

June 3, 2015

Ms. Katie Sweeney, Esq.  
General Counsel  
National Mining Association  
101 Constitution Avenue, NW, Suite 500 East  
Washington, DC 20001

SUBJECT: RESPONSE TO JANUARY 23, 2015, NATIONAL MINING ASSOCIATION  
LETTER

Dear Ms. Sweeney:

I am writing in response to your letter to the U.S. Nuclear Regulatory Commission (NRC, or the Commission) dated January 23, 2015 (found in the Agencywide Documents Access and Management System (ADAMS) under Accession No. ML15034A263). In your letter, you stated concerns about health physics issues related to effluent monitoring and public dose calculations specific to radon-222 (radon) and its decay products (radon progeny). By letter dated February 24, 2015 (ADAMS Accession No. ML15035A610), I replied to your letter and stated that I will provide a detailed response to your concerns prior to the June 2015 National Mining Association (NMA) Uranium Recovery workshop. This letter provides a detailed response to your concerns.

In your January 23, 2015, letter, you expressed concerns about what you believe are NRC staff positions on health physics issues related to regulating exposure to radon that deviate from approved Commission regulations, guidance and policy in a manner not merited by the risks related to radon emissions. You also stated that the NRC staff's approaches to regulating exposure to radon are not always technologically feasible due to conditions specifically related to radon, including both high and variable background concentrations in air. Your letter addresses these issues in four sections: (I) background information that describes the history of work by the uranium recovery industry and NRC staff to resolve health physics issues; (II) particular concerns with the NRC staff's technical evaluation of a July 13, 2013, submittal by Lost Creek ISR, LLC (Lost Creek) to satisfy License Condition 12.10 (ADAMS Accession No. ML14289A148); (III) your concerns that the NRC staff's positions on health physics issues are contrary to risk-informed, risk-based approach to regulation mandated by the Commission, and (IV) your conclusions. My responses to your concerns, provided in Enclosure 1, follow the structure of your letter. Enclosure 2 of this letter provides a summary of meetings and correspondence on the issues you identified. Enclosure 3 provides the NRC staff's detailed responses to your concerns regarding the staff's technical evaluation of Lost Creek's July 13, 2013, submittal.

The NRC staff looks forward to further discussions on these issues at the NMA Uranium Recovery workshop in June 2015. NRC staff would also like to hold another workshop at NRC this Fall concerning measurement of radon in plant effluent and compliance with public dose

requirements in 10 CFR Part 20. We will contact you regarding details of this workshop after issuance of the final Interim Staff Guidance, "Evaluations of Uranium Recovery Facility Surveys of Radon and Radon Progeny in Air and Demonstration of Compliance with 10 CFR 20.1301." I look forward to discussions with you in the coming months about the schedule and agenda for this workshop.

The NRC appreciates NMA's interest in our regulatory process and welcomes its ideas regarding efficiency in our licensing process. If NMA has any questions, please contact David Brown, Sr. Health Physicist, Uranium Recovery Licensing Branch. Mr. Brown can be reached at (301) 415-7677 or [david.brown@nrc.gov](mailto:david.brown@nrc.gov).

In accordance with 10 CFR 2.390 of the NRC's "Agency Rules of Practice and Procedure," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of the NRC's ADAMS. ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>.

Sincerely,

**/RA/**

Larry W. Camper, Director  
Division of Decommissioning, Uranium Recovery  
and Waste Programs  
Office of Nuclear Material Safety  
and Safeguards

Enclosures:

1. NRC Staff Response to National Mining Association's Letter dated January 23, 2015.
2. Meetings and Correspondence on Health Physics Issues
3. NRC Staff Replies to Industry Responses to NRC Staff's Technical Evaluation Report on Lost Creek ISR LLC's July 13, 2013, submittal

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**ML15118A852**

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<b>NAME</b>	DBrown	SAchten	BVonTill	JBiggins	DPersinko	LCamper
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## **I. Background on Health Physics Issues**

In your letter, you summarized a number of correspondence and meetings since 2008 between NRC staff and the uranium recovery industry. These correspondence and meetings focused on resolution of health physics issues that arose during NRC staff's review of applications for the first three uranium recovery facilities to be licensed after completion of the "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities" (NUREG-1910) in May 2009. A summary of the correspondence and meetings on health physics issues is provided as Enclosure 2 of this letter. Regarding the sum of industry and NRC staff efforts from 2008 through the April 2011 Focus Group Meeting, you stated that "while the focus group did not resolve all the issues, the exercise was useful in that it brought the areas of disagreement into more focus." I agree and I look forward to industry's continued involvement to bring these issues to full resolution.

I would like to correct two NMA statements about the April 2011 Focus Group Meeting. On p. 3 of your letter, you stated:

For example, on the issue of acceptance of offsite meteorological data and despite its permissibility under Regulatory Guide 3.63, NRC staff continued to push for on-site data, claiming representativeness was too difficult to prove with off-site data.

Contrary to your statement, Regulatory Guide 3.63, "Onsite Meteorological Measurement Program for Uranium Recovery Facilities – Data Acquisition and Reporting," (ADAMS Accession No. ML003739874) does not address using offsite meteorological data to represent onsite conditions. You also stated:

Another troublesome issue discussed by the focus group was the difficulty in demonstrating compliance with 10 CFR Part 20 exposure limits for Radon-222 and progeny. Again, deviating from past practice, staff began expecting industry to use measurement, in addition to modeling, to demonstrate compliance.

Contrary to your statement, licensees have generally relied upon measurement results reported in semiannual effluent reports to demonstrate compliance with public dose limits. MILDOS has been used to calculate effluent releases and determine quantities of radionuclides in the effluent, and not to demonstrate compliance with public dose limits. See example semiannual effluent reports by Cameco Resources for its Smith Ranch (ADAMS Accession No. ML13073A836) and Crow Butte Uranium Project (ADAMS Accession No. ML13070A014). Therefore, the staff's efforts leading up to the April 2011 Focus Group Meeting did not represent a deviation from past practices.

In the next part of your letter (starting on page p. 4 of Section I., "Background"), you stated concerns that focused on the radon-related issues that became the focus of industry and NRC staff interactions following the November 2011 issuance of the draft Interim Staff Guidance (ISG), "Evaluation of Uranium Recovery Facility Surveys of Radon and Radon Progeny in Air and Demonstrations of Compliance with 10 CFR 20.1301" (Radon ISG). I would like to address several points contained in this part of your letter.

First, you stated that during the development of the Radon ISG, "...these health physics issues continued to be raised in RAIs [requests for additional information], compliance matters and industry/staff meetings." It is a matter of regulatory efficiency that NRC staff would simultaneously address regulatory compliance matters with applicants and licensees and prepare guidance on those matters. This is especially important in cases where past industry practice may not be consistent with current regulations. For this reason, the staff does not intend to delay or postpone regulatory decisions until guidance documents are finalized.

Second, you expressed concern with the staff's response to comment 3-3 on the first draft Radon ISG. Regarding a public comment about measuring incrementally low concentrations of radon in areas with elevated natural background concentrations of radon, the staff responded that, "The minimum detectable concentration (MDC) should not be a difficult issue; in most cases, background concentrations are above the MDC for the alpha track detectors typically used." (ADAMS Accession No. ML13310A197). In your letter, you stated that the staff's response did not account for the fact that "added radon-222 effluent from a facility may not be above the MDC for the detectors typically used and is thus not discernible from background." The second draft Radon ISG remedied this problem and provided four options for licensees to conduct surveys of radon in air. Option 1 involved radon measurements at the boundary of the unrestricted area. Should the use of Option 1 be precluded by radon-222 effluent quantities so low that radon concentrations at the boundary of the unrestricted area could not be measured above background, the second draft Radon ISG provided three other options. In fact, versions of these latter three options are the basis for effluent monitoring plans currently under review by the staff.

Third, you stated your concern regarding the NRC staff's position that compliance should not be demonstrated by modeling alone, but that modeling and calculations should be supported by environmental monitoring. A full explanation of the NRC staff's position on why modeling alone is not sufficient is provided in a April 15, 2014, safety evaluation on a license amendment to remove preoperational license conditions from an ISR license (ADAMS Accession No. ML14087A244). In addition, an approach to "verified modeling" was described by an industry representative at the April 2014 workshop, an approach substantially similar to Option 3 in the second draft Radon ISG.

## **II. Lost Creek Technical Evaluation Report**

In Section II of your letter, "Lost Creek Safety Evaluation Report," you provided industry responses to eight "statements," each of which consists of text excerpted from the NRC staff's November 3, 2014, technical evaluation report (TER) on Lost Creek's July 13, 2013, submittal to satisfy License Condition 12.10 of Materials License SUA-1598 (ADAMS Accession No. ML14289A148). As presented in your letter, the "statements" you created from text excerpted from the staff's TER were in no particular order relative to the order of subjects in the staff's TER. These "statements" were also generally removed from their context in the TER. In two cases, you combined separate excerpted text with the capitalized conjunction "AND," even though the multiple excerpts comprising the "statement" were not from the same page or even the same subject matter in the TER. Nevertheless, I have given all of your statements full consideration. The NRC staff's detailed replies are provided in Enclosure 3 to this letter.

After reviewing your comments on the NRC staff's TER, it appears that the licensee involved misunderstood, at least in part, what was being asked of it. As you know, the NRC staff is available to provide clarification of any regulatory issues to applicants and licensees that arise

during the licensing process. Consistent with your September 16, 2010, letter to the NRC, this appears to be a case where misunderstandings could have been resolved by contacting the NRC project manager (ADAMS Accession No. ML102640020).

### **III. Risk of Uranium Recovery Facilities**

In Section III of your letter, you state that the NRC staff's positions on health physics issues are contrary to the risk-informed, risk-based approach to regulation mandated by the Commission. You also stated that industry believed these issues were previously settled, either by guidance, policy or past agency practice, and you believed that NRC staff was now "reopening" these issues "...without any showing that reopening was necessitated by potential or actual risk." In support of your position, you cited numerous Commission documents which span over a decade, from the Commission's 1995 Policy Statement on use of Probabilistic Risk Assessments to the 2009, "Generic Environmental Impact Statement for In Situ Uranium Milling Facilities." You also cited the 1980 Supreme Court *Benzene* decision (*Industrial Union Department, AFL-CIO v. American Petroleum Institute*) and cautioned staff to narrow its focus to "significant risks" of harm, rather than a large range of "insignificant risks."

As you will recall, in May 2001, the Commission directed the staff to discontinue 10 CFR Part 41 rulemaking efforts and focus staff resources on updating guidance documents. At that time, the NRC staff was directed to "work closely with the industry, States, Environmental Protection Agency and the Department of Energy to find efficient and effective means to reduce any unnecessary regulatory burdens to licensees." (SRM-SECY-01-0026, "Alternatives for Rulemaking: Domestic Licensing of Uranium and Thorium Recovery Facilities.") The Commission also directed that updates to guidance should consider earlier Commission direction on, among other things, performance-based licensing (SRM-SECY-99-0012, "Use of Uranium Mill Tailings Impoundments for the Disposal of Waste Other Than 11e.(2) Byproduct Material and Reviews of Applications to Process Material Other Than Natural Uranium Ores.") As a result, after years of development and multiple opportunities for public participation, these principles are now embodied in the current guidance in NUREG-1569, "Standard Review Plan for In Situ Leach Uranium Extraction License Applications." For example, uranium recovery licenses include a performance-based license condition that provides for facility and procedures changes, and certain tests and experiments, using the licensees' Safety and Environmental Review Panels. In addition, the acceptance criteria in NUREG-1569 are not overly prescriptive in nature, and allow licensees to use standard practices to demonstrate compliance.

However, while NUREG-1569 provides general guidance to the NRC staff on acceptable methods for compliance with the existing regulatory framework, and even provides for flexibility for applicants and licensees to propose other methods as long as the applicant or licensee demonstrates that those alternate methods meet regulatory requirements, NUREG-1569 does not revise or modify existing regulations. The uranium recovery industry must comply with all applicable regulatory requirements.

### **IV. Conclusion**

Finally, you suggested that "uranium recovery facilities should continue to estimate dose to the public using previously-accepted methods (i.e., MILDOS with operational inputs and measurement in certain cases if due to site specific circumstances it is a simpler approach)." As stated above, MILDOS is not used by licensees in semiannual reports to estimate dose to the public. Licensees have generally used measurement results reported in semiannual reports

for this purpose. However, as noted in 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: Revised Draft Report for Comments," FSME-ISG-01(ADAMS Accession No. ML13310A198), the staff has identified problems with how licensees are using measurements to demonstrate compliance in semiannual reports in accordance with 10 CFR 20, Subpart D and 10 CFR 40.65. As a result, the staff will continue to provide comments on semiannual reports and it will continue to resolve these issues in the course of ongoing licensing activities.

**Meetings and Correspondence on Health Physics Issues**

<b>Date</b>	<b>Licensee / Description</b>	<b>Subject</b>	<b>ADAMS Accession No.</b>
12/12/2008	Lost Creek ISR, LLC	Response to 11/6/2008 NRC Request for Information (RAI)	ML090080451
02/28/2009	Crow Butte Resources, Inc.	Response to 11/17/2008 NRC RAI	ML090750429
05/15/2009	Lost Creek ISR, LLC	Summary of 04/16/2009 meeting – accidents, DAC, worker dose, contamination control, preoperational monitoring, maximally exposed public	ML091120502
09/17/2009	Energy Metals Corporation	Summary of 08/18/2009 teleconference – designated individuals; plant airborne sampling (location, MDC, methods); occupational dose records; effluent monitoring, etc.	ML092520565
11/12/2009	Crow Butte Resources, Inc.	Summary of 10/05/2009 teleconference – met issues; air effluent monitoring; background characterization	ML093060198
12/22/2009	Industry Meeting	Summary of 11/17-18/2009 workshop - RG 8.30 (HP Surveys); U solubility class; contamination control	ML093510162
02/17/2011	Industry Meeting	Summary of 01/11-12/2011 workshop - included health physics issues	ML110470469
01/19/2011	Kennecott Uranium Company	Kennecott E-mail re: 01/12/2011 presentation by D. Schmidt – requesting J. Webb to approve equilibrium fraction result for Kennecott Sweetwater	ML110260279
02/28/2011	Kennecott	NRC response to 01/19/2011 Kennecott E-mail	ML110610660
05/10/2011	Industry Meeting	Summary of 04/11/2011 Health Physics Focus Group meeting	ML111250213
09/30/2011	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: Draft Report for Comment,” FSME-ISG-01	ML112720481
12/02/2013	NMA Letter	Letter from NMA requesting, among other things, status of radon guidance	ML13337A259



<b>Date</b>	<b>Licensee / Description</b>	<b>Subject</b>	<b>ADAMS Accession No.</b>
01/16/2014	Industry Meeting	Summary of 12/05/2013 meeting regarding licensing issues	ML14014A342
01/06/2014	Industry Meeting	Summary of 12/19/2013 teleconference regarding FSME-ISG-01	ML13364A259
03/19/2014	Draft Interim Staff Guidance	Summary Responses to Comments	ML13310A197
03/20/2014	Revised 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: Revised Draft Report for Comments," FSME-ISG-01	ML13310A198
04/30/2014	Industry Meeting	Summary of 04/02/2014 workshop - FSME-ISG-01 draft guidance	ML14090A118
11/03/2014	Lost Creek ISR, LLC	NRC staff technical evaluation report of licensee's response to license condition 12.10.	ML14289A148
11/12/2014	Uranium One USA, Inc.	NRC letter regarding license condition 11.3 re: radon air effluent monitoring	ML14295A668

**NRC Staff Replies to Industry Responses to NRC Staff's Technical Evaluation Report  
on Lost Creek ISR LLC's July 13, 2013, submittal**

In this Enclosure, the NRC staff provides its reply to each of the statements in Section II of the January 23, 2015, letter from the National Mining Association (NMA) (available at ADAMS Accession No. ML15034A263). The statements prepared by NMA are comprised of excerpts from the NRC staff's Technical Evaluation Report (TER) on Lost Creek ISR LLC's July 13, 2013, submittal to satisfy License Condition 12.10 (ML14289A148).

**Statement No. 1**

*"Statement: Therefore, staff does not have reasonable assurance that the licensee can determine the dose to the individual likely to receive the highest dose from its licensed operation using the measurement method it proposed. [p. 6] AND With no other monitoring to enable the licensee to calculate the maximum public dose received throughout the facility, staff does not have reasonable assurance that the licensee's proposed measurement methodology will allow the licensee to demonstrate that annual public dose is within regulatory limits.[p. 6] AND "In summary, staff does not have reasonable assurance that placing the radon detectors in the manner proposed by the licensee will be representative of radioactivity concentrations in effluents for reporting purposes or for the purpose of demonstrating that annual public dose is within regulatory limits." [p. 5] AND staff does not have reasonable assurance that the licensee's proposed measurement methodology will allow the licensee to demonstrate that annual public dose is within regulatory limits using the method allowed in 10 CFR 20.1302(b)(2)(i). [p. 5]*

**Industry response:**

- These statements call in to question whether there is the potential that the dose to the public is being exceeded. Such statements are irresponsible absent complete, compelling and verified data that exceedances are occurring as they expose (1) the licensee to actions by interveners and (2) NRC to accusations that it is not adequately protecting public health and safety. These statements are even more potentially inflammatory given the fact that operations at this site have already begun.
- The Lost Creek Project began operations on August 2, 2013. Yet, it was not until 15 months later that the agency sent the letter to Lost Creek that prompted this NMA response. The NRC letter raised perceived issues with the company's compliance methodology and the language used makes it clear that the agency had serious concerns with Lost Creek's approach. Industry does not understand why, If this problem is as serious as the agency implies in the letter, the agency did not take action sooner.
- NRC staffs' position ignores the clear language of 10 CFR 20.1302 which states that calculational methods, without reference to "verification by measurement" can be an acceptable method for demonstrating compliance with limits in 10 CFR 20.1301.

- Staff also ignore NUREG 1156, “Consolidated Guidance about Material Licenses (2001)’ Vol. 11, Appendix Q—Methodology for Determining Public Dose, which provides detailed guidance for acceptable methods to demonstrate compliance both “by measurement” and “by calculation”.
- Additionally, staff fail to consider NUREG-1501, “Background as a Residual Radioactivity Criterion for Decommissioning (1994).” This NUREG was an appendix to the Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for Decommissioning of NRC-Licensed Nuclear Facilities. The associated discussion recognized that in some circumstances, e.g., those involving residual contamination from naturally occurring radioactive materials, the ability to “measure” very low levels of residual contamination relative to the natural background of these radionuclides, which can be several times higher, is not technically feasible and calculational methods must be used.”

### NRC Staff Reply

This first statement prepared by NMA is comprised of four conjugated excerpts from the NRC staff’s November 2014 TER. The third excerpt is from the section of the staff’s November 2014 TER which evaluates the licensee’s response to LC 12.10(A), while the other three excerpts pertain to the staff’s evaluation of the licensee’s response to LC 12.10(B). LC 12.10(A) required the licensee to “discuss how, in accordance with 10 CFR 40.65, the quantity of the principal radionuclides from all point and diffuse sources will be accounted-for in, and verified by, surveys and/or monitoring.” LC 12.10(B) required the licensee to “evaluate the member(s) of the public likely to receive the highest exposures from licensed operations consistent with 10 CFR 20.1302.”

At the time the initial license for the Lost Creek ISR Project was issued, as stated in Section 5.7.8.4 of the NRC staff’s August 2011, “Safety Evaluation Report for the Lost Creek Project,” (ADAMS Accession No. ML112231724), the staff’s reasonable assurance determination for airborne effluent monitoring at Lost Creek was contingent upon the licensee’s fulfillment of preoperational license conditions LC 12.10(A) through 12.10(D). That is, aside from the particular issues that were the subject of these and other preoperational license conditions, NRC staff had reasonable assurance that the licensee would appropriately measure airborne effluents and doses to the public, as required in 10 CFR Part 20. Therefore, in the November 2014 TER, in which the staff evaluated the licensee’s July 2013 response to preoperational license conditions LC 12.10(A) through 12.10(D), the staff is not calling into question whether doses are being exceeded. Rather, the staff is evaluating whether the licensee’s proposed measurement methodologies are sufficient to demonstrate that dose limits are being met.

With regard to the urgency of the staff’s review (i.e., that 15 months transpired between when LCI submitted its letter in response to LC 12.10 and when NRC staff completed its technical review), this work was prioritized along with a number of higher priority licensing actions. Its priority reflects the staff’s continued assurance that airborne effluents would be measured and dose limits would continue to be met until LC 12.10 could be resolved.

The staff has explained elsewhere its position on whether 10 CFR 20.1302 can be met by calculations alone. The staff's position is fully explained in Enclosure 3 to the staff's April 15, 2014, letter to Uranerz (ADAMS Accession No. ML14087A244). This has also been the subject of several meetings between NRC and industry. In fact, at the April 2014 workshop, industry and NRC discussed a concept referred to as "verified modeling," in which measurement results are used to ensure that computational models are reasonable.

The staff did not ignore the guidance in NUREG-1556 (not NUREG-1156, as stated in your letter), Volume 11, "Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Licenses of Broad Scope." This byproduct materials licensing guidance is not applicable to uranium recovery facilities. Similarly, the information contained in NUREG-1501, "Background as a Residual Radioactivity Criterion for Decommissioning: Appendix A to the Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for Decommissioning of NRC-Licensed Nuclear Facilities: Draft Report for Comment," is not relevant and the staff does not utilize this guidance for its licensing activities associated with uranium recovery facilities.

The NRC staff did, however, utilize guidance that is relevant to the uranium recovery industry, including Regulatory Guide 4.14 and NUREG-1736, during its technical review of uranium recovery licensing actions. At the same time, the NRC staff also recognizes the nature of guidance documents and thus the NRC staff will accept alternatives to achieving regulatory compliance. However, it is up to each applicant or licensee to demonstrate that any proposed alternatives that are not consistent with relevant guidance still achieve regulatory compliance. In the case that you cited here, there was no attempt by a licensee to demonstrate that the NUREGs mentioned by you (i.e., NUREG-1556, NUREG-1501) were an acceptable alternative to current relevant uranium recovery guidance. As stated in Regulatory Guide 4.14, this process of evaluating alternatives is performed on a case-by-case basis and, I would note, this approach would most likely result in a lengthier review.

Lastly, there appears to be a misunderstanding of what was required to sufficiently address LC 12.10(A). While the license condition specified "quantities" of radionuclides, the licensee responded with a plan to report "concentrations" of radionuclides. This type of misunderstanding can be easily resolved by contacting the NRC project manager. I encourage you to remind your membership of this service.

## **Statement No. 2**

*"Statement: The NRC expects that radon progeny will be present with Rn-222 and that the licensee should be using the 10 CFR part 20, Appendix B, Table 2, value for Rn-222 with daughters present. Therefore, the NRC staff concludes that the appropriate value from 10 CFR Part 20, Appendix B, Table 2, for this licensee to use is the value for Rn-222 "With daughters present. [p. 3]"*

### **Industry response:**

- NRC staffs' insistence on the use of Table 2 values with daughters present contravenes the preamble to 10 CFR Part 20 (May 21, 1991) that allows, upon approval, the use of site specific equilibrium factors. Specifically, 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.*

This insistence also contravenes current policy in that in at least one case a current licensee is specifically allowed to use a site specific equilibrium factor. This also contravenes information presented in Analysis of Radiation Exposure on or Near Uranium Mill Tailings Piles (Schiager, K.J., July 1974) which states:

*For typical tailings piles of several hundred meters in width and typical wind speeds of a few meters per second, the transit time over the tailings is rarely more than a few minutes. Thus, the ingrowth of radon progeny in the immediate vicinity of the pile can seldom exceed 10 percent of its equilibrium value, or 0.001 WL per pCi of radon per liter.*

While this language is specific to tailings impoundments, the concept is applicable to any radon source including an in-situ uranium recovery facility.”

#### NRC Staff Reply

This second statement prepared by NMA is a portion of one sentence from p. 3 of the NRC staff's November 2014 TER. The excerpt is from the section of the staff's evaluation of the licensee's response to LC 12.10(A). In its context within the TER, NRC staff is not insisting that LCI use Table 2 values for daughters present. The staff is merely stating that since short-lived radon progeny will be present at the licensee's facility, then the licensee has not provided sufficient justification for its proposal to use the Appendix B, Table 2 value for radon without progeny present. The licensee did not propose to use a site equilibrium factor. Therefore, that portion of the NMA's statement regarding use of equilibrium factors, which account for the actual degree of equilibrium present in the environment, is not relevant. This issue also could have been resolved by contacting the NRC project manager to obtain clarification of the NRC staff's response.

### **Statement No. 3**

*“Statement: Staff observes that SOPs may be revised many times during the lifetime of a facility, including their removal from use. Therefore, due to the non-permanent nature of the SOPs, staff is not considering the SOPs in its evaluation of the licensee’s response to this license condition. [p.1]”*

#### **Industry response:**

- Standard Operating Procedures (SOPs) are part of every radiation safety program. SOPs must be available, reviewed annually and are subject to inspection. As an example, Kennecott Uranium’s license SUA-1350 states:
  - *License Condition 9.6 Standard operating procedures (SOPs) shall be established and followed for all operational process activities involving radioactive materials that are handled, processed, or stored. These SOPs for operational activities shall enumerate pertinent radiation safety practices to be followed and will be available for the pre-operational inspection.*
  - *Additionally, written procedures shall be established for non-operational activities to include in-plant and environmental monitoring, bioassay analyses, and instrument calibrations. An up-to-date copy of each written procedure shall be kept in the mill area to which it applies.*
  - *All SOPs (for both operational and non-operational activities) shall be reviewed and approved in writing by the RSO before implementation and whenever a change in procedure is proposed to ensure that proper radiation protection principles are being applied. In addition, the RSO shall perform a documented review of all existing operating procedures at least annually.*
- Given that SOPs are inspected as part of routine site inspections, it is nonsensical that SOPs are not an acceptable means to document dose calculation procedures. If a procedure were inadequate or if one were removed when in fact it was required, a Notice of Violation (NOV) would be issued.”

#### **NRC Staff Reply**

This third NMA statement is an excerpt from the first section (p. 1) of the staff’s TER. In this part of the November 2014 TER, the staff describes the appropriate level of detail required of a response to license conditions 12.10(A) through 12.10(D). The appropriate level of detail the staff describes is consistent with the staff’s long-standing performance-based licensing approach to the uranium recovery industry. Performance-based licensing, in which the licensee develops procedures governing the functioning of a Safety and Environmental Review Panel, ensures that the licensee retains the ability to make certain changes to the facility, its operating procedures, and conduct tests and experiments without the need for a license amendment in accordance with 10 CFR 40.44. NMA is correct that licensees are still required to have and maintain SOPs. However, given that NRC encourages licensees to retain the flexibility to change SOPs under its Safety and Environmental Review Panel (SERP) process, NRC is reluctant to base licensing decisions on the content of specific SOPs. The alternative is to subject revisions to SOPs to a license amendment. This alternative would not be a constructive use of resources for either the industry or the Commission. A program description with the level

of detail usually seen in a license application is sufficient to satisfy the requirements of LC 12.10.

#### **Statement No. 4**

*Statement: In addition, for sources on or near buildings (e.g., the CPP), the concentrations of the effluent are difficult to predict due to complexities associated with curved streamlines, sharp velocity discontinuities, and highly non-homogeneous and non-isotropic turbulence (Slade, 1968). Aerodynamic effects due to buildings and other structures are reported to be significant, not only in the vicinity of the structures, but at considerable distances downwind (EPA, 2000). It is suggested that the best way to estimate concentrations near buildings and other structures is to obtain experimental data (Slade, 1968). Staff is not aware of any attempts by the licensee to characterize the flow of air, and thus expected concentrations of radioactive materials from its effluents, in the vicinity of the CPP and other structures. Therefore, due to the uncertainties associated with determining effluent concentrations near buildings and other structures, and in the absence of empirical data describing air flow characteristics in the vicinity of the CPP and other structures, staff concludes that the method proposed by the licensee does not provide a reasonable estimation of effluent from its licensed activities for demonstrating compliance with 10 CFR 40.65 or 10 CFR 20.1302(b)(2)(i).[p. 4-5]*

#### **Industry response:**

- 10 CFR § 20.1301 Dose limits for individual members of the public states:

*(a) Each licensee shall conduct operations so that –*

*(1) The total effective dose equivalent to individual members of the public from the licensed operation does not exceed 0.1 rem (1 mSv) in a year, exclusive of the dose contributions from background radiation, from any administration the individual has received, from exposure to individuals administered radioactive material and released under § 35.75, from voluntary participation in medical research programs, and from the licensee's disposal of radioactive material into sanitary sewerage in accordance with § 20.2003,*

- NRC staffs' concern seems to ignore the regulatory language that indicates the dose to the public in question is a dose from the licensed operation as a whole. If looking at dose from licensed operations as a whole, it is unnecessary to specifically address air flow around buildings. Additionally, modeling that will account for air flows around buildings greatly increases the complexity of dose modeling for a facility, pushing modeling toward the use of computational fluid dynamics (CFD) which is not justified given the low risks posed by uranium recovery operations.<sup>2</sup>

<sup>2</sup>These statements appear to potentially be an attempt to open the door to the use of computational fluid dynamics (CFD). These issues have been raised by the Environmental Protection Agency (EPA). Please see: Modeling Near-Road Air Quality Using a Computational

Fluid Dynamics Model, CFD-VIT-RIT Y, Jason Wang and K. Maxzhang; A Framework For Fine-Scale Computational Fluid Dynamics Air Quality Modeling and Analysis, Alan H Huber; Using CFD to Study Air Quality in Urban Microenvironments, J.D. McAlpine and Michael Ruby.”

#### NRC Staff Reply

This fourth NMA statement is comprised of several sentences from pp. 4-5 of the NRC staff's November 2014 TER. The excerpt is from the section of the staff's evaluation of the licensee's response to LC 12.10(A), which reviews the licensee's discussion of how, in accordance with 40.65, the quantity of principal radionuclides from all point and diffuse sources will be accounted for in, and verified by, surveys and/or monitoring. In its context within the TER, the staff explained why downwind samples from a location very close to the east side of the CPP are unlikely to result in technically valid estimates of effluent quantities. The approach proposed by the licensee was akin to estimating the emissions from a motor vehicle by taking roadside air samples as a car drives by. Continuing this analogy, the staff is not suggesting that the licensee use computational fluid dynamics to improve the situation of the roadside analyst. A more reasonable approach would be to stop the car and measure emissions from the tailpipe. Again, I encourage you to notify your membership the NRC project manager to provide this type of clarification.

#### Statement No. 5

*Statement: Firstly, the licensee characterizes the source of radon as “fresh radon with negligible in-growth of daughters” (LCI, 2013b) with no technical justification.[p. 2] AND For these reasons, the radon exiting the buildings can't be characterized as “fresh radon with negligible in-growth of daughters” (LCI, 2013b).[p. 3]*

#### Industry response:

- If Radon-222 from a uranium recovery facility is being measured by that facility it is by default fresh. This contravenes information presented in Analysis of Radiation Exposure on or Near Uranium Mill Tailings Piles (Schiager, K.J., July 1974) which states:

*For typical tailings piles of several hundred meters in width and typical wind speeds of a few meters per second, the transit time over the tailings is rarely more than a few minutes. Thus, the ingrowth of radon progeny in the immediate vicinity of the pile can seldom exceed 10 percent of its equilibrium value, or 0.001 WL per pCi of radon per liter.*

While this language is specific to tailings impoundments, the concept is applicable to any radon source including an in-situ uranium recovery facility.”

#### NRC Staff Reply

This fifth NMA statement is comprised of two different sentences from one paragraph on pp. 2-3 of the NRC staff's November 2014 TER. The excerpts are from the section of the staff's technical evaluation of the licensee's response to LC 12.10(A), which reviews the licensee's discussion of how, in accordance with 40.65, the quantity of principal radionuclides from all point



and diffuse sources will be accounted for in, and verified by, surveys and/or monitoring. In this part of the TER, the staff is explaining that the licensee offered no technical justification for why radon progeny would not be present at its facility. As a result, the licensee has not justified the use of the Appendix B, Table 2 values for radon-222 with daughters removed.

In its response, NMA cites Schiager 1974, which states that the ingrowth of radon progeny in the immediate vicinity of a tailings pile can seldom exceed 10 percent of its equilibrium value, which NMA states is conceptually true for radon sources at in-situ recovery (ISR) facilities. However, as the NRC staff discussed in its November 2014 TER, there is a source of radon at ISR facilities that is already at some fraction of equilibrium with its progeny prior to exiting the building. As demonstrated by operational radon working level monitoring programs at ISR facilities, occupational exposures to radon progeny inside buildings such as the central processing plant occur on a routine basis. Therefore, the Schiager citation is not relevant to this source of radon progeny, which is well established prior to the building exhaust releasing this source of radioactivity to the environment from ISR facilities.

Lastly, the staff is pleased to consider the industry's views on this topic, including what industry believes is a valid technical basis for addressing radon exposure. However, the industry response that you provided is not part of any NRC staff guidance relevant to the uranium recovery industry nor did the licensee in question provide this statement as a technical basis for its approach to LC 12.10(A) for the NRC staff to evaluate. As I mentioned above, the NRC staff will evaluate alternatives to current relevant guidance on a case-by-case basis. It is the responsibility of each applicant or licensee to provide and defend each such alternative.

#### **Statement No. 6**

Statement: *However, for calculating annual public dose, short term variations (i.e., year to year or within a year) can have a more profound impact if, for example, a dominant sector is missed in any given year. [p. 4]*

#### **Industry response:**

- How much monitoring will ultimately be required to account for small variations in wind direction within a year? This statement appears to address short term temporal variations, however spatial variations can occur as well. Is the Agency proposing that wind speeds and directions be measured at multiple locations around a site? Earlier in the letter, the Agency states:
  - In addition, for sources on or near buildings (e.g., the CPP), the concentrations of the effluent are difficult to predict due to complexities associated with curved streamlines, sharp velocity discontinuities, and highly non-homogeneous and non-isotropic turbulence (Slade, 1968). Aerodynamic effects due to buildings and other structures are reported to be significant, not only in the vicinity of the structures, but at considerable distances downwind (EPA, 2000).

It appears as if the Agency is requesting both more detailed temporal and spatial meteorological monitoring neither of which is justified given the low risks posed by uranium recovery operations.”

### NRC Staff Reply

This sixth NMA statement is an excerpt of one sentences from one paragraph on p. 4 of the NRC staff's November 2014 TER. The excerpt is from the section of the staff's technical evaluation of the licensee's response to LC 12.10(A), which reviews the licensee's discussion of how, in accordance with 40.65, the quantity of principal radionuclides from all point and diffuse sources will be accounted for in, and verified by, surveys and/or monitoring. Although the licensee answered a different question from what was asked (i.e., concentration instead of quantity), the staff is explaining why radon measurements at a few locations immediately downwind of a source does not provide a reasonable estimate of effluent quantities to meet the requirements of either 10 CFR 40.65 or 10 CFR 20.1302(b)(2)(i). The staff is not recommending, and the staff never stated, that the licensee is required to collect wind speed and direction data at multiple locations or more detailed temporal or spatial meteorological monitoring.

### **Statement No. 7**

*Statement: Since the dominant wind is from the west, the licensee proposed placing the radon detectors along the eastern fence in the manner described above. Staff observes that even if the radon detectors were arranged in such a manner as to accurately measure radon in the four dominant wind sectors (from the W, WSW, SW, and SSW, refer to Figure 2.2-3 of NRC, 2011a), they would capture less than approximately 50 percent of the total wind frequency (by compass direction) and thus measure less than approximately 50 percent of the total potential effluent of radioactive material. [p.4]*

### Industry response:

- How much monitoring is enough and when does it become excessive and unreasonable?"

### NRC Staff Reply

This seventh NMA statement is an excerpt of two sentences from one paragraph on p. 4 of the NRC staff's November 2014 TER. The excerpt is from the section of the staff's technical evaluation of the licensee's response to LC 12.10(A), which reviews the licensee's discussion of how, in accordance with 40.65, the quantity of principal radionuclides from all point and diffuse sources will be accounted for in, and verified by, surveys and/or monitoring. Similar to the sixth NMA Statement, in this part of the TER, the staff is explaining the licensee's proposed placement of radon detectors, and why radon measurements at a few locations immediately downwind of a source does not provide a reasonable estimate of effluent quantities to meet the requirements of 10 CFR 40.65 and 10 CFR 20.1302(b)(2)(i). The staff is not recommending, and the staff never stated, that the licensee is required to collect more samples downwind in order to adequately characterize effluent quantities.

### **Statement No. 8**

Statement: *The licensee did not provide any technical justification for rejecting uranium and other particulates as a potential effluent from its facility (LCI, 2013b). [p. 6]*

#### **Industry response:**

- Lost Creek is a uranium recovery facility that uses a rotary vacuum dryer that does not have a stack to release emissions. It is considered a zero emission system. This statement shows a total lack of understanding of the process.
- Regarding dose the Generic Environmental Impact Statement (GEIS) (4.2.11.2.1 Radiological Impacts to Public and Occupational Health and Safety From Normal Operations) states: *Because a vacuum dryer system is assumed, the only releases are radon.*
- Table 4.2-2 (Section 4.2.11.2) of the Generic Environmental Impact Statement (GEIS) is included below:

[Table 4.2-2 is not repeated here]

None of the above doses approach 50% of the 100 millirem dose limit.”

#### **NRC Staff Reply**

This eight NMA statement is an excerpt of a sentence fragment from one paragraph on p. 6 of the NRC staff's November 2014 TER. The excerpt is from the section of the staff's technical evaluation of the licensee's response to LC 12.10(B), which required the licensee to "...evaluate the member(s) of the public likely to receive the highest exposures from licensed operations consistent with 10 CFR 20.1302.”

In this part of the staff's November 2014 TER, the staff is explaining that the licensee did not provide justification for not evaluating uranium and other particulate matter as potential effluent from its facility. In the sentence of the November 2014 TER which follows the statement excerpted by NMA, the staff explains why it found the licensee's information inadequate, including a citation to the staff's April 18, 2013, safety evaluation report (ML13038A325, p. 23). In the April 2013 safety evaluation report, the staff explained that the licensee needs to demonstrate that releases from sources other than the vacuum dryer are not occurring, such as from yellowcake packaging operations and maintenance activities.