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Michael R. Kansler
Senior Vice President &
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June 13, 2002
NL-02-085
IPN-02-047
JPN-02-017
ENO Ltr.-1.2.02.053
CNRO-2002-00037

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station PI-137
Washington, DC 20555-0001

SUBJECT: Indian Point Energy Center, Units 1, 2 and 3
Docket Nos. 50-003, 50-247 and 50-286
Pilgrim Nuclear Power Station
Docket No. 50-293
Arkansas Nuclear One, Units 1 and 2
Docket Nos. 50-313 and 50-368
James A. FitzPatrick Nuclear Power Plant
Docket No. 50-333
Waterford 3 Steam Electric Station
Docket No. 50-382
Grand Gulf Nuclear Station
Docket No. 50-416
River Bend Station
Docket No. 50-458
Response to NRC Request for Additional Information on Application for Exemption from the Definition of Total Effective Dose Equivalent

Reference: Letter from Thomas W. Alexion, Project Manager, Section 1, Project Directorate IV, Division of Licensing Project Management, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission to Mr. Michael R. Kansler, SVP&COO, Entergy Nuclear Operations, Inc., dated May 14, 2002

Dear Sir:

Entergy is providing the attached responses to the NRC staff request for additional information included with the referenced letter.

A001

If you have any questions, please contact Mr. J. Kelly at (914) 272-3370.

Very truly yours,

Michael R. Kansler
Senior Vice President and
Chief Operating Officer

Attachment 1 Entergy's Response to NRC's May 14, 2002 Request for Additional Information on Application for Exemption from the Definition of Total Effective Dose Equivalent (TEDE)

cc:

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ATTACHMENT 1
NL-02-085
IPN-02-047
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CNRO-2002-00037

ENTERGY'S RESPONSE TO NRC's MAY 14, 2002 REQUEST FOR ADDITIONAL INFORMATION ON REQUEST FOR EXEMPTION FROM THE DEFINITION OF TOTAL EFFECTIVE DOSE EQUIVALENT (TEDE)

June 13, 2002

Question 1

The response to Question 1 in Attachment 2 to the July 20, 2001, letter appears to conflict with the exemption request in the body of the letter itself. Verify that Entergy intends to estimate effective dose equivalent (not deep-dose equivalent) with the EPRI method referenced, when you are demonstrating compliance with 10 CFR 20.1201(a)(1)(i) using the requested alternate definition of TEDE. Also verify that compliance with the limit on total organ dose will be demonstrated using deep-dose equivalent (as specified in 10 CFR 20.1201(a)(1)(ii) and 20.1201(c)) instead of as stated in your response.

Response:

Entergy intends to estimate effective dose equivalent (not deep-dose equivalent) with the EPRI method referenced when we are demonstrating compliance with 10 CFR 20.1201(a)(1)(i) using the requested alternate definition of TEDE.

Question 2

Your July 20, 2001, letter states that the EPRI method is applicable to "all radiation exposure situations" (see Attachment 1, page 3) and requests approval to use the weighted two-badge algorithm (A3)* when "there is expected to be a significant difference between the deep-dose equivalent [DDE] and the effective dose equivalent [EDE]." However, the algorithms used in the EPRI method for estimating EDE were developed for directional, broad parallel beam gamma exposures. They are not valid for all non-uniform exposure situations. Verify that the method will only be applied in those situations that approximate exposure to directional parallel gamma beams (e.g., no significant dose-rate gradient across the space occupied by the body, ignoring the shielding of the body itself).

*Since the one-badge (A1) "algorithm" discussed in the EPRI documents is consistent with dosimetry practices allowed under the current regulation, no exemption from Part 20 is needed.

Response:

In the exemption request of July 20, 2001 on page 3 of Attachment 1 Entergy stated: "Using the simple algorithms applied to two dosimeters (on the front and the back) yielded a more accurate and numerically lower effective dose equivalent under all radiation exposure situations." This question states, "Verify that the method will only be applied to those situations that approximate exposures to directional parallel gamma beams (e.g. no significant dose-rate gradient across the space occupied by the body, ignoring the shielding of the body itself)."

Reference 5.5 of Entergy's exemption states, "Doses from point sources three meters or more away from the phantom can be predicted using beam geometry results". Since a point source is a limiting case, Entergy will treat any source at a distance of three meters or more as a planar source.

In reference 5.4 of the exemption request, in Table 8 on page 4-3 and in tables and graphs of Attachment 1, calculated effective dose equivalent information is provided for a point source 44 cm from the phantom centerline (approximately 30 cm from the surface). This data demonstrates that use of EPRI algorithm [A3] as requested in our response to Question 6 (letter of July 20, 2001) will result in a conservative assessment of dose for the case of a point source at 44 cm from the centerline or approximately 30 cm from the body. Entergy is requesting permission to use the EPRI methodology for planar radiation sources and other radiation sources at a distance of 30 cm or more from the body. This will result in a conservative estimate of dose.

Entergy is not requesting use of this EPRI methodology in a water environment such as experienced by divers.

Question 3

Your response to the question above need not discuss body-to-dosimeter self shielding, since it is covered by your response in the July 20, 2001, letter (Question 2 in Attachment 2), to ensuring that at least one dosimeter "see" the major exposure source at all times. However, the statement in this response that "job-specific Radiation Work Permits will require the worker to move about to ensure this requirement is met" seems impractical. Please clarify.

Response:

Radiation Work Permits and radiation worker training will provide guidance to assure that the personnel dosimeter remains exposed to the radiation source. Similar instruction is currently provided to workers wearing only one personnel dosimeter for routine work in radiation areas.

Question 4

Verify that the front and back dosimeters used in the A3 method of assessing EDE will be calibrated to read DDE at the point of measurement.

Response:

The front and back dosimeters used in the A3 method of assessing EDE will be calibrated to read DDE at the point of measurement.

Question 5

The published paper, "Two Methods For Examining Angular Response of Personnel Dosimeters," by P. Plato, et. al. (Reference 5.13 in the July 20, 2001, letter), provides evidence that the Panasonic UD-802 dosimeter, currently in use in the Entergy system, has angular dependent response characteristics suitable to support the EPRI algorithms. Is the Entergy request narrowly restricted to the use of the UD-802 dosimeter? If not, commit to using

dosimeters that have an angular response at least as good as that described in the paper, "A Study of the Angular Dependence Problem in Effective Dose Equivalent Assessment," by X. Xu, et. al. (Reference 5.7 in the July 20, 2001, letter).

Response:

Entergy's request is not restricted to the use of the UD-802 dosimeter. Entergy will use dosimeters that have an angular response at least as good as that described in the paper, "A Study of the Angular Dependence Problem in Effective Dose Equivalent Assessment," by X. G. Xu, et al (Reference 5.7 in the July 20, 2001 letter).

Question 6

The guidelines for implementation of the EPRI methodology for assessing EDE in Reference 5.8 in the July 20, 2001, letter are vague as to whether the EPRI algorithms (specifically A3) are valid for assessing EDE from point sources (or hot particles) on or near the surface of the body. Therefore, it is unclear if assessing EDE from external point sources is included in the Entergy request. The information in Volumes 1 and 2 of EPRI TR-101909 (July 20, 2001, letter, References 5.4 and 5.6, respectively), is insufficient for the staff to conclude that the A3 method is valid for assessing EDE from point sources in all cases. Verify that Entergy does not intend to use this method for assessing EDE from point sources on or near the surface of the body or provide the following information.

6.1 The "true" EDE (calculated by Monte Carlo method) values resulting from point source exposures, provided in Tables 5, 6 and 7 of Volume 1, are not based on the organ weighting factors given in Part 20 and therefore not appropriate for demonstrating compliance with the requirement in 20.1201(a)(1)(i). The geometry of these calculations is constrained to locations on the trunk of the body (from 6 cm to 61 cm above the point the legs join the body). It is easy to describe an exposure situation, outside the bounds of these calculations, where a point source (i.e., located on the inside of upper thigh) would result in a significant EDE. Describe how a conservative EDE, consistent with the definition in Part 20, will be assessed for all exposures to point sources located on, or near, the surface of the entire body.

6.2 The data in Table 9 of Volume 2 is too limited to demonstrate that the EDE values assessed with the EPRI methodology are valid for hot particle exposures. The geometry of the exposure situation, discussed in 6.1 above, is further restricted such that the two dosimeters are located either at the hip or mid-torso, with the point sources located at the same height (e.g., in the same plane cutting horizontally through the body) as the dosimeters. No information is provided on how the calculated, or indicated, EDE varies as the source is moved up or down the body away from the plane of the dosimeters. The ratio of the EDE calculated by the A3 method to the "true" EDE is presented for just five grid locations radially around the body in each dosimeter plane. The potential for self-shielding of both dosimeters from the point source is not addressed since the source grid locations evaluated are not on the surface of the body. Provide

data that demonstrates that the EDE calculated with the A3 method is a conservative (e.g., the ratio of the calculated to "true" EDE is greater than or equal to one) estimate of the EDE for all point source locations on, or near, the surface of the entire body.

Response:

The method will not be used to assess effective dose equivalent for point sources less than 30 cm from the body or hot particles.

Question 7

Verify that the values for parallel beam sources, in units of "E-15 rad-cm squared per photon," as stated in EPRI TR-101909, Volume 2, Table 8, are off by 5 orders of magnitude, and will not be used specifically for calculating EDE in a real exposure situation.

Response:

The values for parallel beam sources, in units of "E-15 rad-cm squared per photon," as stated in EPRI TR-101909, Volume 2, Table 8, are off by 5 orders of magnitude; the correct units should be "E-10 rad-cm squared per photon." These values will not be used specifically for calculating EDE in a real exposure situation.