Department of Energy
Washington, DC 20585

March 16, 1999

Mr. R. R. Harbert
Project Manager
Formerly Utilized Sites Remedial
Actions Programs
Bechtel National, Inc.
Oak Ridge Corporate Center
151 Lafayette Drive, P.O. Box 350
Oak Ridge, Tennessee 37831-0350

Dear Mr. Harbert:

This is in follow-up to the former Assistant Secretary for Environment, Safety and Health's February 9, 1996, response to your requests for exemption from certain provisions contained in Title 10 Code of Federal Regulations, Part 835 (10 CFR 835), "Occupational Radiation Protection."

You requested exemptions due to inherent problems in conducting dose assessments, performing real-time air monitoring, and posting and personal monitoring for radon, thoron, and their progeny. In response to your request, you were granted, with conditions, a set of exemptions intended to permit a practical application of the system of radiation protection provided in 10 CFR 835 to exposure of Department of Energy (DOE) workers from radon, thoron, and their progeny.

The intent of the Department's February 9, 1996, response was to provide interim relief and guidance until the Department revised the specific provisions for which the exemptions were granted. On November 4, 1998, the Department published an amendment to 10 CFR 835 in the Federal Register. Some of the provisions for which you were granted exemption have been revised such that: 1) An exemption is no longer needed or 2) your exemption decision needs to be revised to be consistent with the amended rule.

I am enclosing a table of revisions for your exemption decision. This table should be kept with the original exemption decision. The original technical position accompanying the exemption decision and the conditions specified in the exemption decision remain in effect.

Sincerely,

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

Enclosure

cc w/enclosure:
James M. Owendoff
Keith Christopher
James C. Hall, Oak Ridge
Operations Office

Update of February 9, 1996, Exemption Decision for Formerly Utilized Sites Remedial Actions Programs Bechtel National, Inc.

Original Exemption	Revision	New Exemption
§835.(1)(b)(4)	(b)(4) was revised to (b)(6)	§835.(1)(b)(6)
§835.2(a)	The definitions in the exemption decision were revised with no effect on the exemption decision.	§835.2(a)
§835.4	Provision was modified with no effect on exemption decision.	§835.4
§835.202(c)	Provision was modified with no effect on exemption decision.	§835.202(c)
§835.402(c)(1)	Provision was modified with no effect on exemption decision.	§835.402(c)(1)
§835.403(a)(1)	Provision was modified with no effect on exemption decision.	§835.403(a)(1)
§835.702(c)(4)(iii)	Provision was modified such that an exemption is no longer necessary.	None
Appendix C	Provision was modified such that an exemption is no longer necessary.	None

The original technical position accompanying the exemption decision and the conditions specified in the exemption decision remain in effect.

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

3-16-99
Date

Department of Energy
Washington, DC 20585

February 9, 1996

Mr. R.R. Harbert
Project Manager
Formerly Utilized Sites Remedial
Actions Programs
Bechtel National, Inc.
Oak Ridge Corporate Center
151 Lafayette Drive
P.O. Box 350
Oak Ridge, Tennessee 37831-0350

Dear Mr. Harbert:

This letter responds to your set of seven requests for exemption from certain provisions contained in Title 10, Code of Federal Regulations, Part 835 (10 CFR 835), "Occupational Radiation Protection." Specifically, this exemption concerns your request for exemption from certain provisions contained in sections 402, 403, 404, and 603 of 10 CFR 835. The purpose of the exemption request is to obtain relief from inherent problems in conducting dose assessments, performing real-time air monitoring, and posting and personal monitoring for radon, thoron, and their progeny.

In response to your request, I grant, with conditions, a set of exemptions and provide needed clarification to 10 CFR 835. Below is a summary of the exemptions granted and exemptions denied, which apply regardless of whether or not the individual exemption request addressed a specific provision. The technical position accompanying the transmittal letter forwarding this decision discusses the rational for granting and denying specific provisions and contains the terms and conditions of the exemptions granted.

Exemptions granted

§835.(1)(b)(4), §835.2(a), §835.4, §835.202(c), §835.402(c)(1), §835.403(a)(1), §835.702(c)(4)(iii), and Appendix C.

Exemptions denied

§835.202(a)(1), §835.202(a)(2), §835.202(b), §835.203(a), §835.206(a), §835.206(c), §835.208, §835.209(b), §835.209(c), §834.401(a)(1), §835.402(c)(2), §835.402(c)(3), §835.402(d), §835.403(a)(2), §835.403(a)(3), §835.404(f), §835.603(d), §835.701(a), §835.702(a), §835.702(c)(1), §835.702(c)(2), §835.702(c)(4)(i), §835.702(c)(4)(ii), §835.702(c)(5), §835.702(c)(6), §835.702(d), §835.702(f), §835.801(a), §835.801(b), §835.801(c), §835.801(d), and Appendix A, footnote 4.

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This set of exemptions and clarifications is intended to permit a practical application of the system of radiation protection provided in 10 CFR 835 to exposure of Department of Energy (DOE) workers from radon, thoron, and their progeny and thus provide relief from regulatory problems with the control of occupational exposure to radon, thoron, and their progeny. The details of this set of exemptions, conditions, and clarifications are contained in the enclosed technical position and are summarized below.

Exemptions are provided to permit the following actions (note that the following set of exemptions and clarification apply only to exposure from radon, thoron, and their progeny):

- o Raising the monitoring threshold for radiation workers exposed to radon, thoron, and their progeny from 100 mrem to 500 mrem. The 500 mrem monitoring threshold includes background sources of radon, thoron, and their progeny;

- o raising the criterion for air sampling from 2 percent of an annual limit on intake (ALI) to 10 percent of an ALI;

- o permitting the use of the units Working Level (WL) and Working Level Month (WLM) in official records and reports;

- o eliminating the requirement to record intake resulting from exposure to radon, thorn, and their progeny; and

- o modification of the definitions of controlled area, radiation worker, and background radiation to achieve consistency with the 500 mrem monitoring criteria.

Technical clarification is provided for the conversion of exposure to radon, thoron, and their progeny to committed effective dose equivalent (CEDE) and for the calculation of lung dose from CEDE.

The analysis of each exemption request, a list of the specific provisions for which the exemptions are granted and the associated conditions, a list of the provisions denied, the technical basis for each decision and the details of the technical clarifications are contained in the enclosures accompanying this letter.

This response has also been approved and provided to three other DOE contractors requesting relief from various requirements contained in 10 CFR 835, associated with the control of occupational exposure to radon, thoron, and their progeny. The reason for this approach is that our analysis indicated that, in general, each exemption request could be considered to have a basis for approval under the provisions of 10 CFR 820.62. However, we determined that: (1) It was not necessary to grant an exemption from each of the provisions requested to provide the requested relief; and (2) no two exemption requests requested relief from the same set of provisions. Therefore, it was decided that instead of responding to each request individually, we would develop one response that would address the concerns of all facilities that submitted exemption requests pertaining to radon, thoron, and their progeny.

The intent of this response is to provide interim relief and guidance until the Department revises regulatory provisions pertaining to the specific provisions for which the exemptions are granted. DOE will continue monitoring the status of new recommendations, including those contained in the International Committee on Radiological Protection Publication 65, and amend its regulations when appropriate.

Pursuant to 10 CFR 820.66, Bechtel National, Inc., 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. If no Request to Review is submitted, the exemption decision becomes a Final Order fifteen days after it is filed.

The DOE Office of Environmental Management staff concur with this response.

Sincerely,

Tara O'Toole

Tara O'Toole, M.D., M.P.H.
Assistant Secretary
Environment, Safety and Health

2 Enclosures

cc w/enclosures:
T. Grumbly, EM-1
Keith Christopher, EH-3
Docketing Clerk, EH-3
James M. Turner, Oak Ridge
  Operations Office
Radiological Control
  Coordinating Committee

Technical Position

Radon/Thoron
Title 10, Code of Federal Regulations, Part 835 (10 CFR 835)
Exemption Requests

Four contractors have sought relief from various requirements contained in 10 CFR 835, "Occupational Radiation Protection," for monitoring, reporting, posting, and assessing dose from occupational exposure to radon and/or thoron and their progeny. Exemption requests have been received from the Formerly Utilized Sites Remedial Actions Programs (FUSRAP) (contractor: Bechtel National, Inc.), Uranium Mill Tailings Remedial Act (UMTRA) (contractor: M.K. Ferguson), Grand Junction Program Office (GJPO) (contractor: RUST/Geotech, Inc.), and Fernald Environmental Remediation Management Corporation (FERMCO). As discussed below, relief from specific provisions of 10 CFR 835 are justified; other relief is not justified. The Office of Worker Protection Programs and Hazards Management (EH-52) recommends providing exemption to those sections of 10 CFR 835 as specifically discussed in this technical position. These exemptions would no longer be effective when the Department revised regulatory provisions pertaining to the specific provisions for which the exemptions are granted.

Discussion of Exemption Requests

General

1. FUSRAP

   Bechtel National, Inc., contractor for the FUSRAP, has submitted seven requests for exemption from various provisions in 10 CFR 835 which deal directly with inherent problems in conducting dose assessment, performing real-time air monitoring, and posting and personal monitoring for radon, thoron, and their progeny.

2. UMTRA and GJPO

   MK-Ferguson, contractor for the UMTRA project, and RUST/Geotech, contractor for the GJPO have requested temporary exemptions from numerous provisions contained in 10 CFR 835 involving the development of a dose assessment program for radon. These contractors state that they will develop such programs when the Department of Energy (DOE) provides guidance relative to radon dose assessment. UMTRA and GJPO have essentially requested the same temporary exemption. UMTRA has also requested a temporary exemption from the derived air concentration (DAC) value for Radon replacing it with a DAC based on International Commission on Radiological Protection (ICRP) Publication 65. GJPO did not request this exemption.

3. FERMCO

   FERMCO has requested exemptions from several requirements of 10 CFR 835 addressing controls particular to radon, thoron, and their progeny. FERMCO specifically identifies the need for relief from requirements concerning dose assessment, real-time air monitoring, and posting and monitoring requirements.

Applicable Requirements

Table 1, below, provides a summary of the applicable requirements matrixed with the contractor making the specific exemption request. The associated test for these requirements are provided in Appendix A of this document.

Table 1

Comparison of Applicable Requirements to Specific Exemption Requests

Provision	FUSRAP	UMTRA	GJPO	FERMCO
§835.1(b)(4)[1]				
§835.2(a)[1]				
§835.4		X	X	
§835.202(a)(1)		X	X	
§835.202(a)(2)		X	X	
§835.202(b)		X	X	
§835.202(c)[1]				
§835.203(a)		X	X	
§835.206(a)			X	
§835.206(c)		X	X	
§835.207[1]				
§835.208		X	X	
§835.209(b)		X	X	
§835.209(c)		X	X	
§835.401(a)(1)		X	X	
§835.402(c)(1)	X	X	X	X
§835.402(c)(2)	X	X	X	X
§835.402(c)(3)	X	X		X
§835.402(d)		X	X	X
§835.403(a)(1)				X
§835.403(a)(2)	X			X

[1]These provisions were included due to their direct application to the relief granted.

Provision	FUSRAP	UMTRA	GJPO	FERMCO
§835.403(a)(3)	X			X
§835.404(f)	X			X
§835.603(d)	X			X
§835.701(a)		X	X	
§835.702(a)		X	X	X
§835.702(c)(1)		X	X	
§835.702(c)(2)		X	X	
§835.702(c)(4)(i)		X	X	
§835.702(c)(4)(ii)		X	X	
§835.702(c)(4)(iii)		X	X	
§835.702(c)(5)		X	X	
§835.702(c)(6)		X	X	
§835.702(d)		X	X	
§835.702(f)		X	X	
§835.801(a)		X	X	
§835.801(b)		X	X	
§835.801(c)		X	X	
§835.801(d)		X	X	
Appendix A, Footnote 4		X		
Appendix C[1]		X		

Results of Analysis

Discussion

Radon (Rn-222) and thoron (Rn-220) and their progeny present unique problems associated with occupational radiation protection. The Radiological Control Coordinating Committee (RCCC) Subcommittee on Radon reviewed and documented

[1]These provisions were included due to their direct application to the relief granted.

six issues associated with radon monitoring. These issues are discussed in Appendix B of this document. One of these issues is that unlike other occupational exposure received while conducting DOE activities, radon and thoron are present in natural background. The concentrations of radon and thoron occurring in background vary with a variety of environmental factors, the time of day, and the time of year. This creates technical difficulties in differentiating occupational exposure from background exposure at sites where radon and thoron are present due to current or previous DOE activities. Several contractors (FUSRAP, UMTRA, GJPO, and FERMCO) have requested exemptions from various provisions in 10 CFR 835 because of these problems. Difficulties have been noted particularly in the areas of dose assessment, real-time air monitoring, and posting and monitoring requirements.

UMTRA has also questioned the dose conversion basis implicit to Footnote 4 in Appendix A of 10 CFR 835. 10 CFR 835 equates 4 Working Level Months[2] (WLM) radon exposure (12 WLM thoron exposure) to 5 rem committed effective dose equivalent (CEDE). However, ICRP Publication 65 has implied and the International Atomic Energy Agency (IAEA) interim basic safety standards recommend a dose conversion for 4 WLM radon exposure (12 WLM thoron exposure) to 2 rem CEDE.

Based upon EH-52 review and analysis of the exemptions requested and considering the basis for the occupational radiation protection regulatory standards, the fundamental problems in achieving compliance with 10 CFR 835 dealing with occupational exposure to radon and thoron and their progeny fall into the following three categories:

1. There is a technology shortfall in the ability of available instrumentation to reliably differentiate occupational exposures to low levels of radon and thoron from natural background. Therefore, meeting the individual monitoring requirements contained in §835.402 are not practical. The Department anticipates releasing a request for public comment on this issue in the near future. Comments regarding the exclusion of radon and thoron and their progeny from 10 CFR 835 will be considered.

2. In the preamble promulgating the final rule, the DOE committed to provide guidance regarding dose assessment for radon and thoron. This guidance has not been provided.

3. The Department did not anticipate the difficulties identified in achieving compliance with 10 CFR 835 under situations involving occupational exposure to radon and thoron and their progeny. Advanced technologies are not under development to alleviate such shortfalls nor is the Department anticipating such development in the foreseeable future.

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[2]Working Level Month is defined as the amount of alpha particle energy potentially emitted by any mixture of radon or thoron progeny per unit volume of air, reported in units of working levels, multiplied by the worker's exposure time in months of 170 hours.

The following specific issues were raised in each of the contractors' exemption requests:

FUSRAP

FUSRAP-10CFR835-EX-01: §835.402(c)(1)
FUSRAP-10CFR835-EX-02: §835.402(c)(2)
FUSRAP-10CFR835-EX-03: §835.402(c)(3)

FUSRAP requests an exemption from the requirement of calculating or recording the CEDE or the committed dose equivalent (CDE) to radon and thoron and their short-lived decay products until DOE adopts the recommendations of ICRP Publication 65 and develops guidance for evaluation of occupational exposure to radon.

FUSRAP also requests an exemption from the requirement of using the DAC values published in 10 CFR 835 for Rn-220 and Rn-222, which are based on ICRP Publication 32. FUSRAP requests approval to use the DAC values for Rn-220 and Rn-222 that are based on the recommendations from ICRP Publication 65 rather than 10 CFR 835.

FUSRAP-10CFR835-EX-04: §835.403(a)(2)
FUSRAP-10CFR835-EX-05: §835.403(a)(3)

For those areas where the airborne contaminant is radon or thoron and their progeny, FUSRAP requests an exemption from the requirement of utilizing real-time monitoring for radon, using continuous air monitors. FUSRAP maintains that instruments to accurately assess representative Working Level (WL) exposures in real-time and provide alarm capabilities are not commercially available.

FUSRAP-10CFR835-EX-06: §835.404(f)

FUSRAP requests an exemption from the requirement of whole body contamination monitoring for personnel when they exit airborne radioactivity areas posted only for elevated levels of radon.

FUSRAP-10CFR835-EX-07: §835.603(d)

FUSRAP requests an exemption from posting an airborne radioactivity area based on a single measurement exceeding 10 percent of the DAC (radon only). FUSRAP requests that postings of airborne radioactivity areas be based on long term averages of air concentrations.

UMTRA and GJPO

UMTRA and GJPO (GJPO-10CFR835-EX-02) are requesting a temporary exemption from the requirements contained in numerous sections of the 10 CFR 835 (included in some of the previously discussed exemption requests), which involve the development of a dose assessment program for radon. UMTRA and GJPO stated that they will develop radon dose assessment programs when the DOE provides regulatory guidance on implementing those requirements.

UMTRA also seeks a temporary exemption from the requirement of using the DAC value for Rn-222 contained in Appendix A of 10 CFR 835, which is based on ICRP Publication 32. UMTRA requests permission to use a DAC value, which is based on ICRP Publication 65.

FERMCO

FERMCO-ER-94-04

FERMCO is requesting exemptions from numerous requirements in 10 CFR 835 (included in some of the previously discussed exemption requests) addressing controls specific to short-lived radioactive airborne contaminants (i.e., radon, thoron, and subsequent decay products). These exemptions focus on dose assessment, real-time monitoring, posting, and contamination monitoring. FERMCO also noted that making occupational dose evaluations at levels near background is extremely difficult and in some cases not technically feasible.

Concurrence

Two specific issues relative to these exemption requests concerning occupational exposure to radon and thoron must be resolved in order to ensure that compliance can be achieved with the provisions of 10 CFR 835. First, relief from monitoring requirements must be provided in recognition of a technology shortfall of current instrumentation and monitoring techniques in being able to distinguish background levels of radon or thoron from levels created as a result of DOE activities. Second, guidance on assessing dose from occupational exposure to radon and thoron, and their progeny must be provided.

The first issue involves the difficulty in differentiating between background and occupational exposure to radon and thoron and their progeny. This issue is addressed for radiological workers by including background contributions in occupational exposure to radon or thoron and their progeny and changing appropriate thresholds contained in 10 CFR 835 from 100 mrem to 500 mrem CEDE. To be more precise and considering that exposure to radon and thoron is more typically measured in WLM, the thresholds are raised to 0.4 WLM for radon and 1.2 WLM for thoron. These thresholds include:

- Designating and posting controlled areas (10 CFR 835.2(a) and §835.603);
- classifying individuals as radiological workers (§835.2(a));
- monitoring radiological workers for internal exposure (§835.401(a)(1) and 402(c)); and
- air sampling (§835.403(a)(1)) [requirement stated in percent of annual limit of intake (ALI)].

The 500 mrem threshold includes all contributions from sources of radon or thoron and their progeny including background.

The second issue regarding conversion of exposure to radon or thoron and their progeny to a dosimetric quantity is also addressed. Exposures to radon or thoron and their progeny are typically reported in units of WLM. Consistent with the bases for the DACs presented in Appendix A of 10 CFR 835, continuous occupational exposure at 1 DAC (i.e., 170 hours per month) would result in a committed effective dose equivalent of 5 rem. Such continuous exposure would result in exposures of 4 WLM for the radon scenario and 12 WLM for the thoron scenario. In order to normalize these exposures, the derived conversion to determine committed effective dose equivalent, in rem, from radon or thoron exposure in WLM is 5/4 rem per WLM for radon and 5/12 rem per WLM for thoron. Committed dose equivalent to the lungs would be determined by dividing the committed effective dose equivalent by the tissue weighting factor for the lungs, which is provided in §835.2(b). Because of the reliance on the term WLM in controlling radon and thoron exposures, records of intakes under §835.702(c)(4)(iii) and §835.703(b) will be recorded in units of WLM rather than units of curies. Appendix C of this document provides further guidance on determining dose from exposures to radon and thoron and their progeny.

The following exemptions should be granted for the following reasons:

1. Exclusion of background levels of radon or thoron and their progeny [§§835.1(b)(4), 2(a), and 202(c)]:

   Due to the diurnal, geographic, and seasonal variations in background levels of radon, thoron, and their progeny, differentiating occupational levels from background levels is impractical. Accordingly, for the purpose of determining occupational exposure of individuals from radon or thoron and their progeny, background levels of these radionuclides will not be excluded from individual occupational exposure monitoring results.

   Exposure to background levels of radon or thoron and their progeny in the controlled area will be considered to be part of an individual's occupational exposure under this exemption.

2. Airborne radioactivity area definition [§835.2(a)]:

   The definition for airborne radioactivity area is modified to mean any area where the measured concentration of airborne radioactivity, above natural background for all radionuclides except radon and thoron and their progeny, exceeds or is likely to exceed 10 percent of the DAC values listed in Appendix A or Appendix C of this part.

   This definition was modified as a result of including background radon and thoron exposures with occupational exposures to radon and thoron.

3. Controlled area definition [§835.2(a)]:

The definition for controlled area is modified to mean any area to which access is managed in order to protect individuals from exposure to radiation and/or radioactive material. Individuals who enter only the controlled area without entering radiological areas are not expected to receive a total effective dose equivalent of more that 100 mrem (0.001 sievert) in a year from sources other than occupational exposure to radon or thoron and their progeny. Individuals who enter only the controlled area without entering radiological areas are not expected to receive a committed effective dose equivalent of more that 500 mrem (0.005 sievert) in a year from exposure to radon or thoron and their progeny. Posting requirements would conform with these modified conditions. Minors and members of the public are still required to meet the 100 mrem total effective dose equivalent dose limit.

This definition was modified as a result of including background radon and thoron exposures with occupational exposures to radon and thoron. In addition, background for the entire site must be considered when determining occupational exposure to radon and thoron under this exemption. Background levels of radon and thoron at each of the four contractor sites is typically greater than 100 mrem in one year. Therefore, if the definition had not been modified, each site would have been required to be posted as a radiological area (i.e., radiation area or airborne radioactivity area) with appropriate access and administrative controls. The elevated exposure limit for exposure to radon and thoron in the modified definition provides relief to contractors for this requirement.

4. Occupational exposure definition [§835.2(a)]:

The definition for occupational exposure is modified to mean an individual's exposure to ionizing radiation (external and internal) as a result of that individual's work assignment. Occupational exposure does not include planned special exposures, exposures received as a medical patient, background radiation (except for radon and thoron and their progeny), or voluntary participation in medical research programs.

This definition was modified as a result of including background radon and thoron exposures with occupational exposures to radon and thoron.

5. Radiological worker definition [§835.2(a)]:

The definition of a radiological worker is modified to mean a general employee whose job assignment involves operation of radiation producing devices or working with radioactive materials, or who is likely to be routinely occupationally exposed above 100 mrem (0.001 sievert) per year total effective dose equivalent from sources other than radon or thoron and their progeny. For exposures to radon or thoron and their progeny, the routine exposure is likely to exceed 500 mrem (0.005 sievert) per year committed effective dose equivalent.

6. Monitoring of radiological workers to demonstrate compliance with the occupational exposure limits [§835.402(c)(1)]:

   Consistent with the discussion regarding technical difficulties associated with differentiating occupational exposure from background levels of radon or thoron and their progeny, the threshold for monitoring radiological workers' exposure to radon or thoron and their progeny is raised to 500 mrem CEDE (0.4 WLM for radon and 1.2 WLM for thoron). This is consistent with monitoring thresholds under U.S. Nuclear Regulatory Commission radiation protection regulations. The monitoring threshold of 5 rem committed dose equivalent has not been modified since the 500 mrem CEDE threshold is more restrictive; the corresponding committed dose equivalent to the lungs would be 4.17 rem. As noted previously, this threshold includes background.

   The 500 mrem CEDE monitoring threshold for radiological workers' exposure to radon and thoron is independent of the 100 mrem CEDE threshold for all other radionuclides. Therefore, if the radiological worker is exposed to radon and thoron and other radionuclides during the year, the 500 mrem CEDE monitoring threshold would apply only to radon and thoron and the remaining radionuclides would have a 100 mrem CEDE monitoring threshold.

7. Air sampling requirements [§835.403(a)(1)]:

   Consistent with the monitoring threshold, the air sampling threshold for radon or thoron and their progeny is raised from 2 percent ALI to 10 percent ALI. These levels correlate with 100 mrem and 500 mrem CEDE, respectively. To be consistent with the terminology and quantities used when measuring exposure to radon and thoron, the monitoring threshold is raised to 0.4 WLM for radon and 1.2 WLM for thoron.

   The 500 mrem CEDE air sampling threshold for exposures to radon and thoron is independent of the 100 mrem CEDE threshold for all other radionuclides. Therefore, if a mixture of radon and thoron and other airborne radionuclides existed, the 500 mrem CEDE monitoring threshold would apply only to radon and thoron and the remaining mixture would have a 100 mrem CEDE monitoring threshold.

8. Requirements for individual monitoring records and use of radiological units [§§835.4, and 702(c)(4)(iii)]:

   The exposure to radon or thoron and their progeny present unique challenges towards meeting the requirement to record estimated intake. Since radon and thoron exposure is typically reported in terms of WLMs, the Department recognizes this as an acceptable surrogate for the estimated intake for compliance with §835.702(c)(4)(iii). The requirements of §835.702(c)(4)(i) and (ii) remain unchanged. The selection of an equilibrium factor is left to the contractor, but technical justification must be provided.

The DOE also recognizes the use of WLMs as an acceptable unit for radon and thoron exposure monitoring. Accordingly, when reporting the internal dose evaluation results from radon or thoron exposures, the estimated intake would be reported in units of WLMs. Any internal doses would be included in the determination of total effective dose equivalent (§835.202(a)(1)) and total organ dose equivalent (§835.202(a)(2)).

9. DAC for Workers from External Exposure During Immersion in a Contaminated Atmospheric Cloud [Appendix C]: The DOE recognizes that immersion DAC, for Rn-220 and Rn-222 were erroneously included in Appendix C of 10 CFR 835. To preclude any confusion, the need to evaluate occupational exposure to radon and thoron based on this appendix is not required.

The above exemptions meet the criteria for granting a permanent exemption under 10 CFR 820.62:

1. Granting these exemptions would be authorized by law.

2. These exemptions would not present an undue risk to public health and safety, the environment, or facility workers.

3. The exemptions would be consistent with the safe operation of a DOE nuclear facility.

4. In granting these exemptions pursuant to §820.62(d)(2), the DOE recognizes that special circumstances exist where the application of the requirements discussed, above, because the application of these requirements in the case of occupational exposure to radon or thoron and their progeny would not serve the underlying purpose of the stated requirements and such compliance would result in resource impacts, which are not justified by the safety improvements.

The following exemption requests should be denied for the reasons stated:

1. Assessment of dose from exposures to radon and thoron and their progeny [§§835.202(a)(1) and (2), 202(b), 203(a), 209(b) and (c), 402(d) and Appendix A, Footnote 4]:

   Appendix C of this technical position provides guidance on assessing dose from occupational exposure to radon and thoron, and their progeny. Therefore, no exemptions to the above provisions of the rule are necessary.

2. Limits for the embryo/fetus [§§835.206(a) and (c) and 402(c)(2)]:

   The limits for determining the dose equivalent to the embryo/fetus from occupational exposure to a declared pregnant worker are irrelevant in the case of exposures to radon and thoron and their progeny. Intakes of these radionuclides result only in dose to the lungs and would not result in any concurrent exposure to the embryo/fetus. Therefore, no exemptions to the dose limit and monitoring threshold provisions of 10 CFR 835 are necessary.

Likewise, there is no justification for granting an exemption from reassignment of declared pregnant workers per §835.206(c).

3. Exposure limits and individual monitoring for minors and members of the public entering a controlled area [§§835.207, 208, and 402(c)(3)]:

   Exposure limits for minors and members of the public entering a controlled area are not increased for exposure to radon or thoron and their progeny. Monitoring thresholds for minors and members of the public remain at 50 mrem CEDE. This includes all exposures to radon and thoron and their progeny while in the controlled area. To demonstrate compliance with these monitoring provisions requires an assessment of the levels of radon and thoron and their progeny and appropriate controls for limiting the occupancy time for minors and individual members of the public. The occupancy times are typically expected to be quite low, in the order of hours, since any exposure would occur within a properly defined controlled area.

   Notably, contractors may face a situation where radon and thoron levels outside a controlled area could result in a minor or member of the public exceeding the 50 mrem monitoring threshold while on-site, but outside a controlled area. This exemption would not require these individuals to be monitored for exposure to radon or thoron outside the controlled areas.

4. Monitoring to demonstrate compliance with 10 CFR 835 [§835.401(a)(1)]:

   The basis for this exemption request is that it is not technically feasible to demonstrate compliance with the monitoring requirements of 835.402(c)(1) for radon and thoron exposure. Therefore, an exemption to this requirement is not necessary due to the relief being granted under §835.402(c)(1).

5. Real-time monitoring for radon and thoron [§835.403(a)(2) and (3)]:

   Real-time monitoring using continuous air monitors continue to be required in normally occupied areas where an individual is likely to be exposed to airborne radioactivity concentrations (including radon or thoron and their progeny) exceeding 1 DAC (⅓ WL and 1 WL, respectively). The commercial availability of working level monitors with the requisite sensitivity and alarm capability preclude the need for relief from these requirements.

6. Appropriate monitoring to detect and prevent the spread of contamination from airborne radioactivity areas [§835.404(f)]:

   The provisions in 10 CFR 835 relating to administrative and physical controls to prevent the spread of contamination from airborne radioactivity areas are applicable in the case of occupational exposure to radon and thoron and their progeny. The rule requires appropriate monitoring, entry control commensurate with potential radiological hazards, and development of administrative procedures necessary to demonstrate compliance.

7. Posting of airborne radioactivity areas [§835.603(d)]:

   The posting of airborne radioactivity areas corresponding to 10 percent DAC (1/30 WL for radon and 1/10 WL for thoron) for occupational exposure to radon or thoron remain unchanged.

8. Recordkeeping requirements [§§835.701(a) and 702(a), (c)(1), (c)(2), (c)(4)(i), (c)(4)(ii), (c)(5), (c)(6), (d), and (f)]:

   Other than those provisions for records related to internal dose evaluation and monitoring, recordkeeping requirements are pertinent to documenting compliance with 10 CFR 835 for radiation protection programs where occupational exposure to radon or thoron is present. The units and methods for achieving compliance with certain regulatory provisions have been previously discussed in detail.

9. Reports to individuals [§§835.801(a), (b), (c), and (d)]:

   The requirements to report the results of monitoring for occupational exposure to radon and thoron remain unchanged. The information required under §835.702(c) includes the data as specified under the exemption to §835.702(c)(4)(iii).

A summary of those exemptions granted and those exemptions denied, which apply to all four contractors regardless of whether or not their individual exemption request addressed a specific provision is shown below:

Exemptions granted	Exemptions denied	
§835.1(b)(4)	§835.202(a)(1)	§835.603(d)
§835.2(a)	§835.202(a)(2)	§835.701(a)
§835.4	§835.202(b)	§835.702(a)
§835.202(c)	§835.203(a)	§835.702(c)(1)
§835.402(c)(1)	§835.206(a)	§835.702(c)(2)
§835.403(a)(1)	§835.206(c)	§835.702(c)(4)(i)
§835.702(c)(4)(iii)	§835.208	§835.702(c)(4)(ii)
Appendix C	§835.209(b)	§835.702(c)(5)
	§835.209(c)	§835.702(c)(6)
	§835.401(a)(1)	§835.702(c)(6)
	§835.402(c)(2)	§835.702(d)
	§835.402(c)(3)	§835.702(f)
	§835.402(d)	§835.801(a)
	§835.403(a)(2)	§835.801(b)
	§835.403(a)(3)	§835.801(c)
	§835.404(f)	§835.801(d)
		Appendix A, Footnote 4

Appendix A

Applicable 10 CFR 835 Requirement Text

§835.1 (b)(4) The requirements of this part do not apply to: Background radiation, radiation doses received as a patient for the purposes of medical diagnosis or therapy, or radiation doses received from voluntary participation in medical research programs.

§835.2(a) *Airborne radioactivity area* means any area where the measured concentration of airborne radioactivity, above natural background, exceeds or is likely to exceed 10 percent of the DAC values listed in Appendix A or Appendix C of this part.

Background means radiation from:

(i) Naturally occurring radioactive materials which have not been technologically enhanced;

(ii) cosmic sources;

(iii) global fallout as it exists in the environment (such as from the testing of nuclear explosive devices);

(iv) radon and its progeny in concentrations or levels existing in buildings or the environment which have not been elevated as a result of current or prior activities; and

(v) consumer products containing nominal amounts of radioactive material or producing nominal amounts of radiation.

Occupational exposure means an individual's exposure to ionizing radiation (external and internal) as a result of that individual's work assignment. Occupational exposure does not include planned special exposures, exposures received as a medical patient, background radiation, or voluntary participation in medical research programs.

Radiological worker means a general employee whose job assignment involves operation of radiation producing devices or working with radioactive materials, or who is likely to be routinely occupationally exposed above 0.1 rem (0.001 sievert) per year total effective dose equivalent.

§835.4 Unless otherwise specified, the quantities used in the records required by this part shall be clearly indicated in special units of curie, rad, or rem, including multiples and subdivisions of these units. The SI units, becquerel (Bq), gray (Gy), and sievert (Sv), are only provided parenthetically in this part for reference with scientific standards. These SI units are not authorized for use in records required under this part.

NOTE: Although units WL are not discussed in this paragraph, Appendix D does specify their use and is, therefore, an acceptable unit under this provision.

§835.202(a) The occupational exposure to general employees resulting from DOE activities other than planned special exposures under §835.204 and emergency situations under §835.1302 shall be controlled so the following annual limits are not exceeded:

(1) A total effective dose equivalent of 5 rems (0.05 sievert).

(2) The sum of the deep dose equivalent for external exposures and the committed dose equivalent to any organ or tissue other than the lens of the eye of 50 rems (0.5 sievert).

§835.202(b) All occupational exposure received during the current year shall be included when demonstrating compliance with §835.202(a).

§835.202(c) Exposures from background, therapeutic and diagnostic medical radiation, and voluntary participation in medical research programs shall not be included in dose records or in the assessment of compliance with the occupational exposure limits.

§835.203(a) The total effective dose equivalent during a year shall be determined by summing the effective dose equivalent from external exposures and the committed effective dose equivalent from intakes during the year. For purposes of compliance with this part, deep dose equivalent to the whole-body may be used as effective dose equivalent for external exposures.

§835.206(a) The dose equivalent limit for the embryo/fetus from the period of conception to birth, as a result of occupational exposure of a declared pregnant worker is 0.5 rem (0.005 sievert).

§835.206(c) If the dose equivalent to the embryo/fetus is determined to have already exceeded 0.5 rem (0.005 sievert) by the time a worker declares pregnancy, the declared pregnant worker shall not be assigned to tasks where additional occupational exposure is likely during the remaining gestation period.

§835.207 Any minor exposed to radiation and/or radioactive material during direct on-site access at a DOE site or facility shall not exceed 0.1 rem (0.001 sievert) total effective dose equivalent in a year.

§835.208 Any member of the public exposed to radiation and/or radioactive material during direct on-site access at a DOE site or facility shall not exceed 0.1 rem (0.001 sievert) total effective dose equivalent in a year.

§835.209(b) With regard to inhalation exposures and external exposures from airborne radionuclides, compliance with this part shall be demonstrated through conformity with §835.101 and §835.202, which establishes the applicable regulatory limits.

§835.209(c) The estimation of internal dose shall be based on bioassay data rather than air concentration values unless bioassay data are:

(1) unavailable;

(2) inadequate; or

(3) internal dose estimates based on representative air concentration values are demonstrated to be as or more accurate.

§835.401 (a)(1) Monitoring of individuals and areas shall be performed to demonstrate compliance with the regulations in this part.

§835.402(c) For the purpose of monitoring individual exposures to internal radiation, internal dose evaluation programs (including routine bioassay programs) shall be conducted for:

(1) Radiological workers who, under typical conditions, are likely to receive 0.1 rem (0.001 sievert) or more committed effective dose equivalent, and/or 5 rems (0.05 sievert) or more committed dose equivalent to any organ or tissue, from all occupational radionuclide intakes in a year;

(2) declared pregnant workers likely to receive an intake resulting in a dose equivalent to the embryo/fetus in excess of 10 percent of the limit stated in §835.206; or

(3) minors and members of the public who are likely to receive, in 1 year, an intake resulting in a committed effective dose equivalent in excess of 50 percent of the limits state in §835.207 or §835.208, respectively.

§835.402(d) Internal dose evaluation programs shall be adequate to demonstrate compliance with §835.202.

§835.403(a) Measurements of radioactivity concentrations in the ambient air of the workplace shall be performed as follows:

(1) Air sampling shall be performed in occupied areas where, under typical conditions, an individual is likely to receive an annual intake of 2 percent or more of the specified ALI values. For a given radionuclide and lung retention class, the ALI is the product of the DAC listed in Appendix A of this part and the constant 2.4×10^9 mL. Samples shall be taken as necessary to detect and evaluate the level or concentration of airborne radioactive material at work locations.

(2) Real-time air monitoring using continuous air monitors as defined in §835.2, shall be performed in normally occupied areas where an individual is likely to be exposed to a concentration of airborne radioactivity exceeding 1 DAC as specified in Appendix A of this part or where there is a need to alert potentially exposed individuals to unexpected increases in airborne radioactivity levels.

(3) For the airborne radioactive material that could be encountered, real-time air monitors shall have alarm capability and sufficient sensitivity to alert potentially exposed individuals that immediate action is necessary in order to minimize or terminate inhalation exposures.

§835.404(f) Appropriate monitoring to detect and prevent the spread of contamination shall be performed by individuals exiting radiological areas established to control removable contamination and/or airborne radioactivity.

§835.603(d) Each access point to a radiological area (as defined in §835.2) shall be posted with conspicuous signs bearing the wording provided in this section.

(d) *Airborne Radioactivity Area.* The words "Caution, Airborne Radioactivity Area" shall be posted for any occupied area in which airborne radioactivity levels exceed, or are likely to exceed, 10 percent of the DAC value listed in Appendix A or Appendix C of this part.

§835.701(a) Records shall be maintained to document compliance with this part and with radiation protection programs required by §835.101.

§835.702(a) Records shall be maintained to document doses received by all individuals for whom monitoring was required pursuant to §835.402 and doses received during planned special exposures, accidents, and emergency conditions.

§835.702(c) The records required by this section shall:

(1) Be sufficient to evaluate compliance with §835.202.

(2) be sufficient to provide dose information necessary to complete reports required by subpart I of this part and by departmental requirements for occurrence reporting and processing.

(3) include the following quantities for internal dose resulting from intakes received during the year:

(i) Committed effective dose equivalent; and

(ii) committed dose equivalent to any organ or tissue of concern; and

(iii) estimated intake and identity of radionuclides.

(4) Include the following quantities for the summation of the external and internal dose:

(i) Total effective dose equivalent in a year;

(ii) for any organ or tissue assigned an internal dose during the year, the sum of the deep dose equivalent from external exposure and the committed dose equivalent to that organ or tissue; and

(iii) cumulative total effective dose equivalent received from external and internal sources while employed at the site or facility, since January 1, 1989.

(5) Include the dose equivalent to the embryo/fetus of a declared pregnant worker.

§835.702(d) Documentation of all occupational exposure received during the current year shall be obtained when demonstrating compliance with §835.202(a). In the absence of formal records of previous occupational exposure during the year, a written estimate signed by the individual may be accepted.

§835.702(f) The records specified in this section that are identified with a specific individual shall be readily available to that individual.

§835.801(a)-(d)

(a) Radiation exposure data for individuals monitored in accordance with §835.402 shall be reported as specified in this section. The information shall include the data required under §835.702(c). Each notification and report shall be in writing and include: the DOE site or facility name, the name of the individual, and the individual's social security number or employee number.

(b) Upon the request from an individual terminating employment, records of exposure shall be provided to that individual as soon as the data are available, but not later than 90 days after termination. A written estimate of the radiation dose received by that employee based on available information shall be provided at the time of termination, if requested.

(c) Each DOE- or DOE-contractor-operated site or facility shall, on an annual basis, provide a radiation dose report to each individual monitored during the year at that site or facility in accordance with §835.402.

(d) Detailed information concerning any individual's exposure shall be made available to the individual upon request of that individual, consistent with the provisions of the Privacy Act (5 U.S.C. 552a).

Appendix A, Footnote 4

These values are appropriate for protection from radon combined with its short-lived daughters and are based on information given in ICRP Publication 32: Limits for Inhalation of Radon Daughters by Workers and Federal Guidance Report No. 11: Limiting Values of Radionuclide Intake and Air Concentrations, and Dose Conversion Factors for Inhalation, Submersion, and Ingestion (EPA 520/1-88-020). The values given are for 100 percent equilibrium concentration conditions of the radon daughters with the parent. To allow for an actual measured concentration or a demonstrated equilibrium concentration, the values given in this table should be multiplied by the ration (100 percent/actual percent) or (100 percent/demonstrated percent), respectively. Alternatively, the DAC values for Rn-220 and Rn-222 may be replaced by 1 WL* and 1/3 WL*, respectively, for appropriate limiting of daughter concentration. Because of the dosimetric considerations for radon, no f_1 or lung clearance values are listed.

*A "Working Level" (WL) is any combination of short-lived radon daughters, in one liter of air without regard to the degree of equilibrium, that will result in the ultimate emission of 1.3E+05 MeV of alpha energy.

Appendix C

Appendix B

Radiological Control Coordinating Committee Subcommittee on Radon

Six issues were raised by the RCCC Subcommittee on Radon regarding occupational exposure to radon and thoron and their progeny. These issues are:

1. There is no bioassay for radon and thoron and their progeny.

2. Doses are not currently being assigned for occupational exposure to radon, thoron, and their progeny.

3. Compliance with 10 CFR 835 has not been achieved for the requirements for monitoring, dose assessment, records, and reporting.

4. There is significant debate on the validity of DOE's current DAC for radon and thoron. The new ICRP limits (dose conversion convention) suggest that DOE's DAC is 2.5 times too low. A factor of 2.0 is supported by the National Academy of Sciences'(NAS) 1988 Biological Effects of Ionizing Radiation (BEIR IV) report (now dated). ICRP is maintaining their current position presented in ICRP Publication 65. The IAEA has published IAEA Safety Series No. 115-I, which contains recommendations on thoron and endorses the ICRP 65 recommendations on radon. The NAS has convened BEIR VI to further study this issue.

5. Monitoring for exposure to radon, thoron, and their progeny is impractical at 1 percent and 2 percent of current DAC (⅓ WL = 3E-08 μCi/mL equilibrium equivalent radon concentration = 30 pCi/L), as required for members of the public visitors and radiological workers, respectively.

   The determination of background is a problem, since it fluctuates diurnally and seasonally, and is comparable to the trigger levels for monitoring.

6. Guidance from DOE is needed for:

   - conversion of pCi/L and time, or WLM, to dose
   - choice of default values of equilibrium factors

Appendix C

Conversion of Radon/Thoron Exposure to Dose

For the purpose of demonstrating compliance with the occupational exposure limits contained in §835.202, occupational exposure to radon and thoron must be reported and recorded in terms of committed effective dose equivalent.

Appendix A, Footnote 4 provides DAC in terms of WL for Rn-220 and Rn-222 in equilibrium with their daughters of 1 WL and ⅓ WL, respectively. These would correspond to ALIs of 12 WLM and 4 WLM.

Note: The term WLM is defined as the amount of alpha particle energy potentially emitted by any mixture of radon or thoron progeny per unit volume of air, reported in units of working levels, multiplied by the worker's exposure time. Therefore, the exposure times for workers exposed to radon or thoron and their progeny must be tracked to determine their exposure in WLM.

The values for radon and thoron in Appendix A of 10 CFR 835 are based on continuous occupational exposure at 1 DAC (e.g., 170 hours per month) resulting in a committed effective dose equivalent of 5 rem. Alternately, the ICRP Publication 65 implies a dose conversion for 4 WLM radon exposure (12 WLM thoron exposure) to 2 rem committed effective dose equivalent. The National Council on Radiation Protection and Measurement has not yet endorsed the values given in ICRP Publication 65.

For compliance with 10 CFR 835, the conversion of WLM exposure to committed effective dose equivalent for radon and thoron and their progeny should be consistent with the bases of Appendix A of 10 CFR 835. Therefore, the following conversions from WLMs to committed effective dose equivalent are considered appropriate, assuming 100 percent equilibrium:

- For radon (Rn-222) and its progeny: 1.25 rem per WLM.
- For thoron (Rn-220) and its progeny: 0.41 rem per WLM.

WLM are determined using the following equation:

$$WLM = \frac{c_{Rn} F_{eq} T}{KN}$$

c_{Rn} is the Rn-222 and Rn-220 concentration (including background) for the area occupied by the exposed individual as measured in picocuries per liter (pCi/L) (note: 1pCi/L = 1E-9 μCi/mL).

F_{eq} is the progeny equilibrium correction factor. NCRP Report No. 45 provides guidance on the ratio of radon to its short lived daughters in indoor and outdoor atmospheres. When choosing a progeny equilibrium correction factor, contractors must document the technical rationale for their choice.

T is the time the exposed individual spends in the area in hours (h).

K is a correction factor derived from:

- 100 pCi/L per WL Rn-222 and 170 working hours per month, (1.7×10^4); or
- 7.43 pCi/L per WL Rn-220 and 170 working hours per month, (1.26×10^3).

N is any other modifiers, which should be credited (i.e., respiratory protection factors, ventilation factors)

These values are based on stochastic ALIs. The determination of the committed dose equivalent to the lungs ($CDE_{T\text{-}Lungs}$) from occupational exposure to radon or thoron and their progeny is determined by taking the CEDE and dividing by the tissue weighting factor for the lungs (per §835.2(b), the tissue weighting factor, w_T, for the lungs is 0.12).

Therefore:

$$CDE_{T\text{-}Lungs} = \frac{CEDE}{0.12}$$

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.

On June 5, 1995, the Formerly Utilized Sites Remedial Actions Programs contractor (FUSRAP) Bechtel National, Inc., filed seven requests with the Department for exemption from certain requirements contained in 10 CFR 835, "Occupational Radiation Protection," for monitoring, reporting, posting, and assessing dose from occupational exposure to radon and/or thoron, and their progeny. The requests state that the exemptions are authorized 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. In addition, Bechtel National, Inc. has demonstrated that the exemption requests meet the special circumstances provided in 10 CFR 820.62.

Based on a review of the supporting documentation, relief from specific provisions of 10 CFR 835 are justified; other relief is not justified. Below is a summary of the exemptions granted and exemptions denied which apply regardless of whether or not the individual exemption request addressed a specific provision. The technical position accompanying the transmittal letter forwarding this decision discusses the rational for granting and denying specific provisions and contains the terms and conditions of the exemptions granted.

Exemptions granted

§835.(1)(b)(4), §835.2(a), §835.4, §835.202(c), §835.402(c)(1), §835.403(a)(1), §835.702(c)(4)(iii), Appendix C.

Exemptions denied

§835.202(a)(1), §835.202(a)(2), §835.202(b), §835.203(a), §835.206(a), §835.206(c), §835.208, §835.209(b), §835.209(c), §834.401(a)(1), §835.402(c)(2), §835.402(c)(3), §835.402(d), §835.403(a)(2), §835.403(a)(3), §835.404(f), §835.603(d), §835.701(a), §835.702(a), §835.702(c)(1), §835.702(c)(2), §835.702(c)(4)(i), §835.702(c)(4)(ii), §835.702(c)(5), §835.702(c)(6), §835.702(d), §835.702(f), §835.801(a), §835.801(b), §835.801(c), §835.801(d), and Appendix A, footnote 4.

Based on the foregoing, I hereby approve the Bechtel National, Inc., Requests for Exemption, exemption numbers FUSRAP-10CFR835-EX-01 through 07, on a permanent basis commencing on the date of signature set forth below subject to the following conditions:

- The contractor utilizes the revised definitions for airborne radioactivity areas, controlled areas, occupational exposures, and radiological workers;

- for the purpose of determining occupational exposure of individuals from radon and thoron, the contractor does not exclude background levels of these radionuclides from individual occupational exposure monitoring results; and

- the contractor utilizes the revised thresholds for monitoring radiological worker's exposure to radon and thoron and their progeny of 500 mrem committed effective dose equivalent, and the revised air sampling threshold of 10 percent annual limit on intake.

These exemptions will no longer be effective when the Department revises regulatory provisions pertaining to the specific provisions for which the exemptions are granted.

Tara O'Toole, M.D., M.P.H.
Assistant Secretary
Environment, Safety and Health

Feb. 9, 1996
Date