February 26, 2016

Jesse Toepfer, Closure Manager
Grants Reclamation Project
Homestake Mining Company
P.O. Box 98/Highway 605
Grants, NM 87020

SUBJECT: FOLLOW-UP TO REQUEST FOR ADDITIONAL INFORMATION REGARDING THE HOMESTAKE MINING COMPANY OF CALIFORNIA REQUEST TO CHANGE RADON BACKGROUND MONITORING LOCATION (LICENSE SUA-1471, DOCKET NO. 40-8903)

Dear Mr. Toepfer:

By letter dated July 21, 2014 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14212A399), Homestake Mining Company of California (HMC) submitted to the U.S. Nuclear Regulatory Commission (NRC) a response to a Request for Additional Information (RAI) (ML14051A690) on HMC's license amendment request to change Homestake's monitoring location for background radon-in-air measurements (ML13281A790). The NRC staff has completed its review of the response submittal. The NRC's review was also informed by the October 14, 2015, public meeting between the NRC and HMC staff to discuss the request to relocate the radon in air background monitoring station location at their facility near Grants, NM (ML15278A112).

After careful consideration of your responses, the NRC staff finds that further information is required to evaluate your request. In particular, the staff has additional questions concerning the dispersion modeling analysis and whether its results account for all conditions that contribute to annual average background radon-in-air concentrations. In addition, the NRC staff also finds that further information is needed concerning the proposed northern off-site background monitoring location at HMC-1Off to support it being representative of background conditions at the Grants site.

The bases for these findings are: 1) apparent inconsistencies in the operation and summaries of the meteorological monitoring program that supplied data input to the conceptual modeling analysis; 2) questions about the representativeness of HMC's general atmospheric modeling approach used to support the selection of the proposed new background monitoring location; 3) an apparent absence of data on radon levels for wind directions other than from the drainages to the north and east of the Grants site but which, nevertheless, contribute to the annual background conditions seen at the compliance points for the site; and 4) the license amendment request does not clearly address the approach for applying measured background radon-in-air concentration(s) at each point of compliance.

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 NRC's ADAMS. ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html.

If you have any questions regarding this letter, please contact me at (301) 415-6634, or by e-mail at Jack.Parrott@nrc.gov.

Sincerely,

/RA/

Jack D. Parrott, Senior Project Manager
Reactor Decommissioning Branch
Division of Decommissioning, Uranium Recovery
and Waste Programs
Office of Nuclear Material Safety
and Safeguards

Docket No.: 040-8903
License No.: SUA-1471

cc: Homestake Distribution List

Enclosure

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Enclosure

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Background Information and Request for Additional Information

License No. SUA-1471
Homestake Mining Company of California's Request for an Amendment
to Change the Background Monitoring Location for Radon-222 in Air
at the Grants Reclamation Project,
dated September 23, 2013

NUREG-1620, Revision 1 (dated June 2003), "Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978," (ML032250190) and Regulatory Guide (RG) 3.63 (dated March 1988), "On-site Meteorological Measurement Program for Uranium Recovery Facilities – Data Acquisition and Reporting" (ML13310A198) provide criteria the U.S. Nuclear Regulatory Commission (NRC) staff used to review Homestake Mining Company of California's (HMC's) Grants Reclamation Project License Amendment Request (LAR) titled, "Basis for Selection of a Representative Background Monitoring Location for the Homestake Uranium Mill Site, SUA-1471", dated September 23, 2013 (ML13281A790), and HMC's response to NRC's first Request for Additional Information (RAI) on the LAR dated July 21, 2014 (ML14212A399). U.S. Environmental Protection Agency (EPA) meteorological monitoring and atmospheric dispersion modeling guidance referenced by the Licensee was taken into consideration as well.

The NRC staff has reviewed this LAR and HMC's response to the first RAI, and has identified the following RAI pertaining to:

- the Meteorological (Met) monitoring program, its conduct, and data summaries, which provide direct input to or have been used to inform the atmospheric dispersion modeling supporting the LAR; and,

- the general atmospheric dispersion modeling approach used to support the LAR,

Additional RAI questions to clarify the monitoring methodology for estimating and applying background radon-in-air concentrations, consistent with the duration of the applicable public dose limits, are also provided.

The basis for this second RAI is that the NRC staff is seeking sufficient support for the locations chosen as candidate background monitoring stations and HMC's proposal that the monitoring station at HMC-1Off is the best single location for measuring representative background radon-in-air conditions for the HMC site.

1. Description of Deficiency

Latitude/Longitude (Lat/Lon) coordinates are specified in Section 2.4 of HMC's contractor technical report (TR) attached to the LAR for the location of the on-site Met monitoring station. However, Figure 2-3 (or any other figure in HMC's TR) neither provides a reference grid system nor illustrates where the Met station is located in relation to the site, to routine (site boundary and off-site) and non-routine (off-site) radon-in-air monitoring locations, or to the San Mateo Creek, Lobo Creek, or Northwest Drainage air flows estimated by the dispersion modeling. An appropriate distance scale and the difference

between True and Magnetic North are also not depicted. In addition, the TR does not appear to discuss the site chosen for the Met monitoring station in relation to potential influences on the wind and temperature measurements, especially its proximity to potential obstructions to air flow (e.g., tailings piles, buildings, or other structures or nearby topography). Further, there is an apparent discrepancy between the Lat/Lon coordinates for the Met monitoring station as specified in Section 2.4 of HMC's TR and the location depicted on Figure 2.2-10 which is included on the last page of the Licensee's July 21, 2014, responses to the earlier NRC staff RAI (ML14212A399).

Basis of Request

In Sections 2.1 and 2.2 of HMC's TR, the Licensee articulates a conceptual model for understanding radon transport in and around the Grants site to support its evaluation and proposed recommendation for relocating a background radon-in-air monitoring station. The conceptual model indicates a relationship between high radon concentrations in air under calm and near-calm wind conditions. The discussion also states that "during calm conditions radon transport is driven predominantly by topography." The fields of meteorology and atmospheric dispersion recognize that complex terrain settings are often characterized by nighttime drainage (gravity) air flows that tend to follow the topography.

The representativeness of Met measurements depends, in part, on the proper siting of the meteorological tower and its instrumentation. In that regard, the NRC staff has two overarching technical concerns given the general lack of information in (or referenced from) HMC's TR about the location of the Met monitoring station (presumably a 10-meter tower) and the rationale for its placement:

- whether and to what extent the Met station and instruments have been sited so as to avoid or minimize unacceptable effects on the measured data, especially interference to the wind speed and wind direction sensors by obstructions to air flow; and

- whether the Met station location was positioned so as to capture wind data representative not only of the three drainage flow areas (identified in Figure 2-3 of HMC's TR) that would contribute, in varying degrees, to higher measured background levels of radon-in-air, but also for wind directions with relatively less, but still important, contributions to background radon-in-air concentrations at the new background monitoring location being proposed by the Licensee.

The drainage flow areas up-gradient of the Grants site cover three separate orientations relative to the site – that is, nominally from north-northeast to south-southwest (San Mateo Creek Drainage), from northwest to southeast (Northwest Drainage) until its merging with the San Mateo Creek Drainage then continuing in a more north-to-south orientation, and from east to west (Lobo Creek Drainage).

Section A (Introduction) to RG 3.63 states, in part, that "[m]eteorological conditions in the vicinity of the facility need to be considered….in the assessment of the potential impact of airborne effluent releases, and the monitoring of airborne effluents" (Paragraph 2). Further, Paragraph 3 states that "[a]ny information collection requirements mentioned in this regulatory guide are contained as requirements in 10 CFR Part 40, which provides the

regulatory basis for this guide." Regulatory Position C(2) of RG 3.63 goes on to address various siting considerations for Met instruments, including, among others:

- long-term representativeness of the measured Met characteristics;
- a distance of separation for wind instruments of 10 times the height away from nearby obstructions to air flow; and,
- that to the extent practicable, wind instruments should not be located in the prevailing downwind direction of an obstruction.

Section 2.4 of HMC's TR (Paragraph 4) states that "[t]he meteorological station is configured….to meet EPA Prevention of Significant Deterioration (PSD) quality assurance requirements". It is unclear as to whether the phrase "is configured" is meant to include the exposure of Met instruments. The NRC staff notes that that guidance (dated May 1987) states "[o]pen terrain is defined as an area where the distance between the anemometer and any obstruction to the wind flow is at least five times the height of that obstruction."

However, the NRC staff further notes that the guidance in EPA's "Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV: Meteorological Measurements" (dated March 2008), also cited by the Licensee, includes a different siting criterion for the distance of separation of wind speed and wind direction instruments from obstructions (i.e., 10 times the obstruction height). This criterion is consistent with NRC RG 3.63 and other NRC and industry Met monitoring guidance (i.e., see, respectively, Regulatory Position C(3) of NRC RG 1.23 "Meteorological Monitoring Programs for Nuclear Power Plants" and Subsection 4.3.1 of ANSI/ANS-3.11-2005 (re-affirmed December 23, 2010) "Determining Meteorological Information at Nuclear Facilities." Given the Period of Record (POR) for the Met data used in this this LAR (i.e., 2009), the guidance cited above, and current practice, the NRC staff based its review of Met instrument siting on the wind instrument separation criterion of 10 times the obstruction height away from such potential obstructions.

Formulation of RAI

To support the NRC's evaluation of the conceptual model of air flow at the Grants site, please update the HMC TR, as appropriate, including revision to, or addition of, any associated current or new figure(s) or table(s), in order to help resolve these technical issues:

(a) reconcile the apparent discrepancy between the Lat/Lon coordinates for the Met station as shown in Section 2.4 of the HMC TR and as depicted on Figure 2.2-10 included on the last page of the Licensee's July 21, 2014, responses to the earlier NRC staff RAI (ML14212A399);

(b) update or add a new figure, including an appropriate distance scale and the difference between True and Magnetic North, to show the location of the Met monitoring station in relation to the Grants site, and routine and non-routine

radon-in-air monitoring locations, including labeled elevation contours adequate to illustrate the terrain features resulting in nighttime drainage air flow;

(c) add a new figure, including an appropriate distance scale and the difference between True and Magnetic North, showing a closer view of the Met monitoring station in relation to the large tailings pile, any smaller tailings piles, and any other nearby potential obstructions to air flow with a height greater than one-half the height of the wind instruments, along with labeled elevation contours sufficient to illustrate height differences between the base of the Met monitoring station, the tailings piles, and any other potential obstructions to air flow;

(d) confirm that the Met monitoring station has always been located at the location depicted on Figure 2.2-10 of the HMC's July 21, 2014 RAI responses or indicate when the Met monitoring station was located at the Lat/Lon coordinates shown in Section 2.4 of the HMC TR;

(e) provide or reference any documentation for the basis for, and indicates approval of, the location of the Met monitoring station at the location depicted on Figure 2.2-10 of the Licensee's July 21, 2014, responses to the earlier NRC staff RAI or the station's location in 2009; and,

(f) identify the closest distances between the location of the Met monitoring station in 2009 and directions to each of the tailings piles and any other potential obstructions to air flow, along with the base elevation of the Met monitoring station as well as the base elevation and maximum height of each tailings pile and any other potential obstructions to air flow, and any changes to those maximum heights during the 2009 monitoring period.

2. Description of Deficiency

Figure 2-3 of HMC's TR identified three drainage flow areas up-gradient of the Grants site that cover three separate orientations relative to the site – the San Mateo Creek Drainage which nominally runs north-northeast to south-southwest, the Northwest Drainage generally running northwest to southeast until its merging with the San Mateo Creek Drainage then continuing in a more north-to-south direction, and the Lobo Creek Drainage generally oriented east to west. Table 5-1 of the HMC TR states that "San Mateo Creek is a much larger watershed than Lobo Creek with more potential sources of radon and should be a primary focus for the background location."

Figure 2-5 of HMC's TR presents an annual wind rose for all hours in 2009 indicating a prevailing wind direction (i.e., the direction from which the wind blows most often) from the east-northeast. The second highest frequency occurs only slightly less often and is from the northeast sector. Notwithstanding later RAI questions on data count discrepancies for the 2009 wind data summaries and other QA/QC concerns, the prevailing / predominant nighttime wind directions based on Figure 2-4(b) of the TR appear to occur for the east-northeast and northeast sectors as well. These nighttime frequencies are largely associated with light wind speed conditions (i.e., less than or equal to 2.1 meters per second (m/sec)). Sections 2.1 and 2.2 of HMC's TR discusses a relationship between

high radon-in-air concentrations and the tendency for that air to be transported following local topography when winds are calm or near-calm – in this case towards the Grants site.

Figure 2.2-10 of the Licensee's July 21, 2014, responses to the earlier NRC staff RAI indicates that the large tailings pile is situated to the north of the Met monitoring station (understanding that the location of the Met station in 2009 has yet to be confirmed). Based on the west to east length of the large tailings pile, it appears that the pile is directly upwind of the Met monitoring station fully for all of the north-northeast, north, and north-northwest direction sectors, as well as a large portion of the northeast direction sector. Figure 2-3 of HMC's TR also places the large tailings pile directly between the Met monitoring station and the San Mateo Creek Drainage and its later merger with the Northwest Drainage. And finally, the large tailings pile lies directly upwind of existing site boundary monitoring locations HMC-4 and HMC-5 for the north, north-northeast, and a portion of the northeast direction sectors, these two stations reporting the highest radon-in-air concentrations among the site boundary monitors listed in Table 4-1 of the HMC TR.

Additional information is necessary for the NRC staff to be able to more fully evaluate whether, or to what degree, the 2009 wind data summaries for the Met monitoring station in the HMC TR might have been influenced by the nearby large tailings pile. This information is also needed to evaluate to what extent those data are representative of: (1) the three drainage flow areas and winds from other directions, all of which contribute to a proper estimation of background radon-in-air levels, whether measured at the proposed background monitoring location alone, at another location, or if additional background monitoring locations are necessary; and, (2) at the regulatory compliance point(s) where that background level is to be applied.

Basis of Request

In its previous and current review of HMC's TR, the NRC staff has observed an offset between the orientations of what HMC considers to be the primary drainage flow of interest (i.e., the San Mateo Creek Drainage nominally from the north-northeast to south-southwest) and the prevailing (i.e., east-northeast)/predominant (i.e., northeast) wind directions based on Figure 2-5 and Figure 2-4(b) of the TR for all hours and for (presumably) only nighttime hours, respectively.

Given the general lack of information in (or referenced from) HMC's TR about the location of the Met monitoring station and the rationale for its placement, it is uncertain whether or to what extent the wind measurements for 2009 from the Met monitoring station were affected by the nearby large tailings pile (especially under calm and near-calm wind conditions), other nearby potential obstructions to air flow, subject to other influences, or some combination of the above.

The wind data is an essential input to the AERMOD dispersion modeling analysis in the HMC TR. Subsection 3.2.2 of the TR indicates that the AERMOD modeling results were used to identify potential background radon-in-air monitoring locations in the area around the Grants site. However, without additional explanation the NRC staff cannot yet come to a conclusion on the representativeness of the Met data used as input to the model or of the results generated by it (e.g., the hypothetical concentration plots for the three

drainages in Figures 4-2(a), 4-2(b), and 4-3) used, in part, to justify the proposed relocation of the background monitoring station (i.e., HMC-1Off).

Formulation of RAI

The Licensee should update the HMC TR, as appropriate, including any associated new table(s) or figure(s), by addressing the following technical issues:

(a) Confirm and provide documentation that, at least for the 2009 POR, the wind direction sensor was referenced to True North as opposed to Magnetic North. True North appears to be offset from Magnetic North counterclockwise by about 9.5 degrees or more (i.e., about one-half of a standard 22.5-degree wind direction sector width).

(b) Given the uncertainties discussed in this and the preceding RAI question and the complex terrain in the area around the Grants site, provide a discussion on the representativeness and limitations of the 2009 Met data with regard to the hypothetical concentration plots in Figure 4-2(a), Figure 4-2(b), and Figure 4-3 of the TR for each of the San Mateo Creek, Northwest, and Lobo Creek Drainages, respectively, and for modeling the on-site sources of radon-in-air emissions.

3. Description of Deficiency

Section 2.4 of HMC's TR (Paragraph 5) references Figures 2-4(a) and 2-4(b) as presenting wind rose plots (i.e., illustrations of wind speed and wind direction frequency) for daytime and nighttime hours, respectively, for the year 2009. Both figures are only marginally legible including the entries showing the percent frequency of "Calm Winds" and the "Total Count" of hours (based on labeling of the 24-hour wind rose plot in Figure 2-5), and the "Data Period" (start and end dates and times). Daytime clock hours appear to be from 04:00 to 18:00 (Figure 2-4(a)), a 15-hour period, whereas nighttime clock hours appear to be labeled as covering hours 00:00 through 23:00 (Figure 2-4(b)). More importantly, the Total Counts appear to be 4742 (daytime) and 4744 (nighttime) for a total of 9486 hours, far above the total possible hours for the year 2009 (i.e., 8760).

Basis of Request

The fields of meteorology and atmospheric dispersion recognize that complex terrain settings are often characterized by nighttime drainage (gravity) air flows that tend to follow the topography. The Licensee's intent to illustrate the differences between daytime and nighttime wind conditions at and near the Grants site is important in characterizing that flow as part of its justification for the proposed relocation of a background radon-in-air monitoring station (i.e., HMC-1Off).

Given the discrepancies noted above, without additional explanation, the NRC staff cannot further evaluate the Met data used to generate these various data summaries or used as input to the AERMOD dispersion model nor, more importantly, come to a conclusion regarding the proposed relocation of the background radon-in-air monitoring station drawn from that information.

Formulation of RAI

The Licensee should update the HMC TR, as appropriate, by incorporating clearly legible versions of Figures 2-4(a) and 2-4(b). In addition, the Licensee should identify the hours considered to represent daytime and nighttime for the intended purpose and explain the rationale for those definitions. More importantly, however, the Licensee also needs to:

(a) verify the daytime and nighttime data counts (hours) shown on these figures;

(b) reconcile the apparent discrepancy between the total possible or valid data counts for the year 2009 against the sum of the apparent daytime and nighttime data counts; and,

(c) ensure consistency between these statistics and those discussed, tabulated, or illustrated on these figures or elsewhere in the TR.

4. Description of Deficiency

Section 2.4 of HMC's TR (Paragraph 4) states that "[t]he meteorological station is configured and maintained to meet EPA Prevention of Significant Deterioration (PSD) quality assurance requirements." The text further states that "HMC's meteorological consultant annually audits the performance of the meteorological instruments in accordance with EPA's "Ambient Monitoring Guidelines for Prevention of Significant Deterioration…and "Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV: Meteorological Measurements".

Further, Figure 2-5 indicates that the "Total Count" for the wind rose representing all (presumably valid) hours during 2009 is "8757" hours. This is consistent with the "Missing/Incomplete" data percentage in Table 2-1 of the HMC TR (i.e., 0.03 percent or 3 hours out of a possible 8760 hours for the year 2009).

With so few missing hours for the year 2009, the NRC staff is unclear as to how frequently and which Quality Assurance (QA) and Quality Control (QC) checks, as called for in the EPA meteorological monitoring and QA guidance cited by the Licensee, were implemented over the course of the Met monitoring program, especially during 2009.

Basis of Request

The Licensee has adopted EPA monitoring and QA guidance for establishing and implementing its Met monitoring program at the Grants site. The NRC staff recognizes that the referenced guidance is generally more detailed but, in many respects, similar to, and in some cases more stringent than, the guidance in Regulatory Positions 3 and 4 of RG 3.63. Therefore, the NRC staff considers the EPA guidance cited by the Licensee in Section 2.4 of HMC's TR to be acceptable so long as it is properly implemented.

Section 7 (Paragraph 2) of EPA's PSD monitoring guidelines (EPA, 1987) states, with respect to quality assurance for meteorological data, that "[c]alibration of systems should be accomplished no less frequently than once every 6 months" and that "[i]n corrosive or

dusty areas, the interval should be reduced to assure adequate and valid data acquisition". Section 7 (Paragraph 4) goes on to state that "an independent meteorological audit (by other than one who conducts the routine calibration and operation of the network) should be performed to provide on-site calibration of instruments as well as an evaluation of (a) the network installation; (b) inspection, maintenance, and calibration procedures, and logging thereof; (c) data reduction procedures, including spot checking of data; and, (d) data logging and tabulation procedures." Section 7 (Paragraph 5) further states that "[t]he on-site visit (requiring as little as 1 day in many cases) should be made within 60 days after the network is first in full operation…" and that "[s]uch independent meteorological audit-evaluations should be performed about each 6 months."

The last paragraph of Section 7 in EPA's PSD monitoring guidelines indicates that the 1983 version of EPA's Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV: Meteorological Measurements "should be consulted for more information." The NRC staff notes that the Licensee cited the more recent 2008 version of that particular guidance in Section 2.4 of the HMC TR. Table 0-8 of that document specifies frequencies and acceptance criteria for calibration and measurement accuracy checks for the various meteorological parameters that may be measured under a PSD monitoring program including those listed in Section 2.4 (Paragraph 3) of the HMC TR. With respect to wind speed and wind direction measurements, calibrations are to be performed on a quarterly basis, accuracy checks are to be conducted within 60 days of start-up and then at 6-month intervals.

The NRC staff considers the phrase "accuracy checks" in the EPA QA Handbook to be equivalent, in part, to the phrase "independent meteorological audit" in the EPA PSD monitoring guidelines with respect to on-site calibration of Met instruments. The NRC staff also considers that calibration frequency should have been implemented on a quarterly basis, consistent with Table 0-8 of the EPA QA Handbook rather than the default frequency mentioned in Section 7 (Paragraph 2) of EPA's PSD monitoring guidelines, for two reasons: (1) unless otherwise stated elsewhere in the HMC TR, the more recent 2008 version of the EPA QA Handbook (which pre-dates the 2009 POR of Met data used in the LAR) should take precedence in terms of calibration frequency; and (2) the Grants site would appear to be a generally dry and dusty environment which the EPA PSD monitoring guidelines recognized in its caveat on calibration frequency that "[i]n corrosive or dusty areas, the interval should be reduced to assure adequate and valid data acquisition". If the wind speed and wind direction sensors are of the mechanical type (which is not stated in the HMC TR), dust could affect the bearings of either instrument which could possibly reduce the instruments' response.

Given the amount of time to nominally calibrate meteorological measurement systems and sensors, whether in-situ or new equipment if changed out, and in this case as those systems and sensors relate to the Licensee's dispersion modeling analysis (i.e., wind speed and wind direction, temperature and (if applicable) temperature difference systems, and solar radiation), and to perform accuracy audit checks (including calibrations) at the frequencies given in the cited EPA guidance, the reported annual data loss (i.e., only 3 hours) appears too low without further explanation. Consequently, the NRC staff cannot further evaluate the Met data used to generate the wind rose plots and other data summaries for the year 2009, or used as input to the AERMOD dispersion model, nor,

more importantly, the conclusions regarding the proposed relocation of the background radon-in-air monitoring station drawn from that information.

Formulation of RAI

The Licensee should update the HMC TR or provide the requested documentation, as appropriate, including any new associated tables by addressing the following information needs to help resolve the data quality and technical issues indicated above by confirming:

(a) the types of wind sensors installed (e.g., mechanical cup and vane, sonic), whether protection from icing was provided, and whether the Met monitoring system incorporated redundant wind speed and wind direction sensors;

(b) the type of temperature measurement sensor(s) and system installed, whether and how atmospheric stability was determined or estimated for input to the AERMOD dispersion model (e.g., the Solar Radiation / Delta-Temperature method), and whether the Met monitoring system incorporated redundant temperature sensors or systems;

(c) the type of data acquisition system employed (i.e., digital and/or analog), the sampling rate for each parameter (if digital), and the minimum amount of time designated as being necessary to represent a valid hour of Met measurements;

(d) monthly and annual data recovery rates for individual parameters and for the joint concurrent recovery of those meteorological parameters input directly to the AERMOD dispersion model (e.g., wind speed, wind direction, and atmospheric stability);

(e) whether data substitution approaches were implemented for the year 2009 to supplement periods of missing or invalid Met data, an accounting of those periods, and the source(s) of back-up data;

(f) the frequency and scope of Met instrument and related system calibrations in relation to the cited EPA monitoring guidance, and providing documentation of those QA checks during 2009, acceptance criteria, results, the need for and resolution of any corrective actions, and any effects on data validity;

(g) the frequency and scope of independent audits of the Met monitoring program, in general (including data processing and validation) and of the instruments and related systems in relation to the cited EPA monitoring guidance, and providing documentation of those independent system and performance audit checks during 2009, acceptance criteria, results, the need for and resolution of any corrective actions, and any effects on data validity; and,

(h) the frequency and scope of any other periodic QA checks, inspections, and maintenance activities (whether performed on site or remotely) of Met instrumentation and related systems, the basis for those periodic checks, and providing documentation of those checks during 2009, acceptance criteria,

results, the need for and resolution of any corrective actions, and any effects on data validity.

5. Description of Deficiency

Table 2-1 of HMC's TR lists a wind frequency distribution (in percent) for the Grants site for the year 2009 summarized by the 16 standard directional sectors (i.e., north, north-northeast, northeast, etc.), for all sectors combined, and for six wind speed ranges, as well as listing the frequency of calm winds and missing or incomplete wind data. Sections 2.1 and 2.2 of HMC's TR discuss a relationship between high radon concentrations in air and calm and near-calm wind conditions. Section 2.2 further states that "calm and near-calm (wind speeds less than or equal to 2.1 meters per second) conditions are prevalent regionally at night and in early morning hours."

Based on the Table 2-1 entries, the NRC staff notes that wind speeds at the Grants site appear to be less than or equal to 2.1 m/sec (including calm wind conditions) more than 50 percent of the time throughout the year without further explanation.

Basis of Request

Given the uncertainties discussed previously in this RAI regarding the type(s) of wind instruments deployed for the Grants on-site Met monitoring program, that the site appears to be a dry and dusty environment (with its potential effects on mechanical wind instrumentation), and the questions regarding how frequently various QA and QC checks were performed during the 2009 data year, the NRC staff needs additional information to better understand: (1) the validity of the wind speed data in the HMC TR, which shows that wind speeds less than or equal to 2.1 m/sec occur more than 50 percent of the time on an annual basis; and (2) how one year of data represents long-term conditions at the Grants site consistent with Regulatory Position C.1 (Paragraph 4) in RG 3.63.

Formulation of RAI

The Licensee should update the HMC TR by addressing the following data quality and technical issues:

(a) Confirm whether any wind measurement instruments or components were replaced during 2009, the nature of such replacement (e.g., as called for by periodic QA or maintenance procedures, instrumentation or other failure, fouling of wind speed or wind direction bearings due to ambient dust levels), and any effects on data validity.

(b) Calm and near-calm wind speed conditions are stated to be prevalent regionally, particularly at night and in the early morning hours. Explain the basis for this statement, including the station(s) used, their location(s) relative to the Grants site (e.g., distances, directions, differences or similarities in elevation and topography), and the period(s) of record considered.

6. Description of Deficiency

Table 2-1 of HMC's TR lists a wind frequency distribution (in percent) for the Grants site for the year 2009 summarized by the 16 standard directional sectors (i.e., north, north-northeast, northeast, etc.) and for all sectors combined, as well as the frequency of calm winds and missing or incomplete wind data. Figure 2-6 plots the frequencies of calm wind conditions by hour of the day for the year 2009, also showing the data count for calms for each hour.

The sum of the calm data counts in Figure 2-6 totals 1534. Using this value, a cross-check between the percent calm frequency in Table 2-1 (i.e., 8.76 percent) versus the total count in Figure 2-5 (i.e., 8757 hours) equals 17.52 percent and versus the sum of the daytime / nighttime data counts from Figures 2-4(a) and 2-4(b) (presumably 9486 hours) equals 16.17 percent. These values are up to two times greater than the percent calm frequency in Table 2-1 or Figure 2-5.

Basis of Request

Apparent discrepancies have been noted in this RAI between the total of the daytime/nighttime data counts from Figures 2-4(a) and 2-4(b) and the possible or actual valid data hours during the year 2009. Additional discrepancies between the percent frequencies of calm conditions during 2009 based on comparisons between the information in Table 2-1 and Figure 2-6 have been identified here. Consequently, without additional information, the NRC staff cannot further evaluate the Met data used to generate these various data summaries or used as input to the AERMOD dispersion model nor, more importantly, the conclusions regarding the proposed relocation of the background radon-in-air monitoring station (i.e., at HMC-1Off) drawn from that information.

Formulation of RAI

The Licensee should update the HMC TR, as appropriate, including any associated current or new table(s) or figure(s) to address the discrepancies between the percent frequencies of calm hours based on Table 2-1 and Figure 2-6 and to ensure consistency between these statistics and those discussed, tabulated, or illustrated elsewhere in the TR.

7. Description of Deficiency

Section 2.5 of HMC's TR (Paragraph 2) refers to Figure 2-6 as showing "the watersheds that contain potential sources that may contribute to radon concentrations at the site". Figure 2-6 shows the frequency of calm conditions by hour for the year 2009.

Basis of Request

Internal inconsistency.

Formulation of RAI

The Licensee should update the HMC TR by correcting the indicated cross-reference to Figure 2-6 in Section 2.5 of the TR.

8. Description of Deficiency

Section 3.1.2 of HMC's TR indicates that hypothetical off-site sources of radon emissions were conceptually modeled with the EPA AERMOD dispersion model to evaluate their contribution to radon levels in the general area. These hypothetical sources "were placed in each of the drainages discussed in Section 2.4" (i.e., the San Mateo Creek, Northwest, and Lobo Creek Drainages). The discussion goes on to indicate that each of these off-site sources were represented in the conceptual model as point sources. Section 2.1 of the TR (Paragraph 3) earlier stated that the modeling results were used to site "additional locations where radon concentrations may be more representative of the background concentration at the site" (i.e., designated as HMC-1Off through HMC-6Off).

TR Figure 2-3 illustrates the locations of "potential anthropogenic sources of radon" near the Grants site, the location of the three drainages, the nine (9) site-related radon monitoring stations (i.e., HMC-1 through HMC-7 on the site perimeter, HMC-1A just north of the site boundary, and HMC-16, the current background monitoring location approximately 3 kilometers (km) northwest of the site), and the six (6) additional off-site radon monitoring locations sited for the Licensee. TR Figure 2-7 further indicates the number and extent of potential off-site legacy sources of radon-in-air emissions within and around the three drainages relative to the Grants site.

A point source is typically used to represent pollutant emissions released from a stack, vent, or other similar, relatively small opening. Area sources, on the other hand, are used to account for emissions released over a much larger area, often at an assumed uniform rate. In some cases, where appropriate, emissions are assumed to be released on a conditional basis (e.g., by season, month, and/or time of day, or as a function of the wind speed). Potential radon-in-air emission sources associated with legacy mining operations within and near the three drainages (especially the San Mateo Creek and Northwest Drainages) are shown in TR Figure 2-7 as being broadly distributed up-gradient from the Grants site. The Licensee's decision to model these hypothetical sources of radon emissions as individual point sources results in the dispersion patterns illustrated in TR Figures 4-2(a), 4-2(b), and 4-3 for each drainage (i.e., extending out from each release point). The HMC TR does not present, or appear to evaluate, a composite (or the combined impacts) of those modeled point source results.

As indicated previously, Sections 2.1 and 2.2 of HMC's TR discuss a relationship between high radon concentrations in air and calm and near-calm wind conditions and that "calm and near-calm (wind speeds less than or equal to 2.1 meters per second) conditions are prevalent regionally at night and in early morning hours." Notwithstanding previous RAI questions on data count discrepancies for several of the 2009 wind data summaries and other QA/QC concerns, TR Table 2-1 suggests that wind speeds at the Grants site appear to be less than or equal to 2.1 m/sec (including calm wind conditions) for a significant amount of time (slightly more than 50 percent) throughout the year.

However, Section 2.2 also states that "[d]uring the solar heating and resulting windy conditions of daytime, radon quickly mixes and turbulent air becomes indistinguishable from background concentrations" which implies that ambient radon-in-air concentrations are significantly different for half the year as well. Nevertheless, Appendix A to the TR indicates that the AERMOD model runs for the three drainage flow areas assumed that emission rates did not vary in time or with other conditions.

Consequently, it is not clear from the information in HMC's TR whether the AERMOD modeling results, used, in part, to recommend an alternate location for the background radon-in-air monitoring station for the Grants site, are reasonably representative of the dispersion patterns within the San Mateo Creek, Northwest, and Lobo Creek Drainages, or what effect (if any) a composite presentation of those results would have on the Licensee's recommendation.

Basis of Request

The regulations at 10 CFR 20.1301 establish dose limits for individual members of the public that are applicable to radiological emissions from uranium processing facilities. In particular, Section 20.1301(a)(1) specifies the relevant compliance criterion (i.e., 0.1 rem) which is determined over a one-year period, typically on a calendar-year (annual) basis. Compliance with this limit is "exclusive of the dose contributions from background radiation". To that end, the focus of HMC's LAR of September 23, 2013 (ML13281A790) is to provide a technical basis for selecting a representative background monitoring location for radon concentrations in air as an alternative to the current background monitoring location designated as HMC-16.

Section 10 CFR 20.1302(a) provides that "[t]he licensee shall make or cause to be made, as appropriate, surveys of radiation levels in unrestricted….areas….to demonstrate compliance with the dose limits for individual members of the public in Section 20.1301." Such surveys and compliance determinations would include accounting for background radon-in-air levels around the Grants site that are representative not only temporally, but spatially as well. As indicated above, compliance with the 10 CFR 20.1301(a)(1) dose limit is evaluated <u>on an annual basis</u>. <u>Spatial representativeness</u>, however, <u>implies that the background concentration is representative of the location(s) at which compliance is to be demonstrated</u>.

Without additional explanation regarding some of the assumptions made by the Licensee in its AERMOD modeling runs and the presentation of its results, the NRC staff cannot further evaluate the representativeness of the hypothetical concentration plots for the three drainages in TR Figures 4-2(a), 4-2(b), and 4-3 used, in part, to justify the proposed relocation of the background radon-in-air monitoring station to HMC-1Off.

Formulation of RAI

The Licensee should address the following technical issues and update the HMC TR, as appropriate, including any associated current or new table(s) or figure(s).

(a) The Licensee represented potential background sources of airborne radon emissions, naturally occurring and due to legacy mining operations within and

near the three drainages, as individual point sources. Appendix A to the HMC TR lists the UTM coordinates assigned to the single modeled emission point in each drainage. Presumably, TR Figures 4-2(a), 4-2(b), and 4-3 show the respective point source coordinates as the three red dots in each of those figures.

- Confirm whether the red dots in the referenced figures indicate the locations of the modeled point sources.

- Explain the rationale for selecting the coordinates assigned to these three point sources in relation to the topography of the respective drainages and with respect to the potential legacy sources of radon emissions expected to contribute to background levels from those drainages.

- Except for an outline of the site boundary, there is no distance scale or other referencing information on TR Figures 4-2(a), 4-2(b), and 4-3. In order to clarify what each modeled point source was intended to represent, illustrate the location of each point source in relation to the potential legacy sources of radon emissions (e.g., by updating TR Figure 2-7).

(b) The Licensee has indicated that the modeling results served two purposes: (1) to support the conceptual model for radon transport in complex terrain under calm and near-calm wind conditions; and, (2) to site potential background radon monitoring locations (one of which has been proposed in the HMC TR – that is, the HMC-1Off station).

In the April 17, 2014, RAI to HMC (see ML14051A687 and ML14051A689), the NRC staff indicated in its general description of RAI No. 1 that "[t]here is not enough quantitative detail on the strength of local sources of radon emissions and how they contribute to radon concentration at the Homestake site and site boundary". In its July 21, 2014, responses (see ML14212A399), the Licensee stated, in part, that "[m]odeling the actual impact of off-site sources as suggested in the RAI would require a quantitative estimate of the source strength of the more than 300 uranium mines in and around the project area" and that "[t]his is neither practical nor needed to determine an appropriate location to measure background radon concentrations in air for the site." For the purpose of demonstrating the Licensee's conceptual model of drainage air flow occurring north and east of the Grants site, it is reasonable to not quantify and include (model) all potential off-site sources of airborne radon emissions (naturally occurring and due to legacy mining operations).

Potential radon-in-air emission sources associated with legacy mining operations are numerous and widely distributed within and near the three drainages (especially the San Mateo Creek and Northwest Drainages) as shown in Figure 2-7 of the HMC TR. Consequently, with respect to the support provided for the siting of potential background monitoring locations, the NRC staff cannot yet conclude that the Licensee's representation of these many sources as a single point source in each drainage is reasonable. Typically, for

modeling fugitive emission sources, broad areas would be represented in the dispersion model by a series of area sources in each drainage. As a result, the point source-related dispersion patterns illustrated by TR Figures 4-2(a), 4-2(b), and 4-3, of which some portions appear to overlap the impact areas from adjacent drainages, might change along with the recommended alternate monitoring station or its initial siting.

In order to support its recommendation for an alternate background monitoring station and its location, the Licensee should address the following technical issues:

- Either explain why or demonstrate that the point source-related dispersion patterns, as shown in TR Figures 4-2(a), 4-2(b), and 4-3, would not change if the potential legacy emission sources of radon-in-air in the respective drainages were represented as a series of area sources such that the Licensee's siting of potential background stations and recommendation of an alternate monitoring location would be the same or reasonably similar.

- Figures 4-2(a), 4-2(b), and 4-3 of the HMC TR present the point source-related patterns of dispersion for each drainage as modeled but do not provide information to address any composite effects. Either explain why or demonstrate that the siting of potential background stations and recommendation of an alternate monitoring location would not change based on composite dispersion patterns. Revise or provide any associated current or new figure(s) or table(s) accordingly.

- If additional dispersion modeling using a series of area sources in each drainage is performed, identify and explain how the various input parameters to the AERMOD dispersion model were developed (e.g., number of sources, area source coordinates, elevations, apportionment of hypothetical release rate(s)) and the rationale for those assumptions. Revise or provide any associated current or new figure(s) or table(s) and related discussions accordingly.

(c) In reviewing the AERMOD dispersion modeling assumptions in the HMC TR, the NRC staff notes that the hypothetical emission rate assigned to each of the three drainages appears to be a uniform, non-varying value. Further, as indicated previously, Sections 2.1 and 2.2 of the TR discuss a relationship between high radon concentrations in air and calm and near-calm wind conditions (i.e., wind speeds less than or equal to 2.1 m/sec) and that under these conditions radon transport is driven predominantly by topography.

At the same time, however, Section 2.2 also states that "[d]uring the solar heating and resulting windy conditions of daytime, radon quickly mixes with turbulent air and becomes indistinguishable from background concentrations". The relative magnitude of this marked diurnal variation in radon concentrations is illustrated in Figure 4-5 of the HMC TR for a limited number of days of real-time measurements made during the summer and winter at one of the routine

site boundary monitoring locations (i.e., HMC-4) and at HMC-1Off where the Licensee has proposed to relocate the background monitoring station.

Notwithstanding previous RAI questions on data count discrepancies for several of the 2009 wind data summaries and other QA / QC concerns, the wind frequency distribution data summarized in Table 2-1 of the HMC TR suggests that wind speeds are greater than the upper limit of the stated range conducive to drainage (gravity) flow (i.e., 2.1 m/sec) and lower radon concentrations nearly 50 percent of the time on an annual basis. In addition, based on TR Figure 2-6 calm winds appear to occur at least 25 percent of the time between the daytime hours of 10:00 and 19:00 when some turbulent mixing might reasonably be expected to take place. However, the Licensee has not established that drainage flow occurs in the site area during the daytime.

Consequently, based on the characteristics of radon-in-air described by the Licensee in Section 2.2 and Figure 4-5 and on the wind data summarized in Table 2-1 and Figure 2-6 of the HMC TR, it is reasonable to expect that ambient radon-in-air concentrations would vary as a function of wind speed and/or time of day. In its July 21, 2014, response to RAI No. 1 (see ML14212A399), the Licensee stated that "[k]nowing the actual radon source strength from off-site sources would not change the conceptual model or the selection of off-site monitoring locations, it would only change the magnitude of the modeled result at a given location, which is already measured quantitatively with detectors". However, given the source representation, dispersion pattern, and impact area overlap concerns raised previously, the additional potential effect of variable emission rates and accompanying wind directions adds further uncertainty to those patterns and, as a result, the Licensee's siting of the potential background stations and recommended alternate monitoring location.

The AERMOD dispersion model includes provisions that allow for emissions to be released on a conditional basis (e.g., rates that can be varied by season, month, and/or time of day, or as a function of the wind speed). In order to support its recommendation for an alternate background monitoring station and its location, the Licensee should address the following technical issues:

- Confirm whether the hypothetical radon-in-air emission rate (as listed in Appendix A to the HMC TR for the three drainages) did not vary as applied in the AERMOD modeling runs (i.e., was the same for each hour over the entire year of meteorological data).

- If the emission rate assigned to each of the three drainages did not vary, then given the amount of time on a daily and annual basis that wind speed conditions are not conducive to drainage air flow (i.e., greater than 2.1 m/sec) or vary by time of day to the degree shown in TR Figure 4-5 (i.e., by more than an order of magnitude) but are expected to be associated with lower, background radon levels, provide technical justification for that assumption and demonstrate that the dispersion patterns shown in TR

Figures 4-2(a), 4-2(b), and 4-3 would not change such that the Licensee's siting of potential background stations and recommendation of an alternate monitoring location did not change.

- Confirm whether the hypothetical radon-in-air emission rate (as listed in Appendix A to the HMC TR for the elevated and near-ground level area sources used to represent the on-site large tailings pile) did not vary as applied in the AERMOD modeling runs (i.e., was the same for each hour over the entire year of meteorological data).

- If the emission rate assigned to the two on-site area sources representing the large tailings pile did not vary, then, similar to the above, given the amount of time on a daily and annual basis that wind speeds are greater than 2.1 m/sec and expected to be associated with lower radon levels, provide technical justification for that assumption and why, for those same conditions, these on-site area sources should not be modeled consistently with the off-site sources used to represent the three drainages. Also, demonstrate that the dispersion pattern illustrated in Figure 4-1 of the HMC TR would not change such that the areal extent of the 10 percent contour line and its use in the evaluation did not change.

- If additional dispersion modeling is performed using variable emission rates, identify the AERMOD model options used and explain how the various input parameters were developed (e.g., time periods, wind speed ranges, apportionment of hypothetical release rate(s)), and the rationale for those assumptions. Revise or provide any associated current or new figure(s) or table(s) and related discussions accordingly.

9. Description of Deficiency

Section 5 of the HMC TR briefly summarizes information and analyses from the preceding sections of the report in the context of "selecting an appropriate background location for any site," including:

- the conceptual radon flow model and meteorological conditions under which higher radon-in-air concentrations occur and are transported in the complex terrain setting around the Grants site;

- identification of the AERMOD dispersion code (including an acknowledged limitation on its treatment of heavier-than-air gases) used to model the transport of off-site sources of radon emissions (naturally occurring and due to legacy mining operations) from the three drainages to the northwest, north, and east, up-gradient of the Grants site that potentially contribute to background levels at the site, as well as the impact of emissions from on-site sources that are not considered as background;

- a reiteration of the one current and six potential off-site background monitoring locations and an evaluation "of each location and justification for elimination or inclusion as a representative background area"; and,

- a recommendation that the station designated as HMC-1Off "appears to be the best representation for background radon concentrations in outdoor air for the site" to be used "when determining compliance with Federal public dose limits."

Section 5 further states on Page 25 (first paragraph) that "[t]here is sufficient evidence in this study to show that the conceptual model described herein is a good predictor of radon transport and can be used to select representative background locations." The Licensee also states (Page 25, last paragraph) that "[d]rainage areas to the west and southwest were not considered in this evaluation", going on to give several reasons for not having done so (e.g., that drainage flow during calm wind conditions would not impact the site, and that there are fewer sources of radon emissions in those drainages).

Compliance determinations with the 10 CFR 20.1301(a)(1) dose limit include determining and appropriately accounting for background radon-in-air concentrations. Background levels need to be representative not only temporally, but spatially as well. The 10 CFR 20.1301(a)(1) dose limit is evaluated on an annual basis. However, there is more than one component to establishing spatial representativeness. First, emissions from the regulated site must have minimal effect on the measurements made at the background monitoring station(s). Second, and at least as important, the background concentration must be representative of the location(s) at which compliance is to be demonstrated.

From the standpoint of temporal representativeness, the NRC staff considers that the Licensee's conceptual model has identified potentially significant contributors to the background radon-in-air concentration level near the Grants site and characterized the conditions under which they are expected to occur. However, the conceptual model alone does not account for the entire one-year compliance period. Rather, as indicated previously, wind speeds greater than the upper limit of the stated range conducive to drainage (gravity) flow (i.e., 2.1 m/sec) and higher radon concentrations occur nearly 50 percent of the time on an annual basis. Further, wind speeds below that threshold value (including calms) from the northwest clockwise through the northeast direction sectors (i.e., nominally covering the San Mateo Creek and Northwest Drainages) only account for 25 to 30 percent of the time annually.

In addition to the previously-stated issues with the AERMOD dispersion modeling assumptions and how they may relate to the initial siting of the six potential off-site background monitoring locations, the NRC staff has several related concerns from the standpoint of spatial representativeness given the proposed recommendation of a single, off-site monitoring location at HMC-1Off for determining background:

- wide variability in ambient radon concentrations based on the monitoring results summarized in Table 4-1 of the HMC TR to the northwest clockwise through the east direction sectors;

- no apparent, concurrent monitoring coverage for background radon levels associated with the east-southeast clockwise through the west-northwest direction sectors with presumably lower ambient radon levels even though winds from these sectors occur

well over 40 percent of the time based on the frequencies listed in Table 2-1 of the HMC TR; and,

- the distance between the proposed background monitoring location and the point(s) of compliance with no apparent evaluation or accounting for additional dispersion effects that may occur which might reduce the background value from where it would be measured.

Finally, while it may not be part of the intended scope of the HMC TR, the LAR does not clearly identify the compliance point(s) where the background radon concentration will be applied (presumably at all site boundary monitoring locations) nor does it address the methodology by which the background radon-in-air value(s) will be determined and implemented for each of those locations.

Basis of Request

The regulations at 10 CFR 20.1301 establish dose limits for individual members of the public that are applicable to radiological emissions from uranium processing facilities. In particular, Section 20.1301(a)(1) specifies the relevant compliance criterion (i.e., 0.1 rem) which is determined over a one-year period, typically on a calendar-year (annual) basis. Compliance with this limit is "exclusive of the dose contributions from background radiation." To that end, the focus of HMC's LAR of September 23, 2013 (ML13281A790) is to provide a technical basis for selecting a representative background monitoring location for radon concentrations in air as an alternative to the current background monitoring location designated as HMC-16.

Section 20.1302(a) provides that "[t]he licensee shall make or cause to be made, as appropriate, surveys of radiation levels in unrestricted….areas….to demonstrate compliance with the dose limits for individual members of the public in Section 20.1301." Such surveys and compliance determinations would include accounting for background radon-in-air levels around the Grants site that are representative not only temporally, but spatially as well. As indicated above, compliance with the 10 CFR 20.1301(a)(1) dose limit is evaluated <u>on an annual basis</u>. Spatial representativeness, however, implies that the background concentration is representative of the location(s) at which compliance is to be demonstrated.

Without additional justification regarding some of the assumptions made by the Licensee in its AERMOD modeling runs and the presentation of those results, the NRC staff cannot fully evaluate the hypothetical concentration plots for the three drainages in Figures 4-2(a), 4-2(b), and 4-3 of the HMC TR used, in part, to justify the proposed relocation of the background radon-in-air monitoring station from HMC-16 to HMC-1Off. Moreover, given:

- the marked variability of measured radon levels as summarized in the TR for the potential background radon monitoring locations to the north and east of the Grants site;

- the apparent absence of data and little other information about ambient radon levels in all directions about the Grants site;

- the possibility of additional dispersion of airborne radon between the location(s) where those concentrations would be measured and the point(s) at which the presumed background levels would be applied to determine compliance; and,

- the frequency of winds from other directions and wind speeds not associated with drainage air flow,

the staff cannot yet conclude that a measured radon concentration from a single, off-site monitoring location can adequately characterize background radon levels for the Grants site consistent with the duration of the applicable public dose limits. Finally, the LAR of September 23, 2013, does not address the methodology for applying measured background radon-in-air concentration(s) at each of the points of compliance.

Formulation of RAI

The Licensee should update the HMC TR, as appropriate, including revision to or addition of any associated current or new figure(s) or table(s), in order to help resolve these technical issues:

(a) Identify the specific location(s) around the Grants site at which compliance with the dose limits for individual members of the public in Section 20.1301 will be determined and the basis for the specific location(s).

(b) Based on a general knowledge that atmospheric dispersion increases with travel distance from its source(s) and as illustrated by Figures 4-2(a), 4-2(b), and 4-3 of the HMC TR, radon-in-air emissions from legacy mining activities and natural sources could reasonably be expected to undergo some degree of additional dispersion between the background measurement location(s) and the compliance point(s) at which the background concentration is to be applied.

Given the characteristics of radon gas as described in the TR and the distance between the proposed (or any additional) background monitoring locations (i.e., at least 3 km or more away from the site boundary), either:

- explain why the radon-in-air concentration as measured at the proposed background monitoring location, or any other background monitoring stations, would not be further reduced due to additional dispersion between the measurement site and the point(s) where compliance is to be determined; or,

- discuss how much additional reduction is expected, how that reduction is to be determined, and how the adjusted background value is to be applied.

(c) Measured radon levels among the Licensee's off-site monitoring stations summarized in Table 4-1 of the HMC TR vary, in some cases, by almost a factor of 2.5. There is also an apparent absence of data and little other information about radon levels for directions other than the three drainages to

the north and east of the Grants site. In addition, winds from other directions and wind speeds not associated with drainage air flow occur well over 40 percent of the time on an annual basis. All of these factors contribute to the spatial and temporal representativeness necessary to adequately characterize background radon levels for the Grants site.

The NRC staff is aware of the EPA's comments on the LAR submittal in its letter of December 30, 2013 (see ML14029A558). EPA recommended a "weighted gradient" (i.e., a composite) approach for determining a background concentration value that could be applied to all seven site-related radon monitoring stations (i.e., HMC-1 through HMC-7 on the site perimeter). The approach would average radon concentration data for selected groups from among the one current and six potential off-site background monitoring locations with each group being associated with a given range of wind directions. Weighting of the station average for a given group would be based on the frequency of wind directions (from an unreferenced two-year POR) applicable to that group relative to the frequency of all winds from the west-northwest clockwise through the east direction sectors.

The NRC staff independently recognized that there is no apparent monitoring coverage for background radon levels associated with the east-southeast clockwise through the west-northwest direction sectors with presumably lower ambient radon levels. Notwithstanding previous RAI questions on data count discrepancies for several of the 2009 wind data summaries and other QA / QC concerns, Table 2-1 of the HMC TR suggests that winds from these sectors occur well over 40 percent of the time on an annual basis. Ambient radon levels from these direction sectors could contribute to the annual background concentration at the point(s) of compliance. Further, their exclusion, whether based on the EPA's recommended approach or another approach, does not address temporal or spatial representativeness and could bias the resulting background level higher.

Given the preceding technical issues, the Licensee should:

- clearly justify that determining the background radon-in-air concentration based on measurements from a single monitoring location (i.e., HMC-1Off), adequately characterizes background radon levels for all points of compliance at and around the Grants site (which may be different at each location because of varying wind directions and site influences over the course of the entire annual compliance period); and,

- demonstrate that the meteorological conditions at the Met tower site are representative of the wind speeds and wind directions seen at the background monitoring station(s) as well as at each point of compliance, all of which contribute to the cumulative background radon level over the course of the entire annual compliance period.