11/21/2011
76FR 72006

PUBLIC SUBMISSION

(3)

As of: January 17, 2012
Received: January 17, 2012
Status: Pending_Post
Tracking No. 80f9899c
Comments Due: January 20, 2012
Submission Type: Web

Docket: NRC-2011-0266
Notice of Availability of Draft Interim Staff Guidance

Comment On: NRC-2011-0266-0001
Draft Interim Staff Guidance: Evaluations of Uranium Recovery Facility Surveys of Radon and Radon Progeny in Air and Demonstrations of Compliance

Document: NRC-2011-0266-DRAFT-0004
Comment on FR Doc # 2011-29987

Submitter Information

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2012 JAN 17 AM 11:35
RECEIVED

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General Comment

Please find the attached Wyoming Mining Association (WMA) Comments on the Draft Interim Staff Guidance: Evaluations of Uranium Recovery Facility Surveys of Radon and Radon Progeny in Air and Demonstrations of Compliance with 10 CFR 20.1301 Docket ID: [NRC-2011-0266 – (Federal Register / Volume 76, Number 224 / Monday, November 21, 2011 / Notices)

Attachments

WMA ltr re Dose Limits 011612_with_appendices

SUNSI Review Complete
Template = ADM-013

E-RIDS = ADM-03
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January 16, 2012

Ms. Cindy Bladey,
Chief, Rules, Announcements, and Directives Branch (RADB)
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U.S. Nuclear Regulatory Commission
Washington, DC 20555–0001

Subject: Wyoming Mining Association (WMA) Comments on the Draft Interim Staff Guidance: Evaluations of Uranium Recovery Facility Surveys of Radon and Radon Progeny in Air and Demonstrations of Compliance with 10 CFR 20.1301 Docket ID: [NRC-2011-0266 – (Federal Register / Volume 76, Number 224 / Monday, November 21, 2011 / Notices)

Dear Ms. Bladey:

The Wyoming Mining Association (WMA) is an industry association representing mining companies, contractors, vendors, suppliers and consultants in the State of Wyoming. Among its mining industry members are uranium recovery licensees, including two (2) operating in-situ uranium recovery licensees, one conventional uranium recovery operator in standby, several companies planning new uranium recovery operations that are currently in the permitting process and several companies conducting final reclamation/restoration operations.

The following are the Association's comments on the *Draft Interim Staff Guidance: Evaluations of Uranium Recovery Facility Surveys of Radon and Radon Progeny in Air and Demonstrations of Compliance with 10 CFR 20.1301* :

General Comments as to Form, Organization and General Content

The document was overall difficult to follow, confusing and somewhat disorganized in spite of the fact that a flow chart was offered at the beginning of the document. The key issue being addressed by the document is radon and radon progeny in air. The document should begin with a clear, concise and well referenced introductory discussion of Radon-222 emissions from uranium recovery facilities as well as background Radon-222 and Radon-222 progeny in air. The reader should first be provided with a clear discussion of the problems in assessing the dose to Radon-222 progeny to members of the public. The document should also discuss the common methods used in the industry to assess Radon-222 and Radon-222 progeny in air and the problems related to distinguishing Radon-222 emissions from a facility from naturally occurring background. There also should be a clear discussion of the differences between modeling and actual measurement of doses from Radon-222 progeny in air. The reliance of models upon meteorological data should also be discussed.

Radon-222 and Its Progeny

The document states:

Note that in this document, the term "radon," without specifying the isotope, is generally used to mean radon-222, as that is generally the isotope of concern at the uranium recovery facilities currently licensed. As discussed later, radon progeny are addressed because most of the dose to people from releases of radon is actually due to exposure to the radon progeny. Here, radon progeny refers to the short-lived (half lives less than one-half hour) decay products of Rn-222, which are Po-218, Pb-214, Bi-214, and Po-214.

A decay chain chart for Radon-222 should be included so the reader can see where the isotopes of concern lie within the decay chain.

Measurement of Radon-222 and Its Progeny

Radon-222 is a noble high density (9.73 grams per liter) gas that decays by alpha emission with a half life of 3.83 days. The document correctly states that "*...most of the dose to people from releases of radon is actually due to exposure to the radon progeny.*" Radon-222 in the environment is generally measured using a RadTrak device. Appendix 1 contains a description of the RadTrak device manufactured by Landauer, Inc. Please note that the literature states that the "*minimum level of detection is 30 pCi/l days i.e., 0.33 pCi/l based on 90 days*". A client can request that the detectors be read to a higher resolution (at a higher cost) which reduces the Lower Limit of Detection (LLD) to 0.06 pCi/l (6.0 pCi/l-Days) based on a ninety (90) day exposure. This is the first problem with the estimation of dose from Radon-222 and its progeny.

10 CFR Part 2 Appendix B – Table 2 provides Effluent Concentration Limits that "*...are equivalent to the radionuclide concentrations which, if inhaled or ingested continuously over the course of a year, would produce a total effective dose equivalent of 0.05 rem (50 millirem or 0.5 millisieverts).*" The Effluent Concentration Limits for Radon-222 are as follows:

Radon-222

			Table 1 Occupational Values			Table 2 Effluent Concentrations		Table 3 Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	
			Oral Ingestion	Inhalation				Monthly Average
Atomic No.	Radionuclide	Class	ALI (µCi)	ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	Concentration (µCi/ml)
86	Radon-222	With daughters removed	-	1E+4	4E-6	1E-8	-	-
		With daughters present	-	1E+2 (or 4 working level months)	3E-8 (or 0.33 working level)	1E-10	-	-

The concentration limit with daughters present is 1E-10 microCuries per milliliter which is equivalent to 0.1 pCi/l. In this case 0.1 pCi/l of Radon-222 with daughters present is equivalent to 50 millirems of internal exposure. The problem is that the existing measurement technology has a minimum level of detection of 0.33 pCi/l based upon a 90 day exposure with reading at conventional resolution and 0.06 pCi/l based upon a 90 day exposure with reading at high resolution. When measuring Radon-222, the high resolution Lower Limit of Detection (LLD) of 0.06 pCi/l based upon a 90 day exposure is very close to the Effluent Concentration Limit of 0.1 pCi/l. In addition, the error estimates for the data provided for RadTrak detectors read at high resolution can vary, with a range of between +/- 0.08 to +/-0.14 pCi/l as documented by a Wyoming uranium recovery licensee. The resolution and Lower Limit of Detection (LLD) of the existing technology for environmental Radon-222 measurement makes it very difficult to precisely measure doses to Radon-222.

Regarding this issue the document states:

> *Typically, passive alpha-track detectors are used to measure environmental levels of radon. These detectors are relatively sensitive, but the minimum detectable concentration (MDC) is a concern for demonstrating compliance using a comparison to the Part 20, Appendix B, effluent value (0.1 pCi/L with progeny in equilibrium). For certain of these detectors, MDC is given as an time-integrated concentration (i.e., an integrated product of concentration and time at that concentration, for example with units pCi-days/L). The length of deployment of detectors can be increased to improve the MDC and reduce the uncertainty of the measurements (e.g., 6 months exposure results in a lower MDC than does 3 months exposure).*

Doses from Radon-222 decay products are generally determined using the modified Kusnetz Method. This method is discussed in *Regulatory Guide 8.30 - HEALTH PHYSICS SURVEYS IN URANIUM RECOVERY FACILITIES:*

> *The modified Kusnetz method for measuring radon daughter working levels is a suitable method for UR facilities. The procedure consists of sampling radon daughters on a high-efficiency filter paper for 5 minutes and, after a delay of 40 to 90 minutes, measuring the alpha counts on the filter during a 1-minute interval. The original Kusnetz method measured the alpha count rate. In the modified Kusnetz method, the rate meter is replaced by a scaler. This improves the sensitivity to a practical lower limit of 0.03 working level for a 1-minute count on a 10-liter (0.01 cubic meter) sample. This is about a factor of 10 lower than that originally obtained using the original Kusnetz method. A 4-minute count gives a lower limit of about 0.003 working level (Ref. 3). High-efficiency membrane or glass fiber filters should be used to minimize loss of alpha counts by absorption in the filter. However, a correction factor to account for alpha absorption in the filter paper should still be used. Care should be taken to avoid contamination of the alpha counter.*

This method is a good one in that testing is performed by the licensee on site and the method can be varied slightly to improve its Lower Limit of Detection (LLD). For example, the volume of air collected in (pumped through) the filter can be increased improving the Lower Limit of Detection (LLD) and reducing the error estimate.

The modified Kusnetz Method must be used in conjunction with Radon-222 RadTrak measurements to calculate equilibrium factors for Radon-222 and its decay products.

Determination of Background

The document discusses the establishment of background Radon-222 concentration in air stating:

> *Establishing background locations for outdoor radon measurements is difficult in many situations, complicated by spatially and temporally varying concentrations; impact of varying geology on the natural emissions of radon from soil into air; effects of topography on wind patterns, especially on patterns of low speed winds (e.g., down valley drainage); and potentially other nearby radon sources, particularly for sites located in heavily mined areas. Licensees should carefully determine background locations on a case-specific basis. When feasible, preoperational monitoring may provide a more complete understanding of background radon concentrations. Regulatory Guide 4.14 recommends one year of preoperational monitoring. However, annual average background radon concentrations outdoors may vary considerably year-to-year.*

For cases of background monitoring performed concurrently with operational monitoring, NRC staff reviewers should be aware of the complexities of determining an appropriate background outdoor radon concentration that is representative of the receptor (or other monitoring) locations. A background location would typically need to be close to the monitoring locations, with geology similar to the site geology, so that the background location is representative of the monitoring location. But the background location should also be far enough from the facility that the radon concentration is not significantly impacted by radon releases from the facility. If onsite meteorological data are available, the data can be used to help determine if background locations are unimpacted or minimally impacted by site operations.

Background Radon-222 activities vary both temporally and spatially in air. The WMA believes that background Radon-222 activities must be measured concurrently with operational monitoring since background Radon-222 activities vary temporally. In winter for example, when the ground is snow covered, background Radon-222 activities in air may be substantially reduced since radon-222 generated in soils upwind of a site are unable to enter the air due to snow. Agricultural activities (plowing) upwind of the facility may elevate background radon-222 activities in air.

Surface mining activities including uranium mining activities, vents from underground uranium mining operations, and other types of earth moving activities are part of background for the area. These activities can contribute to background Radon-222 concentrations in air as well. Because of these factors background Radon-222 activities in air must be measured concurrently with other operational monitoring. The document should be clear that Radon-222 from any mining activities or other sources not licensed by the Commission (non-licensed sources) are part of the prevailing background for the area as is Radon-222 from mining related barium chloride treatment facilities (from removing radium from mine discharge water) and other sources not regulated by the Nuclear Regulatory Commission (NRC).

Background monitoring sites must be located upwind of the licensed facility as determined by the predominate prevailing wind direction. This should be made clear in the document.

For various site specific reasons, background (upwind) Radon-222 activities in air may exceed supposedly impacted downwind radon-222 activities in air. This is known to be true at one uranium recovery site in Wyoming and may be true at others. Background Radon-222 activity in air can vary markedly both temporally and spatially. Radon-222 activity in air, even in air unimpacted by operations, is not homogeneous. Any method used to calculate a dose to the nearest resident or at the site boundary or a concentration at the site boundary must account for background and its variability.

Dose Modeling versus Measurement

The document discusses in Section 4.2 Alternative Survey Approaches for Radon-222 in Air the measurement of operational process parameters or the measurement of Radon-222 emissions from stacks and other effluent points and the use of that information as inputs to a model (MILDOS-AREA is suggested) to determine Radon-222 activities in air at the site boundary. The WMA believes that Radon-222 emissions from stacks and exhausts can be performed accurately and well via the use of RadTrak detectors placed in the vent/exhaust stacks and changed periodically (quarterly) to measure the Radon-222 activity of the air and measurement of the air flow rates in the stacks since this is precisely what is done to measure Radon-222 activities exhausted from uranium mine ventilation raises to assure compliance with 40 CFR Part 61 Subpart B. The Association has concerns regarding the ability to accurately model Radon-222 concentrations above background in air at the property boundary due to the variability of background as well as the variability of meteorological conditions. The WMA believes that measurement of a dose above background to a specific receptor, a maximally exposed individual is the best means of addressing these issues.

The Association believes that any method used to calculate a dose to the nearest resident to or at the site boundary of a uranium recovery facility must be simple, easy to implement, involve as little calculation as possible and applied consistently year after year to assure that changes in methodology do not yield changes in the estimate of dose. Complex methods involving numerous inputs that may change over time may lead to results that may not be as reflective of the actual dose and/or activity at the site boundary.

The WMA strongly agrees with the document when it states:

NRC staff reviewers need to assure that licensees document completely the assessments performed by licensees to demonstrate compliance, including:

- *Measurement methods should be clearly described.*
- *Measurement locations used to represent background should be clearly described.*
- *Results of measurements should be provided, with associated uncertainties.*

Any method used to complete these assessments should be documented in a Standard Operating Procedure (SOP).

Equilibrium Factors

The Statements of Consideration for the final revised 10 CFR Part 20 (Federal Register Volume 56, Number 98 - Tuesday, May 21, 1991 - Rules and Regulations - page 23375) states:

The Commission is aware that some categories of licensees, such as uranium mills and in situ uranium mining facilities, may experience difficulties in determining compliance with the values in appendix B to Part 20.1001 – 20.2401, Table 2, for certain radionuclides, such as radon-222. Provision has been made for licensees to use air and water concentration limits for protection of members of the general public that are different from those in Appendix B to Part 20.1001 – 20.2401, table 2, if the licensee can demonstrate that the physiochemical properties of the effluent justify such modification and the revised value is approved by the NRC. For example, uranium mill licensees could, under this provision, adjust the table 2 value for radon (with daughters) to take into account the actual degree of equilibrium present in the environment.

The document discusses acceptable equilibrium factors as per the table below:

Acceptable values of and approaches to determining the equilibrium factor.

Type of survey	***Receptor location***	***Equilibrium factor or approach***	***Notes***
Most conservative, always acceptable	*Indoors or outdoors*	*1.0*	
Generally acceptable	*outdoors **	*0.7*	*consistent with NCRP 160 approach*
	*indoors **	*0.5*	*based on RG 3.51, consistent with NCRP 160 approach*
	residential exposure	*0.5*	*see text for conditions*

			on use
Site-specific	*outdoors **	*ingrowth calculations based on travel time*	
	*indoors **	*measure radon and progeny separately and calculate equilibrium factor*	

** If receptors are exposed indoors and outdoors, it is acceptable to use separate equilibrium factor values for indoor and outdoor exposure time, or to use the more conservative equilibrium factor value.*

The equilibrium factors shown are high. Equilibrium factors for Radon-222 and its decay products have been calculated at the site of at least one (1) Wyoming uranium recovery licensee and found to be substantially lower. In fact lower than the 0.5 value discussed in the document when it states:

> *For indoors exposures, Regulatory Guide 3.51 provides a generally acceptable equilibrium factor. Appendix C of Regulatory Guide 3.51 provides technical basis information used by NRC staff for a radon progeny inhalation dose conversion factor. The appendix states that a ratio of 5 × 10-6 WL per pCi/m3 of Rn-222 is established by the assumed indoor air concentration ratios of the individual radon progeny. The relationship between radon concentration, progeny concentration, and equilibrium factor is: progeny concentration (in WL) = radon concentration (in pCi/m3) × equilibrium factor × (1 WL per 100 pCi/L radon at equilibrium) × (1 × 10-3 m3/L). Based on this relationship, the value of progeny concentration per radon concentration in the appendix is equivalent to an assumption of an equilibrium factor of 0.5.*

The WMA believes that it is important that licensees do not rely upon provided equilibrium factors but rather on site specific ones determined by the licensee. The Commission should encourage licensees to measure and calculate their own equilibrium factors rather than relying upon "standard" factors provided by others since the equilibrium factor is site specific.

Annual Average Concentrations

The Association supports the use of average annual concentrations since the limit specified in the regulations (10 CFR 20.1301) is an annual limit.

Workers Residing Onsite

The document states:

NRC staff note that some licensees provide onsite residences for workers; while off-duty, these people are considered members of the public.

The Association agrees with this statement and is aware that at least at one (1) uranium recovery licensee workers at times reside on site.

Conclusions:

- The WMA believes that the document could be better organized, clearer, and easier to understand. It should include a decay chain chart for Radon-222 to better orient the reader as well as a discussion regarding Radon-222 in air, background Radon-222 concentrations, sources of Radon-222 from licensed uranium recovery facilities, as well as modeling and measurement techniques.
- The document should discuss and emphasize the high variability both spatially and temporarily of radon-222 in air and provide ranges for background concentrations in air.
- The document should provide a discussion of the measurement techniques for radon-222 and its progeny and provide information regarding the weaknesses of these techniques.
- The document should discuss the advantages and disadvantages, and accuracy of modeling versus measurement of doses from radon-222 and its decay products.
- The document correctly addresses the issue of workers residing near the site boundary as well as the fact that the average annual concentrations may be used.
- The Association supports the statement regarding the need to document the methods used to calculate dose and/or activities at the site boundary.
- The WMA believes that any method used to calculate a dose to the nearest resident to or at the site boundary of a uranium recovery facility must be simple, easy to implement, involve as little calculation as possible and be applied consistently year after year to assure that changes in methodology do not yield changes in the estimate of dose.

The Wyoming Mining Association (WMA) appreciates the opportunity to comment on this document. If you have any questions please do not hesitate to contact me.

Sincerely yours,
WYOMING MINING ASSOCIATION

Marion Loomis

Marion Loomis
Executive Director

Cc: Katie Sweeney – National Mining Association (NMA)

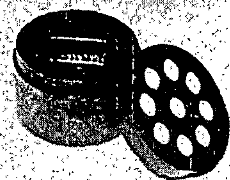
Appendix 1

LANDAUER®

Radtrak® Long-Term Radon Monitoring

Radtrak is an alpha-track radon gas detector designed to monitor radon exposure for three months to one year to obtain a long-term average concentration over time. Landauer service includes the Radtrak detector, comprehensive analysis, and a confidential report of the findings. Radtrak can be packaged for indoor or outdoor area monitoring or personnel monitoring.

Landauer is the leader and pioneer in radon gas detection and monitoring service. Since 1954, our scientists have been involved with the development of radiation monitoring services for nuclear research centers and laboratories, hospitals, medical and dental offices, universities, and other industries where radiation might be present. This experience and technology have been incorporated into Landauer's highly accurate Radtrak radon detector using our exclusive Track-Etch® process. Radtrak radon detectors are used by the Environmental Protection Agency, the National Institutes of Health, the American Lung Association, and many other government and professional organizations.



Radtrak measures the average radon concentration at the location of the detector during the monitoring period. The alpha-track detector has, inside the plastic housing, a radiosensitive element that records alpha particle emissions (alpha tracks) from the natural radioactive decay of radon.

When the detector is returned to Landauer's laboratory, the alpha tracks are counted using computer-assisted image analysis equipment. The number of alpha tracks along with the deployment time period provides the basis for calculating the average radon concentration. The report with the radon gas measurement, reported in picocuries per liter of air (pCi/l), is mailed within seven to ten days after receipt of detector.

Thoron Proof Filter

Upon request, a detector can be fitted with a thoron proof filter that provides measurement of Rn 222 only.

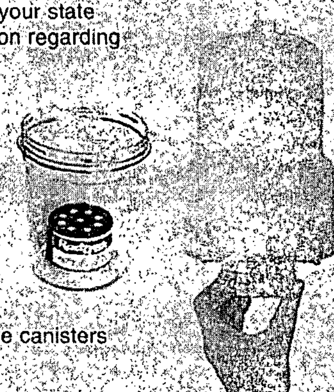
Technical Specifications

- The radiosensitive element is a CR-39 (allyl diglycol carbonate) based, passive alpha-track detector.
- The CR-39 is enclosed in a plastic housing composed of electrically conducting material with filtered openings to permit diffusion of radon gas only.
- Minimum level of detection is 30 pCi/l days i.e., 0.33 pCi/l based on 90 days.
- Detectors, before, during or after exposure, should not be in locations that exceed a temperature of 160°F (70°C).
- Radtrak detectors are packaged in film-foil bags that meet Military specification MIL-B-131, Class 1 to prevent exposure prior to use.
- A metallic label is provided for each detector to seal the filtered openings following the exposure period to minimize subsequent exposure to radon during the return shipment to Landauer's laboratory.
- Each detector is identified by a unique serial number laser engraved on the CR-39, printed and bar coded on the outside of Radtrak, and the film-foil bag.

Indoor Use

Monitoring indoors requires placing the detector in an upright position on a flat surface, or it may be hung from a joist or ceiling with the detector's hanger strip included with the shipment. The U.S. Environmental Protection Agency recommends the detector be placed in the lowest lived-in level of the home. It should be placed in a room that is used regularly but not a kitchen or bathroom. States or other organizations may have differing recommendations. Contact your state agency if you have a question regarding placement.

Outdoor Use



For monitoring outdoors, the detector is fastened to the bottom of a clear plastic cup. The cup is then installed inside a protective canister that has been attached to a post or other location. The protective canisters are sold separately.

Personnel Monitoring

The personnel monitor comes with a clip that easily attaches to the detector and securely fastens to clothing.

For more information on radon, refer to the U.S. Environmental Protection Agency's publication "A Citizen's Guide to Radon" at http://www.epa.gov/iaq/radon/pubs/citguide.html or contact your state department of health.

