



Department of Energy

Washington, DC 20585

February 9, 2000

Mr. Robert I. Van Hook
Lockheed Martin Energy Systems
P.O. Box 2009
Oak Ridge, Tennessee 37831

Dear Mr. Van Hook:

This letter responds to your September 8, 1999, request for exemption from provisions contained in Title 10 Code of Federal Regulations, Part 835 (10 CFR 835), "Occupational Radiation Protection." Based on October 27, 1999, discussions between Office of Worker Protection Programs and Hazards Management staff and your staff, you submitted a clarification to your exemption request on November 17, 1999. Specifically, you requested, for the Y-12 facility, exemption from the requirements of section 203(b) of 10 CFR 835, which requires that the tissue weighting factors provided in 10 CFR 835 be used in determining effective dose equivalents for all chemical forms and lung clearance classes (i.e., Classes D, W, and Y) of uranium. Although not specifically discussed in the exemption request, granting the requested exemption would also require granting an exemption from the definition of "weighting factor" in 10 CFR 835.2(b).

The Office of Worker Protection Programs and Hazards Management conducted a technical review of the exemption request (enclosed). Based on our review of the materials that were provided to us, the Department of Energy (DOE) is granting an exemption, with conditions, from the 10 CFR 835.203(b) and 10 CFR 835.2(b) requirements for using the tissue weighting factors provided in 10 CFR 835 (see enclosed exemption decision). This exemption is only for the Y-12 facility and only includes assessment of dose from intakes of uranium. The effective date of the exemption is for assessing intakes of uranium received after the start of the year 2000. This exemption decision does not apply to internal doses that would be considered when determining compliance with 10 CFR 835 Subpart C for the year 1999.

The enclosed technical review provides additional information concerning the exemption decision.

The DOE Office of Defense Programs (DP) staff concur with this response.

Sincerely,

A handwritten signature in black ink, appearing to read "David Michaels".

David Michaels, PhD, MPH
Assistant Secretary
Environment, Safety and Health

2 Enclosures

cc w/enclosures:
See attached list

cc w/enclosures:

T. Gioconda, DP-1

Keith Christopher, EH-10

Docketing Clerk, EH-3

Manager, Oak Ridge

Operations Office

Radiological Control

Coordinating Committee

Price Anderson Amendments

Act Coordinator

D. Minnema, DP-45

P. Aiken, DP-24

Technical Position

**Lockheed Martin Energy Systems, Inc. (LMES)
Title 10, Code of Federal Regulations, Part 835 (10 CFR 835)
Exemption Request**

On September 8, 1999, Lockheed Martin Energy Systems, Inc. (LMES) requested exemption from certain requirements of 10 CFR 835, "Occupational Radiation Protection." LMES requested exemption from certain requirements for controlling and determining individual doses resulting from intakes of radioactive material. Based on October 27, 1999, discussions between Office of Worker Protection Programs and Hazards Management (EH-52) staff and LMES staff, LMES submitted on November 17, 1999, a clarification to their exemption request. EH-52 concurs with this amended exemption request, with conditions.

Discussion

Request

Specifically, LMES requests, for the Y-12 facility, exemption from section 203(b) of 10 CFR 835, which requires that the weighting factors provided in 10 CFR 835.2(b) be used in determining effective dose equivalents. The exemption request only applies to intakes of uranium, in all chemical forms and lung clearance classes (i.e., Classes D, W, and Y). Although not specifically discussed in the exemption request, EH-52 determined that LMES also requires an exemption from the definition of "weighting factor" provided in 10 CFR 835.2(b). LMES submitted, and subsequently withdrew, a request for exemption from the 10 CFR 835 appendix A requirement to use the derived air concentration (DAC) values for uranium provided in appendix A for radiation protection purposes.

In lieu of the weighting factors provided in 10 CFR 835.2(b), LMES proposes to use the tissue weighting factors provided in International Commission on Radiological Protection's (ICRP) Publication 60, *1990 Recommendations of the International Commission on Radiological Protection*.

Note: For purposes of discussing the exemption request:
Classes Y, W, and D material will be considered equivalent to Types S, M, and F material, respectively, under the newer internal dosimetry methodologies.

In support of their exemption request, LMES also noted that the exemption was needed to reconcile inconsistencies between intake estimates calculated from fecal sample analysis and urinalysis data.

Requirements from which Exemption is Sought

§ 835.2 Definitions

(b) As used in this part to describe various aspects of radiation dose:

Weighting factor (w_T) means the fraction of the overall health risk, resulting from uniform, whole body irradiation, attributable to specific tissue (T). The dose equivalent to tissue (H_T), is multiplied by the appropriate weighting factor to obtain the effective dose equivalent contribution from that tissue. The weighting factors are as follows:

WEIGHTING FACTORS FOR VARIOUS ORGANS AND TISSUES

Organs or tissues, T	Weighting factor, w_T
Gonads	0.25
Breasts	0.15
Red bone marrow	0.12
Lungs	0.12
Thyroid	0.03
Bone surfaces	0.03
Remainder ¹	0.30
Whole body ²	1.00

¹"Remainder" means the five other organs or tissues, excluding the skin and lens of the eye, with the highest dose (e.g., liver, kidney, spleen, thymus, adrenal, pancreas, stomach, small intestine, and upper large intestine). The weighting factor for each remaining organ or tissue is 0.06.

²For the case of uniform external irradiation of the whole body, a weighting factor (w_T) equal to 1 may be used in determination of the effective dose equivalent.

§ 835.203 Combining internal and external dose equivalents.

(b) Determinations of the effective dose equivalent shall be made using the weighting factor values provided in § 835.2.

Analysis

LMES states that the requested exemption will "enhance facility worker safety and health by allowing the utilization of more accurate, state of the art, dose assessment techniques." The

clarification to the exemption request discusses the applicability of the special circumstance described in 10 CFR 820, *Procedural Rules for DOE Nuclear Activities*, Subpart E, *Exemption Relief*. Section 3.2(e) of DOE Standard 1083-95, *Requesting and Granting Exemptions to Nuclear Safety Rules*, requires that the request and supporting documentation shall discuss the special circumstances (listed in 10 CFR 820.62) that warrant the exemption. LMES claims that the exemption request meets the special circumstance provided in 10 CFR 820.62(d)(4), "The exemption would result in benefit to human health and safety that compensates for any detriment that may result from the grant of the exemption." LMES concludes that there would be no detriment resulting from the granting of the exemption, and the benefit would be more accurate dose assessment.

Title 10 CFR 835.203(b) and the definitions provided in 10 CFR 835.2 (b) require the use of the weighting factors provided in 10 CFR 835 for assessing committed effective dose equivalent (CEDE) and effective dose equivalent (EDE). These weighting factors are consistent with the earlier recommendations of ICRP Publication 26, *Annals of the ICRP*, and ICRP Publication 30, *Limits for Intakes of Radionuclides by Workers*, and are published in the *Radiation Protection Guidance to Federal Agencies for Occupational Exposure*, which was signed by the President in 1987.

With the exception of making revisions to weighting factors, DOE permits and encourages the use of newer internal dosimetry methodologies in determining individual dose from intakes of radioactive material. Section 4.4.3 of DOE Guide G441.1-3, *Internal Dosimetry Program Guide* (March 1999), states that methods for evaluating the various doses from intakes "should be based on recommendations given in ICRP publications, NRCP reports, and ANSI standards that embody improvements and updates of the science of internal dosimetry." In addition, the Guide refers to DOE-STD-1121-98, *Internal Dosimetry* (September 1999), which also discusses use of more current, appropriate internal dosimetry methodologies.

LMES contends that failing to grant the exemption will result in uranium dose equivalent calculations that are overly conservative. In support of this contention, LMES attached a report, ORNL/TM-1999/114, *Y-12 Uranium Exposure Study*, dated August 1999. That report demonstrated that, for example, Class Y (or Type S) uranium, using the ICRP Publication 30 methodology, including use of 10 CFR 835 required tissue weighting factors, with a 1 micron size particle, would result in a calculated dose coefficient (i.e., the dose per unit of intake) that was approximately 5 times greater than that calculated using the more current methodology of ICRP Publication 68, *Dose Coefficients for Intakes of Radionuclides by Worker*. The ORNL comparison report included use of ICRP Publication 60 tissue weighting factors, ICRP Publication 66, *Human Respiratory Tract Model for Radiological Protection*, lung model, and a 5 micron size particle.

Note: Title 10 CFR 835 already permits both corrections for particle size and the use of currently available internal dose models. 10 CFR 835 appendix A states that "For situations where the particle size distribution is known to differ significantly from 1 micron, appropriate corrections can be made to both the estimated dose to workers and the DACs."

LMES also provided a copy of a Nuclear Regulatory Commission (NRC) approval of a similar exemption from NRC requirements. The reasons and discussion found in the NRC decision supports LMES's request. The NRC concurred that the use of ICRP Publication 60 tissue weighting factors would presumably result in more accurate estimates of the doses resulting from intakes of radioactive materials than estimates resulting from the current NRC-required model.

EH-52 calculated dose coefficients for the different isotopes of uranium and lung clearance classes using the same assumptions as used in the LMES report referred to in the exemption request and obtained similar results. The following table summarizes these calculations for uranium.

Relative Assessed Dose (CEDE) in Rem from an Intake of Uranium

	CEDE (Rem)		
	Class D	Class W	Class Y
835 Based Model*	1.0	1.0	1.0
Lung and Particle Size Change	6.76	1.47	0.13
Tissue Weighting Factors Change	3.24	1.11	0.18

***835 Based Model** - Uses same models and assumptions used for developing 10 CFR 835 DAC values.
Lung and Particle Size Change - Modifies **835 Based Model** by using 5 micron particle size and ICRP Publication 66 lung model and using 10 CFR 835 weighting factors. This approach does not require an exemption.
Tissue Weighting Factors Change - Modifies **835 Based Model** by using 5 micron particle size and ICRP Publication 66 lung model and using ICRP Publication 60 tissue weighting factors. Use of the ICRP Publication 60 tissue weighting factors requires an exemption.

As can be seen from the above table for the different lung clearance classes of uranium, making particle size corrections and using the ICRP Publication 66 lung model (changes which do not require an exemption) with the 10 CFR 835 weighting factors results in significantly different assessed doses than the methodology used for developing the 10 CFR 835 appendix A DAC values. The differences were sometimes significantly higher (approximately 7 times higher for Class D material) and sometimes significantly lower (approximately 8 times lower for Class Y material).

The additional change of including the ICRP Publication 60 tissue weighting factors, as shown in the third column of the above table, resulted in assessed doses that were closer to those obtained using the methodology used for developing the 10 CFR 835 appendix A DAC values. Results for class Y material were still approximately 5 times lower.

During the October 27, 1999, telephone discussion, LMES personnel indicated that they did not plan on using the ICRP Publication 66 lung model without the exemption to revise tissue weighting factors. Their rationale was that ICRP Publication 66 references use of ICRP Publication 60 tissue weighting factors. LMES believes that it would be inappropriate to use the ICRP Publication 66 lung model without using the ICRP Publication 60 tissue weighting factors. For the types of internal exposure at the Y-12 facility, EH-52 does not believe that this self imposed restriction is required. EH-52 acknowledges LMES's desire to maintain "purity of models" as was discussed during the October 27, 1999, telephone discussion.

According to the 1998 DOE *Radiation Exposure Monitoring System* data, for the Y-12 facility, LMES reported a collective CEDE from uranium intakes of 34.2 rem. Over 1000 individuals had measurable doses, with only 66 individuals having doses above the regulatory monitoring threshold (found in 10 CFR 835.402(c)) of 100 millirem. Calculating doses from uranium intakes using the ICRP Publication 66 lung model and the ICRP Publication 60 tissue weighting factors would result in changes to the assessed individual and collective CEDE at the Y-12 facility; some of the changes would be significant. The dosimetric impact of the proposed exemption would be the assessment of lower doses due to exposures from Class Y uranium.

Granting the exemption would result in assessing doses using a methodology more consistent with current national and international consensus recommendations and, therefore, likely would result in a more accurate assessment of the dose. Granting the exemption will also result in better correlation between dose assessments based on fecal sample analysis and urinalysis data.

Appropriate assessment and control of internal exposures to ionizing radiation is one of the underlying purposes of 10 CFR 835. For this reason, EH-52 believes that the exemption request meets the special circumstance in 10 CFR 820.62(d)(2) "Application of the requirement in the particular circumstances would not serve or is not necessary to achieve its underlying purpose." Accordingly, the exemption request should be granted with the following two conditions:

- (1) LMES revise their Radiation Protection Program (RPP) to permit use of ICRP Publication 60 tissue weighting factors for uranium by revising the definition of "weighting factor" as follows:

"Weighting factor (w_T) means the fraction of the overall health risk, resulting from uniform, whole body irradiation, attributable to specific tissue (T). The dose equivalent to tissue (H_T) is multiplied by the appropriate weighting factor to obtain the effective dose equivalent contribution from that tissue. For assessing dose from intakes of uranium, tissue weighting factors from ICRP Publication 60 shall be used. For all other dose assessments the weighting factors are as follows:"

- (2) LMES revise their RPP to reflect that compliance with 10 CFR 835.203(b) will be achieved by adherence to the definition of "weighting factor" provided in their RPP.

Based on the above discussion, EH-52 concurs that a sufficient basis for the granting of the exemption has been provided. Accordingly, this office recommends approval of the exemption request.

The effective date of the exemption should be for assessing intakes of uranium received after the start of the year 2000. "Year" is defined in 10 CFR 835.2(a). The exemption decision should not apply to internal doses that would be considered when determining compliance with 10 CFR subpart C for the year 1999. This will allow consistent assessment of doses for the entire year and preclude imposing or removing regulatory requirements retrospectively.

Concurrence

Consistent with the technical position provided above, EH-52 concurs with the subject exemption request.

Duration of Exemption

Permanent.

PART 835 EXEMPTION DECISION

Pursuant to Title 10 Code of Federal Regulations, part 820.61 (10 CFR 820.61), the Assistant Secretary for Environment, Safety and Health (EH-1) is authorized to exercise authority on behalf of the Department of Energy (DOE) with respect to requests for exemptions from nuclear safety rules relating to radiological protection of workers, the public, and the environment.

Lockheed Martin Energy Systems (LMES) filed a request with the Department for an exemption from certain requirements of 10 CFR 835, "Occupational Radiation Protection." In particular, LMES requested relief from the requirements of 10 CFR 835.203(b). This requirement applies to determining effective dose equivalents from internal exposures to uranium. The request states that the exemption is not prohibited by law; will not present undue risk to the public health and safety, the environment, or facility workers; and is consistent with the safe operation of a DOE nuclear facility.

Based on a review of the supporting documentation, I find that the request set forth above has been justified for relief from the requirements in the stated sections of 10 CFR 835. LMES has provided appropriate documentation indicating that the requested exemption meets the special circumstances established in 10 CFR 820.62. LMES demonstrated that application of the requirements for internal dose assessment is not necessary to achieve its underlying purpose, which is the appropriate assessment of internal doses. Granting the exemption will also result in better correlation between dose assessments based on fecal sample analysis and urinalysis data. Based on a review of the data included in the exemption request and discussion with LMES personnel, DOE concludes that granting the exemption is consistent with the safe operation of a DOE nuclear facility.

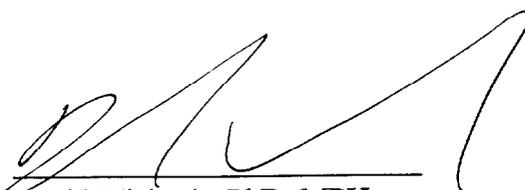
On the basis of the foregoing, I hereby approve LMES's request for exemption from the stated section of 10 CFR 835 at the Y-12 facility for calculating internal dose from intakes of uranium. In addition, I grant an exemption from the definition of "weighting factor" in 10 CFR 835.2(b). Specifically, LMES may use the tissue weighting factors provided in International Commission on Radiological Protection's (ICRP) Publication 60, *1990 Recommendations of the International Commission on Radiological Protection*, to assess dose from intakes of uranium at the Y-12 facility. This LMES shall revise their Radiation Protection Program (RPP) to allow use of ICRP Publication 60 tissue weighting factors for uranium by revising the definition of "weighting factor" as follows:

"Weighting factor (w_T) means the fraction of the overall health risk, resulting from uniform, whole body irradiation, attributable to specific tissue (T). The dose equivalent to tissue (H_T) is multiplied by the appropriate weighting factor to obtain the effective dose equivalent contribution from that tissue. For assessing dose from intakes of uranium, tissue weighting factors from ICRP Publication 60 shall be used. For all other dose assessments the weighting factors are as follows:"

LMES shall also revise their RPP to reflect that compliance with 10 CFR 835.203(b) will be achieved by adherence to the definition of "weighting factor" provided in their RPP.

The effective date of the exemption shall be for assessing intakes of uranium received after the start of the year 2000. This exemption decision does not apply to internal doses that would be considered when determining compliance with 10 CFR 835 subpart C for the year 1999. "Year" is defined in 10 CFR 835.2(a).

Pursuant to 10 CFR 820.66, LMES has fifteen days from the date of the filing of this decision to file a Request to Review with the Secretary. The Request to Review shall state specifically the respects in which the exemption determination is claimed to be erroneous, the grounds of the request, and the relief requested.



David Michaels, PhD, MPH
Assistant Secretary
Environment, Safety and Health

FEB 03 2000

Date