Pacific Gas and Electric Company®

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November 18, 2008

PG&E Letter DCL-08-099
PG&E Letter HBL-08-018

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

Docket No. 50-275, OL-DPR-80
Docket No. 50-323, OL-DPR-82
Diablo Canyon Units 1 and 2
Docket No. 50-133, OL-DPR-7
Humboldt Bay Power Plant, Unit 3
Response to Request for Additional Information, Application to Use Weighting Factors for Effective Dose Equivalent

Dear Commissioners and Staff:

By letter dated June 9, 2008 (PG&E Letter DCL-08-050, HBL-08-013), PG&E requested approval, in accordance with 10 CFR Part 20.1201(c), to use weighting factors for assessing effective dose equivalent (EDE) based on direct measurement of external exposures using personnel dosimeters. The assigned EDE is to be the sum of the dosimeter measurements, modified by the appropriate weighting factor for the given compartment.

By email dated October 20, 2008, the NRC requested additional information to complete its review of the PG&E application. The request was discussed with the NRC staff on November 5, 2007. The revised application included in the enclosure addresses the NRC comments, and supersedes the application submitted by PG&E's June 9, 2008, letter.

PG&E makes no regulatory commitments (as defined by NEI 99-04) in this letter.

If you have any questions, or require additional information, please contact Stan Ketelsen at (805) 545-4720.

Sincerely,

James R. Becker
*Site Vice President*

NMSS01

tcg/4231/DN 50039484
Enclosure
cc: Elmo E. Collins, NRC Region IV
Michael S. Peck, NRC Senior Resident Inspector
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cc/enc: John B. Hickman, NRC Project Manager
Alan B. Wang, NRC Project Manager

# APPLICATION TO USE WEIGHTING FACTORS FOR EFFECTIVE DOSE EQUIVALENT (Revision 1)

# 1.0 INTRODUCTION

## 1.1 Purpose

Pursuant to 10 CFR Part 20.1003, "Weighting factor $W_T$," and 10 CFR Part 20.1201(c), Pacific Gas and Electric (PG&E) requests approval to use weighting factors for calculating external whole body dose.

Specifically, in accordance with 10 CFR Part 20.1201(c), PG&E requests approval to use weighting factors specified in HPS N13.41-1997, "Criteria for Performing Multiple Dosimetry," approved December 1996, American National Standards Institute, Inc., for assessing effective dose equivalent (EDE) based on direct measurement of external exposures using personnel dosimeters. The assigned EDE is to be the sum of the dosimeter measurements, modified by the appropriate weighting factor for the given compartment.

## 1.2 Regulatory Evaluation

Dose limits in 10 CFR Part 20 are specified in the dose quantity total effective dose equivalent (TEDE). TEDE is defined in 10 CFR Part 20.1003 as the sum of the external dose quantity called effective dose equivalent (EDE) plus the internal dose quantity called committed effective dose equivalent (CEDE).

10 CFR Part 20.1201, "Occupational dose limits for adults," states in part: "(c) When the external exposure is determined by measurement with an external personal monitoring device, the deep-dose equivalent [DDE] must be used in place of the effective dose equivalent, unless the effective dose equivalent is determined by a dosimetry method approved by the NRC."

# 2.0 TECHNICAL JUSTIFICATION

## 2.1 Improved Assessment of Occupational Dose

In uniform radiation fields, the dosimeter used to measure whole body dose is normally worn on the chest. The dosimeter measures radiation exposure using the operational dose quantity DDE.

When the radiation field is highly nonuniform, either the chest dosimeter is relocated to the part of the whole body expected to receive the highest dose or additional dosimeters are worn in order that the highest whole body dose can be measured.

The annual occupational dose limit is based on the stochastic risk from whole body exposure, which is related to the dose quantity EDE. While the use of DDE as a surrogate quantity to approximate EDE is quite accurate in uniform radiation fields, in

highly nonuniform radiation fields, a more accurate estimate of EDE would improve the true assessment of occupational dose.

## 2.2 Compartment Factors

HPS N13.41 provides a method for assessing EDE based on measurements of DDE at specific areas of the body called "compartments," and applying appropriate weighting factors called "compartment factors." A compartment factor, "relates the fractional risk to the organs underlying the measurement location to the total risk from uniform irradiation of the whole body.[1]"

HPS N13.41, Appendix A, describes how the 10 CFR Part 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 are contained in, "Table 1 – Compartment Factors of HPS N13.41." These values are reproduced below:

Compartment Factors

| Area of the Body | Compartment Factor |
|---|---|
| Head and neck | 0.10 |
| Thorax, above the diaphragm | 0.38 |
| Abdomen, including the pelvis | 0.50 |
| Upper right arm | 0.005 |
| Upper left arm | 0.005 |
| Right thigh | 0.005 |
| Left thigh | 0.005 |

## 2.3 Dosimeter Selection and Placement

The current National Voluntary Laboratory Accreditation Program accredited dosimeters will be worn at the whole body locations similar to the way in which they are worn today when performing multibadging. With approval of the EDE calculation method, more accurate measurement through multibadging with less single badge relocation is expected.

When placing dosimeters on areas of the body for estimation of EDE, because a nonuniform dose gradient is assumed, the dosimeter for that area or compartment will be placed in such a way as to measure the highest exposed part of the respective whole body compartment, consistent with the dosimeter placement criteria found in NRC Inspection Procedure 71121.01.

[1] HPS N13.41-1997, An American National Standard – Criteria for performing Multiple Dosimetry, Approved December 1996, American National Standards Institute, Inc.

## 2.4 Dose Assignment

In accordance with HPS N13.41, the DDE for each compartment shall be determined from dosimeter(s) placed at that location. If no dosimeter was placed at a particular compartment, the personnel DDE determined from dosimeters positioned in nearby areas, where exposures are judged to be similar to or greater than the unmonitored area, will be used. The assigned EDE will be the sum of the assigned DDE for the compartment multiplied by its appropriate compartment factor.

The lens dose equivalent (LDE) will be determined using the head or surrogate location thermoluminescent dosimeter (at 300 mm depth). The assigned whole body shallow dose equivalent (SDE, WB) will be the highest dosimeter dose (at 7 mm depth) from all assigned whole body dosimeters.

## 2.5 Conclusion

Accurate assessment of occupational dose from external sources in nonuniform radiation fields requires a method for assessing EDE. NRC approval of this application will improve the accuracy of PG&E assessment of occupational dose in these nonuniform radiation fields.

PG&E will assess EDE based on the method contained in paragraph 6.2 of HPS N13.41.

A similar use of HPS N13.41 has been approved for V. C. Summer Nuclear Station in a letter dated March 14, 2008 (ADAMS Accession No. ML080570154), and Wolf Creek Generating Station in a letter dated August 23, 2007 (ADAMS Accession No. ML072220355), as well as other nuclear power stations.

The proposed method is consistent with the criteria for dosimeter selection and placement found in NRC Inspection Procedure 71121.01, "Access Control to Radiologically Significant Areas."