composite compartment) that receives the highest dose. Consistent with current FENOC practice, a single dosimeter placed between the head and the waist is used to measure the dose to the whole body which includes the head, trunk (including male gonads), arms above the elbows, and legs above the knees. National Voluntary Laboratory Accreditation Program (NVLAP) accredited dosimeters are currently used and will continue to be used after the application is approved. Since it is the intention of FENOC to monitor the part of the body expected to receive the highest dose, the dosimeter orientation toward the source will not change. Therefore, there are no new challenges to the dosimeter's angular response characteristics resulting from approval of this application.

3.4 DOSE ASSIGNMENT

Based on the NRC's approval of this request, FENOC will account for dose consistent with the guidance of the Standard as summarized in the following statements. The EDE for each compartment will be determined from dosimeters worn at that location. When no dosimeter is worn at a particular compartment, the EDE will be determined from the dosimeter positioned where the exposure is judged to be similar. The assigned EDE will be the sum of each EDE measurement multiplied by its appropriate compartment factor. The assigned Lens Dose Equivalent (LDE) will be the higher of the head or chest dosimeters. The assigned Shallow Dose Equivalent (SDE) will be the highest of any whole body dosimeter.

4.0 CONCLUSION

Accurate assessment of occupational dose from external sources of radiation in highly non-uniform radiation fields requires a method for assessing EDE. Use of the proposed weighting factors will improve the accuracy of licensee assessment of occupational dose.

FENOC requests approval to assess EDE based on the consensus technical standard, ANSI/HPS N13.41. This Standard was approved by the American National Standards Institute - Accredited HPS N13 Committee on June 20, 1996. At the time of balloting, the HPS N13 Committee membership included representatives from the NRC and the National Council on Radiation Protection and Measurements.

The ANSI/HPS N13.41 consensus standard has been approved for use by the NRC for evaluating occupational dose to medical personnel wearing lead aprons in Regulatory Issue Summary 2002-06.

The use of multiple dosimeters to monitor the part of the whole body expected to receive the highest dose will utilize criteria for dosimeter selection and placement consistent with current NRC inspection procedures.

5.0 REFERENCES

A. ANSI/HPS N13.41-1997, "Criteria for Performing Multiple Dosimetry," December 1996

B. NRC Regulatory Issue Summary 2002-06, "Evaluating Occupational Dose For Individuals Exposed To NRC-Licensed Material And Medical X-Rays," April 16, 2002

C. NRC Regulatory Issue Summary 2003-04, "Use Of The Effective Dose Equivalent In Place Of The Deep Dose Equivalent In Dose Assessments," February 13, 2003

D. NRC Regulatory Issue Summary 2004-01, "Method For Estimating Effective Dose Equivalent From External Radiation Sources Using Two Dosimeters," February 17, 2004

E. NRC Inspection Procedure 71121.01, "Access Control to Radiologically Significant Areas," March 6, 2002

Attachment
L-08-071

Regulatory Commitment List

The following list identifies those actions committed to by the FirstEnergy Nuclear Operating Company (FENOC) for the Beaver Valley Power Station Unit Nos. 1 and 2; Davis-Besse Nuclear Power Station Unit No. 1, and Perry Nuclear Power Plant Unit No. 1 in this document. Any other actions discussed in the letter represent intended or planned actions by FENOC. They are described only as information and are not Regulatory Commitments. Please notify Mr. Thomas A. Lentz, Manager - Fleet Licensing at (330) 761-6071 of any questions regarding this document or associated Regulatory Commitments.

Regulatory Commitments	Due Date
1. FENOC is developing a fleet-wide procedure for determining dosimeter selection and placement. This procedure guidance will be consistent with Nuclear Regulatory Commission Inspection Procedure 71121.01. FENOC will monitor the part of the whole body within each compartment (and/or composite compartment) that receives the highest dose.	30 days after NRC approval
2. Based on the NRC's approval of this request, FENOC will account for dose consistent with the guidance of the American National Standard Institute (ANSI) Health Physics Society (HPS) N13.41-1997, "Criteria for Performing Multiple Dosimetry," (the Standard) as summarized in the following statements. The Effective Dose Equivalent (EDE) for each compartment will be determined from dosimeters worn at that location. When no dosimeter is worn at a particular compartment, the EDE will be determined from the dosimeter positioned where the exposure is judged to be similar. The assigned EDE will be the sum of each EDE measurement multiplied by its appropriate compartment factor. The assigned Lens Dose Equivalent (LDE) will be the higher of the head or chest dosimeters. The assigned Shallow Dose Equivalent (SDE) will be the highest of any whole body dosimeter.	30 days after NRC approval