Revised Draft FSME Interim Staff Guidance FSME-ISG-01:
Summary Responses to Comments on September 2011 Draft Report for Public Comment

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In September 2011, U.S. Nuclear Regulatory Commission (NRC) staff issued *NRC Staff Interim Guidance: Evaluations of Uranium Recovery Facility Surveys of Radon and Radon Progeny in Air and Demonstrations of Compliance with 10 CFR 20.1301* as a draft report for public comment. Comments were received from ten commenters, as summarized in Table 1.

Table 1. Summary of commenters and reference accession number for comments.

	Commenter	Date	ADAMS Accession Number
1	Christina Thompson	11/22/2011	ML11335A044
2	Donivan Porterfield	01/04/2012	ML12012A110
3	Marion Loomis, Wyoming Mining Association	01/17/2012	ML12019A144
4	Oscar Paulson, Rio Tinto, Kennecott Uranium Company	01/17/2012	ML12019A147
5	Steven Brown, SENES Consultants Limited	01/16/2012	ML12019A145
6	Thomas Magette, EnergySolutions	01/20/2012	ML12025A153
7	Josh Leftwich, Cameco Resources	01/20/2012	ML12025A154
8	Sarah Fields and John Weisheit, Uranium Watch	01/20/2012	ML12027A008
9	Ghassan Khoury, U.S. Environmental Protection Agency	01/20/2012	ML12027A009
10	Alan Cox, Homestake Mining Company of California	01/20/2012	ML12032A266

Table 2 provides a summary of the comments received and a summary of NRC staff responses to the comments in preparing the revised draft Interim Staff Guidance (ISG), in ADAMS under Accession No. ML13310A198.

Notes: Some comments that agree with portions of the ISG are not included here, as no response is needed. Comments are numbered here by NRC staff for convenience; numbering is not necessarily consistent with numbering in the actual comment submittal.

Table 2. Summary of public comments and NRC staff responses to comments		
Commenter -comment #	**Comment summary**	**Resolution of comment**
1-1	By law, maximum allowable radon is zero. Discusses MCLs.	This comment is incorrect and does not relate directly to the ISG. No change needed.
2-1	Suggested usage of the "Multi-Agency Radiological Laboratory Analytical Protocols Manual" (MARLAP), NUREG-1576.	Staff has added a brief reference to MARLAP [Section 4.1].
2-2	Application of equilibrium factor less than 1.0 makes practical sense.	Comment supports ISG approach. No change needed.
2-3	Disappointed that more voluntary consensus standards were not cited regarding measurement of radon in air.	Staff evaluated consensus standards, but did not identify additional standards to cite.
3-1	Document was overall difficult to follow. Suggested discussions on: introductory material on Rn-222 emissions from UR facilities; background radon and progeny in air; problems in assessing dose from Rn-222 progeny to members of the public; common method used in industry; differences between modeling and measurements; and reliance of models on meteorological data.	The comment asks for more introductory material and detail than NRC staff considers useful for this document. Staff has worked on improving readability and has added brief introductory material in Section 1.
3-2	Suggested adding decay chain chart for Rn-222.	The ISG is not intended to cover basics on radon; ISG users should already have fundamental knowledge about radon. Staff has added references to some sources of basic information on radon [Section 1].
3-3	Describes problems in determining dose from Rn-222 and progeny based on difficulty of measurement (with typical alpha track detectors) at the level of the Part 20, Appendix B, Table 2 value for radon with daughters (0.1 pCi/L).	NRC staff understands the difficulty in measuring low environmental concentrations of radon. 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. Staff has modified the discussion, now in Section 4.5.

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3-4	Related to difficulty in determining dose (see 3 above), suggests that doses from Rn-222 progeny be determined using modified Kusnetz method for progeny combined with alpha track detectors for Rn-222.	NRC staff agrees in part, but believes there are significant difficulties in using the Modified Kusnetz method to obtain representative samples for environmental radon progeny to determine an equilibrium factor or exposure. Staff has modified the ISG [now Sections 4.6 and 4.9.3] to describe such difficulties.
3-5	Suggests that background Rn-222 must be measured concurrently with operational monitoring.	NRC staff agrees that background monitoring should generally be concurrent with operational monitoring.It may not be necessary in all cases. Staff has modified the ISG [now Section 4.3].
3-6	Suggests that the ISG should be clear that Rn-222 emissions from non-licensed sources are part of background. A specific example was provided.	NRC staff disagrees with the comment. Some unlicensed sources of radiation or radioactive material may need to be accounted for in determining the dose for compliance with 20.1301 (i.e., some such sources may not be considered part of background). Staff has added a paragraph on this issue to what is now Section 4.3.
3-7	Suggests that background monitoring sites must be located upwind of the facility based on predominant prevailing wind direction.	NRC staff disagrees. In general, background locations should be upwind, but not always based on the predominant prevailing direction. In some cases, especially sites in valleys, there may be multiple wind directions that are common. The predominant wind direction may not have the most impact on radon transport/exposure. Staff has slightly modified the text in Section 4.3.
3-8	States that background (upwind) Rn-222 concentration in air may exceed supposedly impacted downwind concentrations. Background radon can vary substantially spatially.	NRC staff agrees that background Rn-222 concentrations can vary substantially on a spatial basis. However, staff disagrees that background concentrations can be greater than impacted concentrations. Such a situation indicates that the supposedly upwind background location may not be representative of the impacted locations without the presence of the licensee activities. This is discussed in the ISG [Section 4.3].

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3-9	Regarding dose modeling, comment states that WMA has concerns about the ability to accurately model Rn-222 concentrations and believes that measurement is the best means of addressing the issue. Suggests that methods used to calculate dose must be simple and easy to implement.	NRC staff agrees that in general, measurements provide the best means of demonstrating compliance. Regarding modeling, NRC staff believes that simple methods are preferable when they adequately address the site-specific conditions. However, some sites have complex topography which may make simple calculations inadequate. Thus, in some cases, more complex modeling may be warranted. NRC staff believes that modeling or calculations should be validated by monitoring or other measurements when feasible. [Section 4.2]
3-10	Regarding acceptable equilibrium factors (table in Section 4.5.4), suggest that the equilibrium factors are too high, based on equilibrium factor determined for one UR facility in Wyoming.	NRC staff disagrees. The values provided in the ISG are intended to be acceptable for use at any site, and should, therefore, be realistic or conservative. A lower equilibrium factor for a single facility is not a sufficient basis for a generally acceptable value. NRC staff has clarified the ISG [now Section 4.9.2].
3-11	Regarding equilibrium factor, suggests that licensees should not rely upon provided equilibrium factors but should instead use site specific values determined by the licensee.	NRC staff disagrees in part. Staff intends that the equilibrium factor values provided in the ISG would be conservative and thus could be used with no specific justification. Thus, if use of provided values indicates compliance, licensees may not need to perform site specific measurements that require additional work. However, licensees may perform site-specific measurements if they want to or if conditions are such that the generally acceptable values are insufficient for the licensee needs.

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4	Note: Most of the comments from commenter 4 are the same as those from commenter 3. Comments that differ significantly are addressed below.	
4-1	[similar to 3-8, but additional information provided] Provided additional information, including data from two sites in Wyoming (Sweetwater and Lost Creek), indicating significant spatial variability in background radon concentrations.	NRC staff agrees that in some locations there may be substantial spatial variability in background radon concentrations. Staff has added to the ISG [Section 4.3] that if preliminary preoperational monitoring or other data indicate substantial spatial variability, licensees or applicants may want to use more preoperational monitoring locations or a longer preoperational monitoring period than otherwise recommended.
4-2	[similar to 3-9, but additional information provided] The comment describes a method used by Kennecott Uranium to measure Rn-222 and the equilibrium factor and then calculate dose from Rn-222 and progeny. The commenter recommends the ISG state acceptability of the method.	NRC staff notes that the NRC email mentioned in the comment did not endorse the specific methods used by Kennecott Uranium. The ISG is intended to describe methods that are acceptable to NRC staff, not to specifically endorse methods used by a particular facility. Staff has evaluated the method discussed in the comment, and has made changes to the ISG [Section 4.6 and 4.9.3] to address some caveats related to use of grab sampling techniques (i.e., modified Kusnetz method) for radon progeny and determining equilibrium factors.
4-3	Suggested the term “land use survey” be used instead of “land use census” in Section 3.3.	NRC staff prefers the term “land use census” for consistency with other NRC guidance. However, “survey” has been added in parentheses.
5-general-1	Suggested some reorganization of the document, to include discussion of: physics of radon and radon progeny; explanation of the basis of the regulatory limits for exposure to radon and radon progeny; state of the art of methods of measurement and modeling; and problems inherent in measurement and modeling.	The ISG is not intended to cover basics on radon. Staff has added references to some sources of basic information on radon [Section 1]. The comment suggests expansion of the scope of the ISG. Staff concluded that the scope is appropriate and has not expanded the scope.

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5-general-2	Suggests that the ISG does not adequately recognize the difficulty of demonstrating compliance by measurement of radon in the environment. Suggests that with the difficulties (described in the comment), compliance may only be demonstrated by modeling calculations.	When the NRC updated 10 CFR Part 20 in 1991, NRC acknowledged difficulties in demonstrating compliance through measurements of radon in the environment. Existing NRC guidance and practice is that compliance should not be demonstrated by modeling alone. NRC staff position is that modeling and calculations should be supported by follow-up environmental monitoring to demonstrate compliance. This ensures that with any changes in operation, licensees continue to demonstrate public doses are compliant. NRC staff continues to believe that in most cases field measurements for compliance are feasible. The ISG indicates one acceptable compliance method is based on measurements of exposure concentrations. Another acceptable method is use of calculations and the ISG recommends that when calculations or modeling are used, there should be measurements to validate or corroborate the calculations.
5-general-3	Suggests NRC consider sponsoring studies of the feasibility of measurements to demonstrate compliance.	NRC staff does not currently plan to sponsor such studies. However, the staff will evaluate licensee compliance and reconsider in the future as appropriate.
5-specific-1	Page 2, 2nd bullet in box: this should recognize that the Appendix B, Table 2, values may be adjusted based on reasonable equilibrium factors.	NRC staff agrees and has made changes to the bullet [now in Section 5].
5-specific-2	Page 3, flowchart: Suggest adding note that Appendix B value can be adjusted.	NRC staff has substantially changed the flowchart, which now addresses adjustment of the Appendix B value.
5-specific-3	Page 7: suggests that reference to “10 CFR 20.1101(b)” should instead refer to “10 CFR 20.1101(d).”	NRC staff has corrected this error.
5-specific-4	Page 8: suggests explaining that the 40 CFR 190 public dose limits are limits on dose equivalent and not directly comparable to the public dose limit in 10 CFR 20.1301.	NRC staff agrees and has modified the referenced bullet [now in Section 4].

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5-specific-5	Suggests that compliance can only be demonstrated via computer code such as MILDOS-AREA or equivalent. One point in support is that the minimum detectable concentration (MDC) of alpha track detectors is about 0.3 pCi/L for a 90-day exposure.	See response to 5-general-2. Also, the staff understands that alpha track detectors are commonly available with an MDC of about 6 pCi-days/L (equivalent to about 0.07 pCi/L for a 90-day exposure period). NRC staff has added this information to the ISG [Section 4.5].
5-specific-6	Section 4.2.1: comment suggests it is unclear how an average concentration of 0.1 pCi/L (the Appendix B value) can be measured within a variable background indoor concentration ten times or more larger.	See response to 5-general-2. Also, the draft ISG indicates that one acceptable method is to use measurements made *outdoors*, with an assumption that the radon contribution from the licensed facility *indoors* would be the same as the radon contribution from the licensed facility *outdoors*. No changes needed.
5-specific-7	Section 4.2.2 and 4.2.3: Comment asks for explanation of term “graded approach.”	The term “graded approach” has been deleted from Sections 4.2.2 and 4.2.3.
5-specific-8	Section 4.2.5: comment suggests that NRC consider sponsoring research and studies to assess if compliance to current 10 CFR 20 limits can be demonstrated via measurement of radon in the environment.	See responses to comment 5-general-2 and 5-general-3 above.
5-specific-9	Section 4.2.4: comment suggests that additional monitoring locations are not necessarily helpful by themselves. Also suggests that there are practical limits on exposure time.	NRC staff modified the text [now in Section 4.3] slightly to clarify.
5-specific-10	Section 4.3: comment suggests that the concept of “points of compliance” be introduced.	NRC staff disagrees with the comment because “points of compliance” would be a new concept not typically used in relation to compliance with the public dose limit. The ISG describes how compliance should be demonstrated for the two compliance methods. No changes are made.

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5-specific-11	Section 4.3: comment suggests that licensees should be provided flexibility to demonstrate that on-site meteorological data is consistent with long-term conditions, in lieu of more expansive radon monitoring networks and complex meteorological modeling.	NRC staff believes that the guidance as written already provides substantial flexibility. Thus, no change is made [now Section 4.7].
5-specific-12	Section 4.3: comment suggests that the public typically does not have access for extended periods next to UR facilities.	Licensees must evaluate what members of the public are most highly exposed [Section 4.12.1]. NRC staff has not modified the section referred to in the comment [now Section 4.7].
5-specific-13	Section 4.5, regarding equilibrium factor: comment suggested nominal equilibrium factor of 0.4 for indoor exposure is reasonable. Also suggested that outdoor equilibrium factor of 0.7 is too high for industrial sources.	NRC staff has not changed the recommended generally acceptable indoor equilibrium value of 0.5. However, the discussion in what is now Section 4.9.2 has been revised to better explain the reasoning. NRC staff has revised the text to better explain the basis for choosing the outdoor value of 0.7 and to explain when it may not be applicable.
6-1	Comment indicates that Energy Solutions not uncommonly observes differences in radon concentrations of 0.2 pCi/L between the three dispersed background monitoring stations. Comment states that due to such variability in background, it is impractical to confidently demonstrate compliance with the public dose limits. Comment suggests that the radon ISG include general acceptance of the dose conversion factor of the International Commission on Radiological Protection Publication 65 (ICRP 65).	NRC staff disagrees with the suggested use of a dose conversion factor (DCF) based on ICRP 65 for two reasons. First, the ISG needs to be consistent with NRC's existing regulations of 10 CFR Part 20, and the DCF from ICRP 65 is not consistent with that used in developing the values of Part 20, Appendix B, Table 2. Second, the ICRP has issued a newer report, ICRP Publication 115, on risk from radon and radon progeny. The DCF in ICRP 115 (13 mSv/WLM for typical aerosol conditions in homes) is significantly different from the dose conversion convention from ICRP 65 (3.88 mSv/WLM for members of the public), and NRC staff considers the values from ICRP 65 to be superseded by the newer ICRP 115. NRC staff has added a brief description of ICRP Publication 115 to the ISG [Appendix 2].

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7-1	Section 3.3: comment recommends deleting phrase "land use census."	NRC staff prefers the term "land use census" for consistency with other NRC guidance. However, "survey" has been added in parentheses.
7-2	Section 4, 1st paragraph, last sentence: comment recommends citing the "<5% is insignificant provision of RG 4.14" as a benchmark for the evaluation. Comment also states that MILDOS assesses dose from plants, which should be identified in the ISG.	NRC staff disagrees with the details, but has modified the referenced sentence to refer to RG 4.14 [Section 4].
7-3	Section 4.2.2, 2nd paragraph, last sentence: comment asks if radium concentration in pregnant lixiviant could represent "some other indicator."	The typical assumption is that the majority of the radon in the lixiviant (which may be released) originates from radium in the ore body, not from radium in the lixiviant. Thus, NRC staff believes that radium in lixiviant is not an appropriate indicator for radon in air. Staff has not modified the text.
7-4	Section 4.5: comment suggests that the option of measuring radon progeny may be a better approach than assumptions and modeling.	NRC staff agrees that measurements of radon progeny may be acceptable and appropriate in some cases. However, the methods must have an appropriate technical basis to be acceptable to NRC staff. And, in many situations it may be difficult to measure the radon progeny due to licensee releases. In such cases it may be reasonable to rely on reasonable assumptions and/or modeling. The text in what is now Section 4.6 and Section 4.9 has been modified accordingly.
7-5	Sections 4.5.4 and 4.8: comment suggests the sections be revised to include the option of measuring radon progeny on a site-specific basis.	See response to comment 7-4.

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8-1	It is unclear how the regulatory requirement to make surveys at appropriate locations applies to licensees that demonstrate Section 20.1301 compliance by calculation rather than measurement.	The requirement in 10 CFR 20.1302(a) is to make surveys of radiation levels and radioactive materials in effluents (surveys to characterize exposure). A survey, as defined in 10 CFR 20.1003, may be based on measurements or calculations [discussed in ISG Section 4.1]. Thus, the surveys to characterize exposure may be based on measurements or calculations.
8-2	The NRC must be sure the ISG and the flowchart covers compliance issues associated with conventional mills.	NRC staff intends that the ISG is applicable to operating conventional mills, operating ISRs, or mills or ISRs in decommissioning. No modifications to the text were made.
8-3	Instead of phrase “NRC staff reviewers,” the ISG should use phrase NRC or Agreement State staff reviewers.”	NRC staff has written the ISG for NRC staff, and retains that wording. However, Section 1 of the ISG has been modified to say that the ISG may be used by Agreement State staff as appropriate.
8-4	Suggests that NRC should develop new guidance documents, as some of the referenced regulatory guides are from the 1980s.	The request is beyond the scope of the present ISG. NRC staff does have a program to update certain regulatory guides for the uranium recovery program.
8-5	[A number of comments or parts of comments were provided that are specific to an existing State-licensed facility but that do not include a comment on the draft ISG itself.]	NRC staff is not responding to specific comments on existing State-licensed facilities. They do not provide comments on the draft ISG.
8-6	Suggests that licensees must submit a new estimation of dose for changes to mill operations that result in additional doses to the public.	Prior to implementing changes, licensees should evaluate potential impacts of the changes on safety, including doses to the public. If the changes are beyond what has been evaluated and allowed in the license, the licensee must submit a request for license amendment before making the change. NRC staff considers this comment outside the scope of the present ISG. The ISG has not been modified.
8-7	Suggests that regulatory reviews should also consider licensee compliance with 40 CFR Part 61, Subpart W.	The NRC does not enforce EPA’s regulation of 40 CFR 61, Subpart W, so this comment is outside the scope of this present ISG.

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8-8	Suggests that NRC should establish a specific time and specific documentation that the licensee must submit to demonstrate compliance with the public dose limit. The comment suggests inclusion into Part 20.	NRC staff disagrees with this suggestion. Staff believes that prescriptive guidance is not necessary. Rulemaking is outside the scope of this present ISG. Licensees' demonstrations may be evaluated at any time during NRC inspections. The licensee's documentation must be sufficient to demonstrate compliance.
8-9	Suggests that NRC staff communicate with the NRC State Programs staff to make sure that Agreement States properly administer and enforce the requirements of 10 CFR 20.1301 and 20.1302.	NRC staff has and will continue to communicate regarding this ISG with Agreement States through NRC Agreement State Program staff.
8-10	Suggests that the ISG must discuss monitoring equipment to measure outdoor radon concentrations.	The draft ISG included a brief discussion of radon measurement methods in Section 4.2.5 (now 4.4). The staff does not intend to provide a detailed discussion of monitoring equipment. Minor changes to what is now Section 4.4 have been made.
8-11	Suggests the ISG should list specific emission sources at conventional mills that must be measured and accounted for in calculations to determine compiance.	Emission sources are discussed in other guidance documents. Reference to those documents has been added to the present ISG [Sections 4.2.2 and 4.2.3].
8-12	Suggested revision of statement about radon flux standard under the current regulatory regime.	NRC staff agrees the referenced statement was incomplete. However, since that statement was not key to the discussion, NRC staff revised the ISG [now in Section 4.7] to delete the reference to the radon flux standard.
8-13	Comment suggests that NRC and Agreement State staff should be required to provide a written review and approval of licensees' annual 10 CFR 20.1301 compliance demonstration.	NRC staff will determine, separately from the present ISG, how reviews of licensee compliance with 10 CFR 20.1301 will be documented. It is also up to Agreement States to decide if and how such reviews will be documented. Thus, this comment is outside the scope of the present ISG.
8-14	Comment suggests incorporating some of the ISG into Part 20 via rulemaking.	Rulemaking is outside the scope of the ISG. However, if NRC staff pursues a revision of Part 20 in the future, this ISG may be considered in such revision.

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9-1	Comment suggests that the use of the term “radon” should also include radon-220 (thoron).	Since no NRC UR licensees have significant thorium present, the ISG does not need to address thoron. No change is made to the ISG.
9-2	Comment states that EPA considers the cancer risk from NRC’s public dose limit of 100 mrem/yr to be greater than what EPA considers an acceptable risk.	The ISG is intended for compliance with NRC regulations, not EPA requirements. NRC staff considers its regulations, including the public dose limit, protective of public health and safety. No changes are made to the ISG.
9-3	Comment suggests clarification that equilibrium factor by travel time should not be applied to radon concentrations at the fence line or exposure locations for members of the public because this would result in double counting the equilibrium factor.	NRC staff disagrees with the comment. Application of an equilibrium factor at receptor locations is appropriate and is not double counting. No changes are made to the ISG.
10-1	Comment suggests that uncertainty in the calculated dose not be assessed explicitly in demonstrating compliance. Comment also suggests that if the uncertainty in measured quantities is too large and if emissions are such that compliance is in question, this would normally lead to licensee attempting to reduce the uncertainties.	NRC staff agrees with this comment. Changes have been made to what is now Section 4.5.
10-2	Section 4.2.5, last paragraph: comment suggests that recommendation for improvements when MDCs are insufficient or overall relative uncertainties are too high is too vague and should be eliminated.	NRC staff believes the concept is useful, but has combined it with the suggestion in Comment 10-1 regarding emissions being high enough that compliance is in question. Staff modified the wording in what is now Section 4.5.

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10-3	Section 4.5.2: regarding the generally acceptable equilibrium factors for outdoors and indoors, the comment suggests using the central values from the NCRP reference which are 0.4 for indoors and 0.6 for outdoors.	NRC staff disagrees. The generally acceptable equilibrium factor values provided in the ISG are intended to not underestimate dose for most cases. To achieve this, NRC staff considers the upper level of the range of central values expressed by NCRP to be more appropriate.