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Decommissioning, Uranium Recovery & Waste Programs
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RE: Homestake Mining Company of California – Grants Reclamation Project – HMC Response to NRC Clarification Request for HMC's 03/11/2022 Response to NRC's 09/14/2021 RAI on HMC's 12/18/2020 Revised Request for Amendment to License No. SUA-1471 to Change the Background Monitoring Location for Radon and Ambient Gamma Radiation

Dear Mr. Linton:

Homestake Mining Company of California (HMC) hereby submits this response to June 10, 2022 clarification requests from the U.S. Nuclear Regulatory Commission (NRC) staff (ADAMS Accession No. ML 22137A097) regarding HMC's March 11, 2022 response (ML22071A000) to NRC's September 14, 2021 request for additional information (RAI) (ML21237A454) on HMC's December 18, 2020 revised request to amend license SUA 1471 with a change in the background monitoring station for ambient radon-222 gas and gamma radiation dose rates (ML20356A287).

With this fifth round of technical comments from NRC staff regarding HMC's efforts over the past decade to amend Materials License SUA-1471 for relocation of the background radon monitoring station to a representative location, HMC notes that the degree of regulatory evaluation of this license amendment request (LAR) has been unprecedented and inconsistent with basic representativeness criteria found in applicable NRC guidance (USNRC, 2019: "Evaluations of uranium recovery facility surveys of radon and radon progeny in air and demonstrations of compliance with 10 CFR 20.1301"). Similar criteria should apply to siting of a representative background gamma radiation monitoring location, though regulatory guidance on this specific subject has not been identified.

HMC's historical efforts to amend Materials License SUA-1471 for relocation of the background radon monitoring station are summarized as follows:

1. September 9, 2013: HMC submits original LAR to move the background radon station (ML13281A790).
2. April 17, 2014: NRC staff issues 1st RAI (ML14051A687 and ML14051A689).
3. July 14, 2014: HMC responds to 1st RAI (ML14212A399).

4. February 26, 2016: NRC staff issues 2nd RAI with extensive set of additional technical review comments (ML15155B689).
5. June 16, 2016: HMC withdraws LAR (ML16181A073).
6. March 31, 2020: HMC submits 2nd LAR to move the background radon station based on new data and updated information (ML20094F627).
7. July 1, 2020: NRC staff issues a request for supplemental information (RSI) containing a 3rd set of technical review comments from NRC staff (ML20171A527), and requires HMC to respond to the previous, February 26, 2016 2nd RAI from NRC staff (ML15155B689), along with earlier technical review comments from EPA (dated December 30, 2013; ML14029A558).
8. December 18, 2020: HMC submits a revised LAR to move the background radon station (ML20356A288), including a response to NRC staff's July 1, 2020 RSI (ML20171A527), responses to previous RAI from NRC staff (ML15155B689), and responses to technical review comments from EPA (ML14029A558).
9. September 14, 2021: NRC staff issues 3rd RAI (4th round of technical comments) (ML21237A454).
10. March 11, 2022: HMC responds to 3rd RAI (ML22071A000).
11. June 10, 2022: NRC staff issues "clarification request" (ML22137A097) on HMC response to 3rd RAI (a 5th round of technical review comments).
12. August 9, 2022: HMC responds to NRC staff clarification request (5th round of technical comments).

Thank you for your time and attention on this matter. If you have any questions, please contact me via e-mail at bbingham@homestakeminingcoca.com or via phone at 505.290.8019.

Respectfully,

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Submittal Contents:

- HMC Responses to 06/10/2022 Clarification Requests (ML22137A097) from NRC Staff

HMC Response to NRC Staff Clarification Requests for HMC's License Amendment Request to Change the Background Radon/Gamma Monitoring Location

Clarification Request # 1 - HMC Response to RAI-1

NRC Staff Comments:

1) *Discuss any differences in the disturbed areas shown in Figure 3-2 of the Completion Report and Figure 7 of the December 2020 submittal.*

2) *Provide an analysis and discussion on potential impacts from the remediated areas in and around the site on the ambient radon concentrations at HMC-4 and HMC-5.*

3) *Discuss the potential impacts from the remediated areas in and around the site on the selection of a representative radon background monitoring location. Specifically, considering the unique spatial distribution of reduced radon emissions in and around the site impacting HMC-4 and HMC-5, discuss why, for example, background locations outside the alluvial plain described by HMC shouldn't be considered.*

HMC Response:

1) The areas disturbed by cleanup of windblown contamination as depicted in the 1995 Completion Report (ERG, 1995) represent anthropogenic disturbance to soils around the facility at the time of major soil cleanup activities (circa 1995). The areas of soil disturbance depicted in HMC's December 2020 LAR submittal (Figure 7) represent the original areas of soil disturbance plus additional areas that have been disturbed since 1995, for example due to the construction of Evaporation Pond 3 and ongoing site reclamation and decommissioning activities, including areas where volcanic rock mulch materials have been borrowed and/or stockpiled.

2) NUREG-1620 describes background as levels representative of "…*undisturbed areas that are not affected by site activities and are geologically and chemically similar to the contaminated areas*", and concentrations "...*that would be expected at a site if contamination had not occurred from the uranium milling operation*" (USNRC, 2003). EPA describes background as "…*constituents or locations that are not influenced by the releases from a site, and is usually described as naturally occurring or anthropogenic*" (US EPA, 1989; US EPA 1995). The Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) describes background as "…*an area that has similar physical, chemical, radiological, and biological characteristics as the survey unit(s) being investigated but has not been contaminated by site activities (i.e., non-impacted)*" (USNRC, 2000).

   Because large-scale excavation of historically contaminated soils and ongoing site reclamation and decommissioning activities have impacted the naturally occurring radiological background environment that existed prior to construction and operation of this milling facility, these disturbed areas do not meet any of the above definitions of background. Note that impacts can involve either increases or decreases in radionuclide concentrations relative to pre-existing natural background conditions, including impacts associated with local excavation and use of unimpacted borrow materials for site reclamation purposes.

   While large-scale cleanup of windblown soil contamination as documented in the 1995 Completion Report (ERG, 1995) may influence current radiological conditions at air monitoring stations HMC-4

and HMC-5, other environmental factors are also involved. For example, adjacent offsite areas to the south and west of these air monitoring stations are not impacted by historic milling operations, yet have naturally occurring, slightly elevated gamma radiation and Ra-226 soil concentrations, similar to alluvial soils across most of the San Mateo Creek (SMC) wash, including areas near proposed background radon monitoring stations HMC-1OFF and HMC-6OFF. These adjacent offsite areas represent a local source of ubiquitous background radon emissions, and based on CALPUFF modeling results, annualized "plumes" of radon migration extend to some extent in more than just a "downwind" or "downgradient" direction from emission source areas (due to temporal variability in wind fields). In addition, onsite areas in the immediate vicinity of these "point of compliance" monitoring stations are slightly radiologically impacted by milling operations as they were not included in areas excavated as part of the 1995 off-pile soil cleanup. Associated radon emissions appear responsible for consistently elevated radon levels at stations HMC-4 and HMC-5, where elevated concentrations likely mask underlying background levels at these locations.

In effect, there are many environmental factors that influence average radon concentrations at monitoring stations HMC-4 and HMC-5, and as previously stated by HMC, there is no perfectly representative background location that precisely matches all environmental influences on background radon levels at these point of compliance monitoring stations. Related uncertainties can be minimized but not eliminated, and the guidance in NRC's Radon ISG (USNRC, 2019) does not indicate that all uncertainties in the representativeness of the background radon station must be eliminated to be acceptable to NRC staff. HMC has identified background locations (HMC-1OFF and HMC-6OFF) that meet the basic representativeness criteria specified in NRC's Radon ISG (USNRC, 2019).

Finally, CALPUFF modeling accounts for multiple factors that influence atmospheric radon migration on an annualized basis, and this modeling predicts that ubiquitous radon emissions across the SMC wash and pooling of radon from near-field upland areas will result in nearly identical average annual background radon concentrations at the point of compliance stations (HMC-4 and HMC-5) and the proposed new background radon monitoring locations (HMC-1OFF and HMC-6OFF). This finding represents a line evidence that monitoring stations HMC-1OFF and HMC-6OFF are representative of background radon concentrations at monitoring stations HMC-4 and HMC-5. In addition, regression analysis of modeled and measured radon emission signal strength with distance from the large tailings pile (LTP) provides a statistical estimate of the expected average background radon concentration at the point of compliance monitoring stations (HMC-4 and HMC-5). The result of this analysis represents an additional line evidence that monitoring stations HMC-1OFF and HMC-6OFF are representative of background radon concentrations at monitoring stations HMC-4 and HMC-5.

3) See response to part (2) above. While past cleanup of windblown soil contamination may have slightly lowered average local radon concentrations near air monitoring stations HMC-4 and HMC-5, this is not an appropriate rationale for intentionally choosing to locate the background radon monitoring station in an upland area beyond the floor of the SMC valley (beyond the SMC "wash" as depicted in HMC's December 2020 LAR). Such rationale would be self-defeating as it would repeat the same lack of representativeness of pre-operational background behind HMC's request to move the current background radon station (HMC-16) in the first place. Placing a background station on the slopes above the wash floor would be inconsistent with the representativeness criteria specified in NRC's Radon ISG (USNRC, 2019) as the topography, geomorphology, and in some cases geology, in upland areas differs from conditions on the wash where the point of compliance monitoring stations HMC-4 and HMC-5 are located. Although ambient radon

concentrations in previously impacted areas have been reduced due to large-scale soil remediation and excavation of borrow materials, associated reductions in local "background" radon emissions are still an impact from site operations, and do not represent the average background radon concentration that existed prior to construction and operation of uranium milling facilities on the floor of the lower SMC valley.

REFERENCES

US EPA. 1989. Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A). EPA/540/1-89/002

US EPA. 1995a. Determination of Background Concentrations of Inorganics in Soils and Sediments at Hazardous Waste Sites. EPA/540/S-96/500.

U.S. Nuclear Regulatory Commission (USNRC). 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. NUREG 1620, Rev. 1.

U.S. Nuclear Regulatory Commission (USNRC). 2019. Evaluations of uranium recovery facility surveys of radon and radon progeny in air and demonstrations of compliance with 10 CFR 20.1301. Final Report. June 2019.

Clarification Request #2 - HMC Response to RAI-2

Elevation

NRC Staff Comments:

1) *Evaluate the elevations for all the monitoring stations and determine the correct elevations.*

2) *Revise, if needed, any CALPUFF model runs, text, tables, and figures, based on any elevation changes associated with this evaluation.*

3) *Provide a response to the NRC staff's RAI using the locations as noted in the RAI.*

HMC Response:

1) NRC staff has clarified that the monitoring stations used for its comparison of elevation differences between monitoring stations in RAI-2 does not precisely match the monitoring stations used by HMC for a similar comparison in HMC's response to RAI-2. The comparison in HMC's response to RAI-2 was in part based on the staff's stated determination in RAI-2 that "*For all practical purposes, HMC-1OFF and HMC-6OFF have essentially the same attributes when reviewed in accordance with this guidance and the NRC staff has not found any significant distinctions between these two proposed locations.*"

   The elevations in Table 4 of the Rood report represent values determined with the TERREL terrain preprocessor that is part of the CALPUFF modeling software. TERREL takes as input digital elevation model (DEM) data and averages the terrain data for the model grid resolution. In this case, the resolution of the DEM was 30 m and the CALPUFF model simulation used a grid resolution of 300 m. What is important is that the grid resolution in the model is sufficient to resolve terrain features in the model domain. The fact that the HMC tailings pile was resolved in the terrain model demonstrates that the 300 m resolution was adequate for this application. The elevations

determined from the 300 m terrain-averaged model will not match those determined from Google Earth. Actual elevations are more closely approximated by the data shown in HMC's response to RAI-2 (Figure 2).

2) For the reasons indicated in response (1) above and (3) below, there is no reason to perform additional CALPUFF modeling based on revised elevation parameter estimates, nor a need to revise related text, tables or figures in HMC's response to RAI-2.

3) As clarified by NRC staff for RAI-2 in this Clarification Request, the staff used grid-averaged model elevations as shown in Table 4 of the Rood report for comparison of elevation differences between HMC-16 and HMC-6OFF (calculated as 75 feet), and between station HMC-6OFF and HMC-4 (also calculated as 75 feet). The staff suggested that elevation differences alone call into question HMC's conclusion that stations HMC-1OFF and HMC-6OFF are representative of background conditions at stations HMC-4 and HMC-5. However, as indicated in HMC's response to RAI-2, use of elevation alone as a criterion for predicting or explaining average ambient background radon levels at any given location does not account for topographical and geomorphic influences on atmospheric radon migration, nor does it account for the spatial distribution of ubiquitous sources of terrestrial background radon emissions that also influence average ambient radon concentrations at any given location. The staff's suggestion of elevation alone as a criterion for representativeness would incorrectly imply that only background locations with elevations identical to that of the point of compliance location(s) can be considered representative. Based on both measurements and modeling of background radon conditions across the lower SMC basin, this is clearly not the case.

<u>Proximity to upland slopes</u>

NRC Staff Comments:

1) Discuss why using a background monitoring location that could be impacted by remediated areas of the site, but not impacted from licensed material, is not acceptable if the radon concentrations at HMC-4 and HMC-5 are impacted by the same remediated areas.

<u>HMC Response:</u>

1) All areas that have undergone soil remediation were impacted by licensed material. If this comment is referring to excavation of borrow materials, that is not a soil remediation measure though most of the borrow areas shown in the 1995 Off-Pile Soil Cleanup Report (ERG, 1995) are located in areas that were once impacted to some degree at the surface by windblown licensed material. These areas were scraped as needed to remove surficial soil contamination, followed by excavation and use of underlying unimpacted borrow soils. There were concentration-based criteria for acceptance of borrow material for use in capping the impoundments, former milling facility areas, and burial pits for demolition debris. Borrow material that exceeded these criteria was placed in the impoundment as contaminated 11e.(2) byproduct waste materials or was used as interim cover over the tailings.

Although ambient radon concentrations in previously impacted areas have been reduced due to large-scale soil remediation and excavation of borrow materials, associated reductions in local "background" radon emissions are still an impact from site operations and do not represent the average background radon concentration that existed prior to construction and operation of this uranium milling facility on the floor of the lower SMC valley. HMC is unaware of any regulation or guidance that would require a licensee to modify the location of an established background radon

monitoring station due to reductions in ambient background levels from soil cleanup and site reclamation activities.

HMC is requesting a change in the existing background radon monitoring location (HMC-16) because this location was inappropriately established to begin with, consistently underrepresenting naturally occurring radon levels on the floor of the valley in which the facility is located. Based on both modeling and measurements, HMC-16 grossly underrepresents background radon levels at the point of compliance monitoring locations (HMC-4 and HMC-5), leading to a systemic high bias in public dose estimates that places the licensee at ongoing risk of exceeding the public dose limits due to a non-representative background location, and use of highly conservative assumptions and methods of calculation as described in the NRC's Radon ISG (USNRC, 2019).

Again, radiological "impacts" can include increases or decreases in radionuclide concentrations relative to pre-operational background conditions. Under applicable NRC regulation (10 CFR 40, Appendix A, Criterion 7) and guidance (USNRC, 1980 and 2019), reductions in background radon levels due to soil remediation or reclamation do not require modification of the operational background radon monitoring location to achieve a corresponding reduction in average background radon levels for public dose estimation purposes. However, a background station that was never representative of pre-operational background levels at the facility to begin with does warrant a change in location, and in this case, HMC-1OFF and HMC-6OFF have been demonstrated to be representative of natural background levels at the HMC Site boundary with multiple lines of evidence, including both measurements and modeling. See also the responses to Clarification Request numbers 1(2) and 1(3) above for closely related discussions.

REFERENCES

U.S. Nuclear Regulatory Commission (USNRC). 1980. Radiological Effluent and Environmental Monitoring at Uranium Mills. NRC Regulatory Guide 4.14, Revision 1. April 25, 1980.

U.S. Nuclear Regulatory Commission (USNRC). 2019. Evaluations of uranium recovery facility surveys of radon and radon progeny in air and demonstrations of compliance with 10 CFR 20.1301. Final Report. June 2019.

<u>Clarification Request #3 – HMC Response to RAI-5</u>

NRC Staff Comments:

1) *Revised Figure 17 in Attachment A2 of the March 11, 2022, submittal depicts a correlation analysis of predicted vs. measured radon concentrations using the 2020 dataset for the measured values. The 2020 dataset was measured under meteorological conditions unique to that year.*

    a. *Identify the year, or years, of meteorological data used in deriving the predicted radon concentrations.*

    b. *If the predicted radon concentrations were calculated with a year(s) other than 2020, please justify the use of the unrelated year(s) in the correlation.*

    c. *Revise Figure 17 as necessary based the response to this clarification.*

2) *The statements and data presented by the licensee appear to indicate that only four of the data points used in deriving the correlation in Figure 17 were expected to be impacted by the tailings piles. Therefore, the correlation is overwhelmed with, according to HMC, variabilities in background values.*

This is not consistent with the approach taken in the Droppo and Glissmeyer study (1981) referenced by HMC which included only a few expected background values to place an upper end on the background.

- *a. Evaluate and address the apparent inconsistencies between HMC's response to RAI-5 discussed above and the remainder of the application.*
- *b. Revise Figure 17 as necessary based the response to this clarification.*
- *c. Please provide an analysis of the 2020 Q2 values omitted from averaging to justify not using them.*

HMC Response:

1(a) The predicted concentrations used in the correlation were based on 2017-2019 meteorological data. These data were shown to be representative of long-term meteorological conditions at HMC (see response to request 7)

1(b) The IML report and analysis of site-specific data demonstrate that meteorological conditions are repeatable from year-to-year. The year-to-year repeatability of meteorological conditions is recognized by EPA, and for air quality assessments, the agency requires only one or more years of site -specific data for prospective assessments of air quality impacts (Section 8.4.2(e) 40 CFR 51). Figure 11 in the Rood Report demonstrates that the annal average predicted concentrations at the radon samplers are consistent from year-to-year. The ratio of any year's predicted annual average concentration at a sampler to the 3-year average ranges from 0.87 to 1.16. This variability is less than the uncertainty in the radon measurements. Moreover, the three-year dataset was shown to be representative of long-term conditions at HMC using the NRC recommended methods (see response to Request 7). The 2020 onsite data only had a 92% data recovery compared to ~99% of the 3-year dataset. While this rate of data recovery is acceptable in Reg Guide 3.63, its use in CALPUFF would not be optimal because CALPUFF requires data from at least one station for the entire simulation period. Thus, during the data gap (June 28 to July 23), the model would rely on the airport data from Grants. While it is acceptable to use only the Grants data for a few hours here and there, we think a better result is obtained using the three-year composite dataset. Thus, the use of the 3-year average predicted concentration based on 2017-2019 meteorological data to compare with 2020 measured concentrations is valid.

1(c) No changes to Figure 17 are necessary.

2(a) Contrary to the staff's assertion, HMC statements in response to RAI-5 regarding the regression technique are consistent with previous statements in the December 18, 2020 LAR submittal. Although the signal strength of radon emissions from the LTP is within the background variability at locations beyond about 600 meters from the LTP, this does not invalidate the results of the regression analysis shown in Figure 17 of Attachment A2 to the December 18, 2020 LAR submittal. The slope, intercept, and coefficient of determination (R^2) for this regression are each influenced to some extent by the fact that signal strength is weak and masked by relatively high background variability at the low end of the measurements (beyond about 600 meters from the LTP). While the significant R^2 value is admittedly governed largely by four values with emission signal strengths that exceed the variability in background, these four values clearly represent a linear average relationship, and it is reasonable (and likely conservative) to assume that this average relationship continues at the low end of the collected data, despite signal interference

from background noise resulting in greater variance of residuals at the low-end “background” portion of the regression.

2(b) HMC concludes that this clarification request does not warrant revision of Figure 17 as provided in Attachment A2 to the December 18, 2020 revised LAR submittal.

2(c) As stated in the footnote to the table of 2020 quarterly radon monitoring values provided to NRC staff for review (ERG, 2021), the reason for omission of one of the two paired detector results at stations HMC-1 and HMC-5 in Q2 2020 from station averages was based on inconsistency with the paired duplicate detector result (for the same monitoring location) and comparisons with historical averages at these locations. Note that applicable historical averages involve only monitoring conducted since the introduction of Rapidos detectors in Q3 2016. Specifically, the magnitude of disagreement between paired duplicates was the primary reason for omission of the high values from averaging because paired duplicate values for other stations showed close agreement with one another. For the two stations in question, the lower of the two Q2 values was retained as it was more consistent with historical averages since Q3 2016. Had HMC included the suspect data in the averaging, the impact on the results of the regression analysis shown in Figure 17 of Attachment A2 to the December 18, 2020 LAR submittal would have been negligible (increasing the statistical estimate of the average background concentration from 0.696 pCi/L to 0.702 pCi/L). There is no justification for revision of Figure 17 based on this issue as it is of negligible consequence.

REFERENCES

Environmental Restoration Group (ERG). 2021. E-mail from R. Whicker, ERG, to R. Linton, U.S. NRC, dated March 31, 2021, Requested Supplemental Information - LAR to Change Background Monitoring Location for Radon and Ambient Gamma Radiation (ML20356A287), ADAMS Accession No. ML21092A009.

<u>Clarification Request #4 – HMC Response to RAI-11d</u>

NRC Staff Comments:

1) *Explain why the following were not excluded from this CALPUFF modeling analysis: all onsite node points located on or directly adjacent to (because of the 600-meter node spacing) the large and small tailings piles, evaporation ponds, collection ponds, and any other features not associated with unaffected, naturally occurring radon emissions from the San Mateo Wash.*

2) *Explain and justify, as being representative of actual background conditions, the emission rates assigned to any of the other onsite and offsite node points that have been affected by various remediation or other activities, and revise accordingly based on new modeling, as needed.*

3) *Revise, as needed, Figures 14, 15, and 16, and any other affected text, tables or figures consistent with the intent of RAI-11d to determine one or more monitoring stations representative of background conditions at HMC-4 and HMC-5.*

<u>HMC Response:</u>

1) The NRC staff’s understanding of the modeling used to produce Figure 15 and 16 is not correct. The purpose of this modeling was to understand the spatial distribution of background radon in the San Mateo Wash. That is, what would background look like had the HMC facility never been built?

Ideally this is what would be captured in a preoperational survey but we cannot go back in time to recreate those conditions. Thus, the model simulation does not include any anthropogenic sources such as the tailings piles or evaporation ponds, or any cleanup of windblown tailings. The purpose of these simulations was to help understand the spatial distribution of background radon in the San Mateo Wash in the absence of the HMC facility. For the ubiquitous radon sources two scenarios were run: 1) a constant radon source of 1 pCi/m^2-s at all grid points and 2) a case where radon flux in the San Mateo wash is elevated (1.5 pCi/m^2-s) relative to radon flux on the surrounding hillsides. In each case, the annual average concentration was calculated and therefore these simulations represent the annual average radon concentration over all conditions that would occur during the year. The second case is based on the fact that before the HMC facility was ever built, Ra-226 concentrations in the San Mateo Wash were elevated relative to the surrounding hillsides. The evidence for this is the gamma survey data that shows in undisturbed areas the gamma exposure rate is elevated relative to the gamma exposure on the hill sides. Both simulations have the same conclusions which were: 1) background radon pools at the bottom of the San Mateo wash resulting in higher background concentrations in the bottom of the wash compared to elevated points outside the wash (more so for the case involving enhanced radon flux) and 2) background radon concentrations at HMC-4 and HMC-5 are about the same as background radon concentrations at HMC-1OFF and HMC-6OFF.

2) As stated above, no anthropogenic sources of radon were included in the simulation. The only purpose of this simulation was to examine the spatial distribution of background radon without the influence of any facility emissions in the conditions prior to construction and operation of the HMC facility. As stated above, the conclusions based on this modeling was 1) background radon pools at the bottom of the San Mateo wash resulting in higher background concentrations in the bottom of the wash compared to elevated points outside the wash, and 2) predicted background radon concentrations at HMC-4 and HMC-5 are about the same as predicted background radon concentrations at HMC-1OFF and HMC-6OFF.

3) HMC concludes that this clarification request does not warrant revision of Figure 15 or 16 as provided in Attachment A2 to the December 18, 2020 revised LAR submittal.

Clarification Request #5–HMC Response to RAI-11d

NRC Staff Comments:

1) *Explain the rationale for the differing PORs of meteorological data used in various CALPUFF dispersion modeling analyses included in both the December 18, 2020, LAR submittal and as revised in the March 11, 2022, addendum.*

HMC Response:

1) The POR for the evaluation of the spatial distribution of background radon was restricted to 1-year of data because of excessive simulation time as stated on page 25 of the Rood Report. For evaluation of radon from the tailings pile, a 3-year dataset was used as stated on page 21 of the Rood report. For the radon from ubiquitous sources) or contour plots showing spatial distribution of various sources, 1-year of data was acceptable because the purpose was to simply understand the spatial distribution. Whereas for the regression, P/O, and other quantitative analysis, the three-year dataset was used. As shown by the comparison of predicted concentration from tailings pile emissions at all the monitoring locations (Figure 11 in the Rood Report) concentrations do not substantially vary from year-to-year and show the same spatial distribution from sampler to

sampler. Thus, using a different year or the three years of data may change the values slightly, but output would have the same spatial distribution and conclusions. Using 1 or 3 years of data would have no impact on the conclusions reached in this analysis.

Request #6 - RAI-4a not Addressed with Sufficient Detail

1) *Please provide a detailed analysis on the proposed change in location for measuring background gamma radiation and a rationale why the preferred location(s) are representative of the current monitoring stations HMC-4 and HMC-5.*

HMC Response:

1) NRC staff points out in the discussion for this clarification request that according to NRC Regulatory Guide (RG) 4.14 (USNRC, 1980), environmental gamma exposure or dose rates should be monitored at the locations chosen for air particulate samples. While this is true, it is inaccurate to suggest that this information contradicts the licensee's statement that co-location of gamma and radon monitors is customary and consistent with RG 4.14 specifications. Indeed, RG 4.14 specifies monitoring of both gamma radiation and radon gas at air particulate monitoring stations, and the licensee's statement about this issue is accurate as written.

   However, the staff's comment on this issue does bring up a deviation from this RG 4.14 protocol at the HMC site because the historical background monitoring location for both gamma radiation and radon gas (HMC-16) is not the same as the background monitoring location for air particulates (HMC-6). HMC notes that NRC staff has accepted this aspect of the licensee's environmental monitoring program design for decades. Moreover, it would be inappropriate for this site to establish the background station for radon gas at the background location for air particulates because the prevailing wind direction that is most important for radon gas emissions (nocturnal drainage flow with low windspeeds out of the northeast) differs from the prevailing wind direction of greatest importance to air particulate emissions (daytime flow out of the southwest with significantly higher windspeeds).

   In addition, it is appropriate to co-locate the gamma monitoring station with the radon monitoring station based on established spatial and statistical associations between average radon levels and gamma radiation, both of which are associated with concentrations of Ra-226 in soils. While a similar relationship may exist between ambient gamma radiation levels and air particulate emissions, this relationship has not been established for this site with actual data. Because ambient gamma radiation and radon gas are both fundamentally governed by a single radiological soil parameter (Ra-226 concentration), it makes technical sense to monitor these two parameters together as has been done (and accepted by NRC staff) for decades at this site.

   As noted by NRC staff, HMC's response to RAI-4a describes why HMC-16 is an inappropriate monitoring location for background gamma radiation as follows:

   - Location HMC-16 has different geology, soil type, and geomorphic setting versus locations on the floor of the SMC valley where both the proposed new background monitoring stations (HMC-1OFF and HMC-6OFF) and the point of compliance monitoring stations (HMC-4 and HMC-5) are situated.
   - The characteristic gamma radiation environment for the Chinle geology and hilly geomorphic terrain surrounding HMC-16 is clearly different from the gamma radiation environment

associated with alluvial deposits on the floor of the SMC wash in which both the proposed background monitoring stations and point of compliance stations are located.

With respect to the specific request for HMC to provide a rationale as to why the proposed background monitoring locations for gamma radiation (HMC-1OFF and HMC-6OFF) would be representative of the point of compliance monitoring locations (HMC-4 and HMC-5), an explanation was also provided in HMC's response to RAI-4a as follows:

- The geomorphic history of alluvial deposits along the floor of the SMC wash (*which includes the locations of the proposed background monitoring locations and point of compliance monitoring locations*) indicates that these alluvial deposits generally originated from fluvial erosion of sandstone mesas by SMC to the north of the GRP facility, including mineralized outcrops of the Jurassic age Morrison formation (Ullrich, 2019). While alluvial fan deposits from Lobo Canyon may have introduced some alluvial materials in the lower portions of the SMC wash near the point of compliance monitoring stations, it is evident from the gamma survey data (Figures 7 and 8 in HMC's Technical Report for the December 18, 2020 submittal) that the lower slopes of the Lobo Canyon alluvial fan also have elevated levels of gamma radiation associated with erosion of mineralized geology from surrounding mesas.

To summarize, the geologic, geomorphic, and meteorological environment on the floor of the SMC wash in the vicinity of monitoring stations HMC-1OFF and HMC-6OFF is very similar to the environs where the point of compliance monitoring stations (HMC-4 and HMC-5) are located. Gamma survey data suggest similar background radiation levels in the vicinity of each of these monitoring stations. HMC maintains that monitoring of background gamma radiation at locations HMC-1OFF and HMC-6OFF would be representative of naturally occurring pre-operational background gamma levels at the point of compliance locations. In addition, both gamma and radon monitoring stations should be co-located as both parameters are fundamentally influenced by Ra-226 levels in soil, and this monitoring design will maintain consistency with a design feature that has been used by HMC and accepted by NRC staff for decades.

REFERENCES

Ulrich, S.; Gillow, J.; Roberts, S.; Byer, G.; Sueker, J.; Farrise, K. 2019. Hydrogeochemical and mineralogical factors influencing uranium in background area groundwater wells: Grants, New Mexico. Journal of Hydrology: Regional Studies 26 (2019) 100636.

U.S. Nuclear Regulatory Commission (USNRC). 1980. Radiological Effluent and Environmental Monitoring at Uranium Mills. NRC Regulatory Guide 4.14, Revision 1. April 25, 1980.

<u>Request #7- RAI-7 not Addressed with Sufficient Detail</u>

1) *Please provide an analysis of the 2017-2019 wind data, demonstrating that it is representative of long-term conditions at the GRP site, as previously requested in RAI-7.*

2) *Please provide an analysis of stability class distributions, as indicated in RG 3.63 and the background information for RAI-7.*

<u>HMC Response:</u>

1) Per the guidance provided in NRC 2017 and 2018, meteorological data at HMC spanning a 5-year period (2016 to 2020) were compared to the data from 2017 to 2019 that were used in the

CALPUFF analysis. Stability class was calculated using the Sigma-Theta method (EPA 2000). Table 1 summarizes these data by year. These data meet the NRC requirement of 5-years of data with at least 3-years of consecutive annual cycles. The data collection recovery rate was greater than 90% for each year which meets the 90% criterion in Reg Guide 3.63 (NRC 1988).

Table 1. Data collection recovery rates for the 5-years of data from the HMC tower and percent calm hours. Calm hours were defined as windspeeds less than 0.5 m/s.

Year	2016	2017	2018	2019	2020
% Complete, wind speed	99.87	99.79	99.86	99.71	92.69
% Complete, wind direction	99.87	99.79	99.86	99.71	92.69
% Complete, Sigma-Theta	99.87	99.79	99.86	99.71	92.69
% Complete, temperature	99.87	99.79	99.91	99.71	99.98
% calms	1.14%	1.86%	2.05%	1.73%	2.48%

Wind roses for each year and composite wind roses for 2016-2020, and 2017-2019 are shown in Figures 1 through 7.

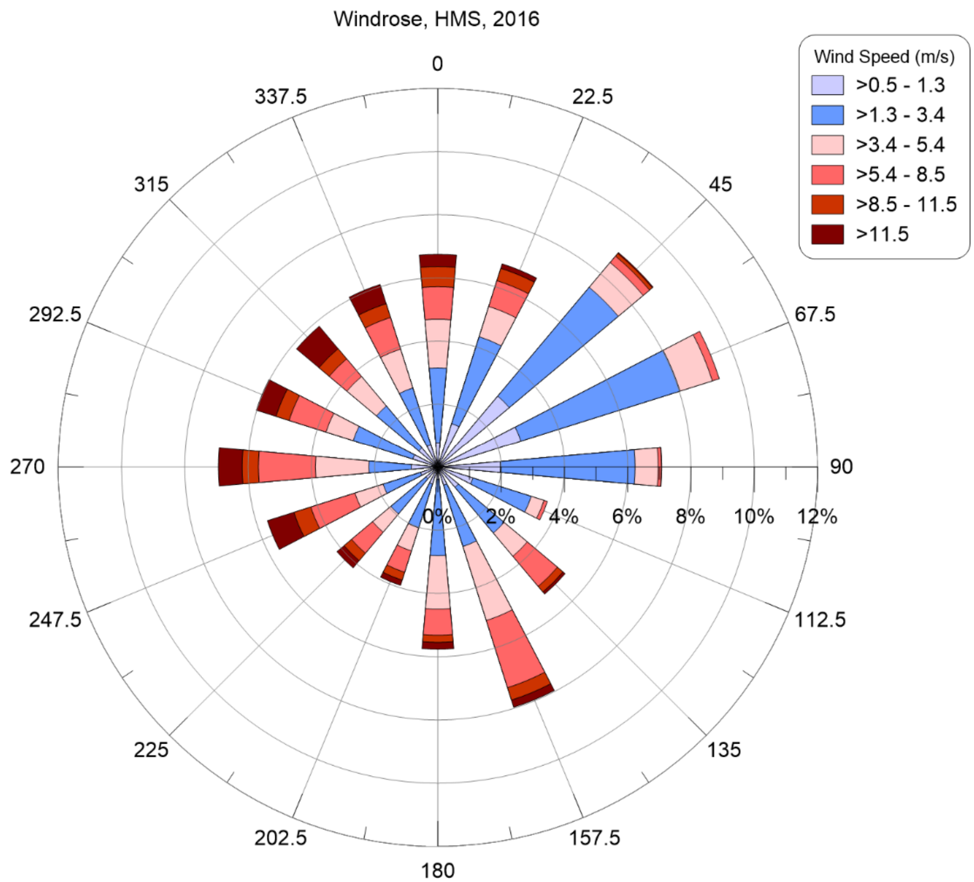


Figure 1. Wind rose for 2016 at the HMC meteorological tower.

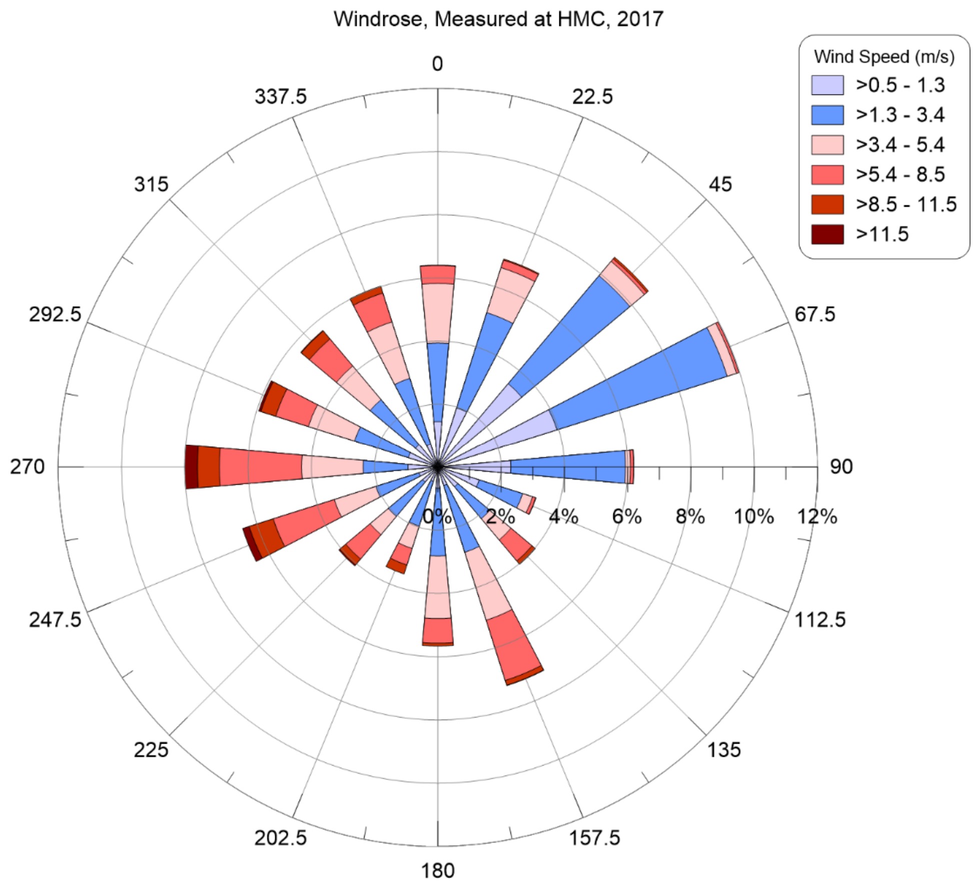


Figure 2. Wind rose for 2017 at the HMC meteorological tower.

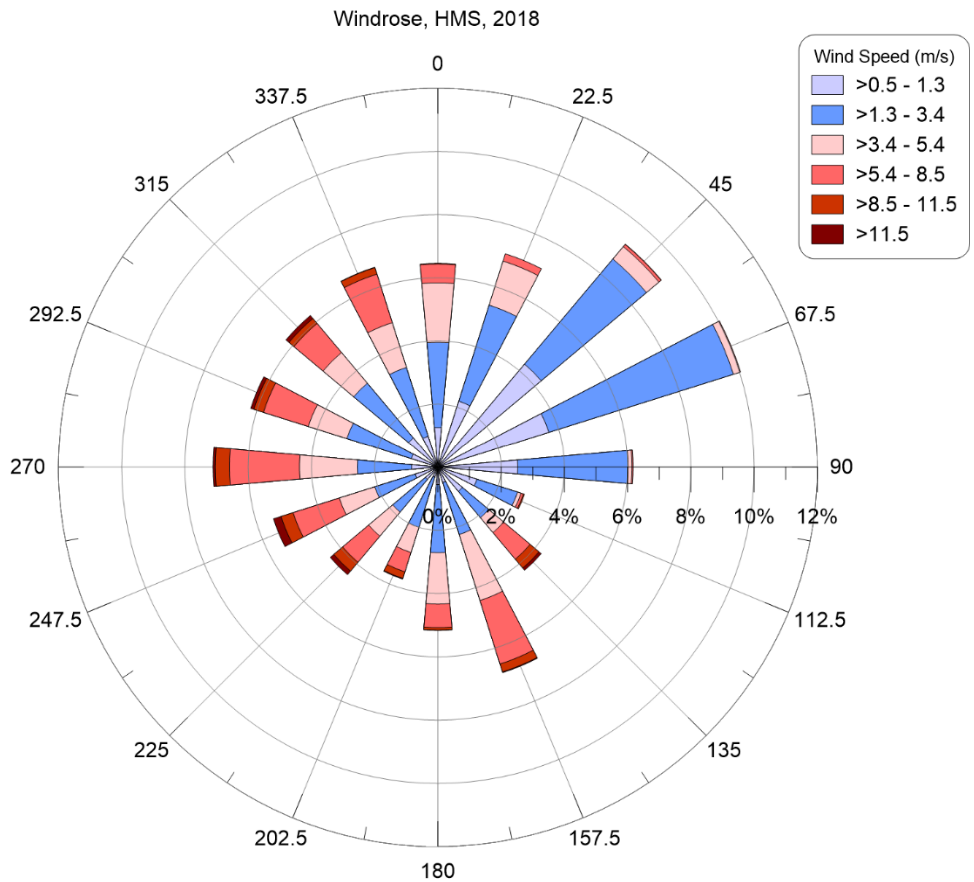


Figure 3. Wind rose for 2018 at the HMC meteorological tower.

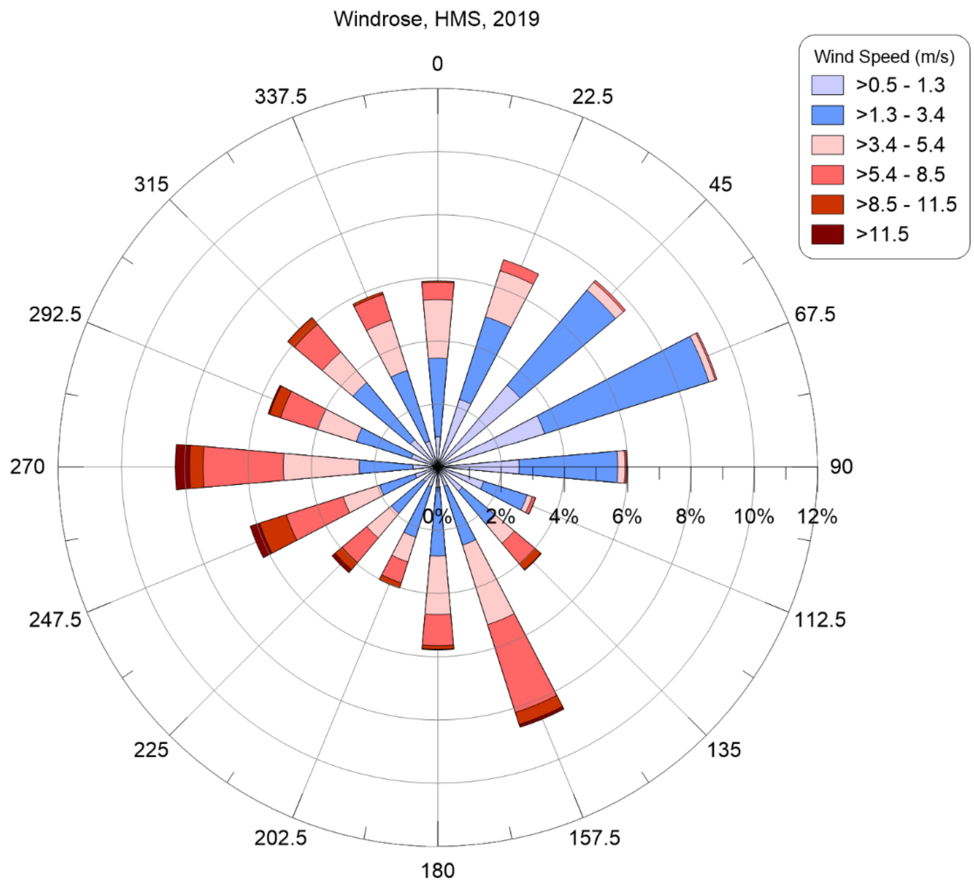


Figure 4. Wind rose for 2019 at the HMC meteorological tower.

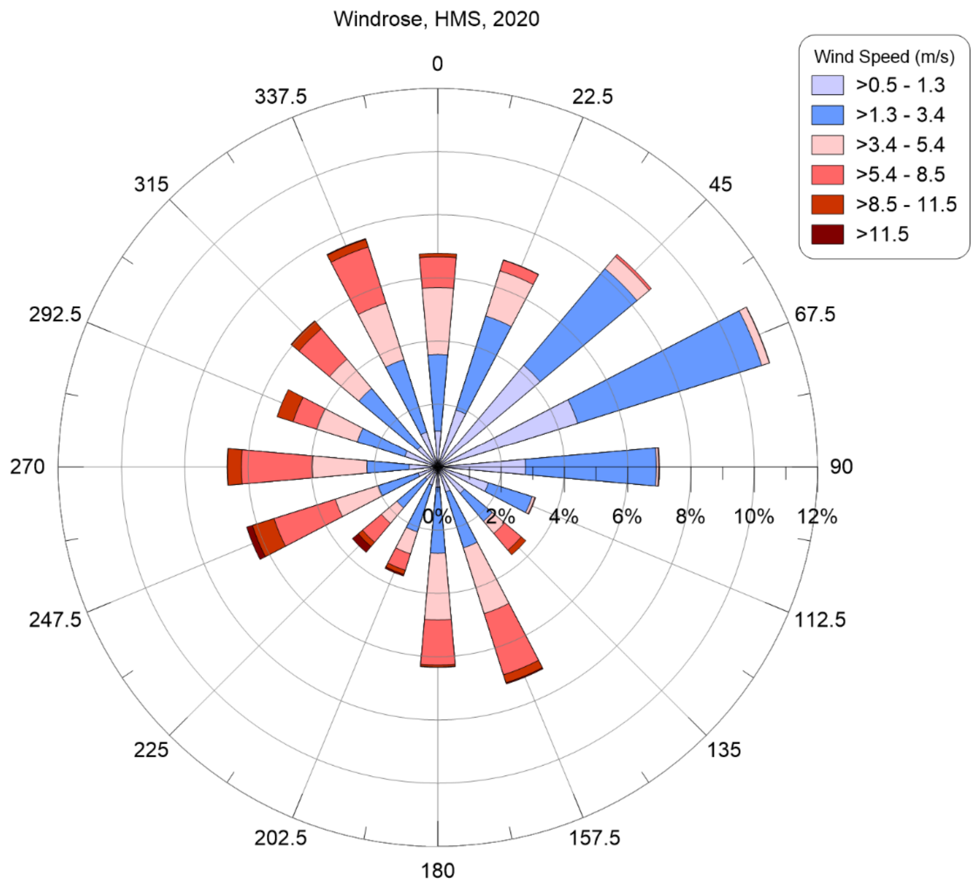


Figure 5. Wind rose for 2020 at the HMC meteorological tower.

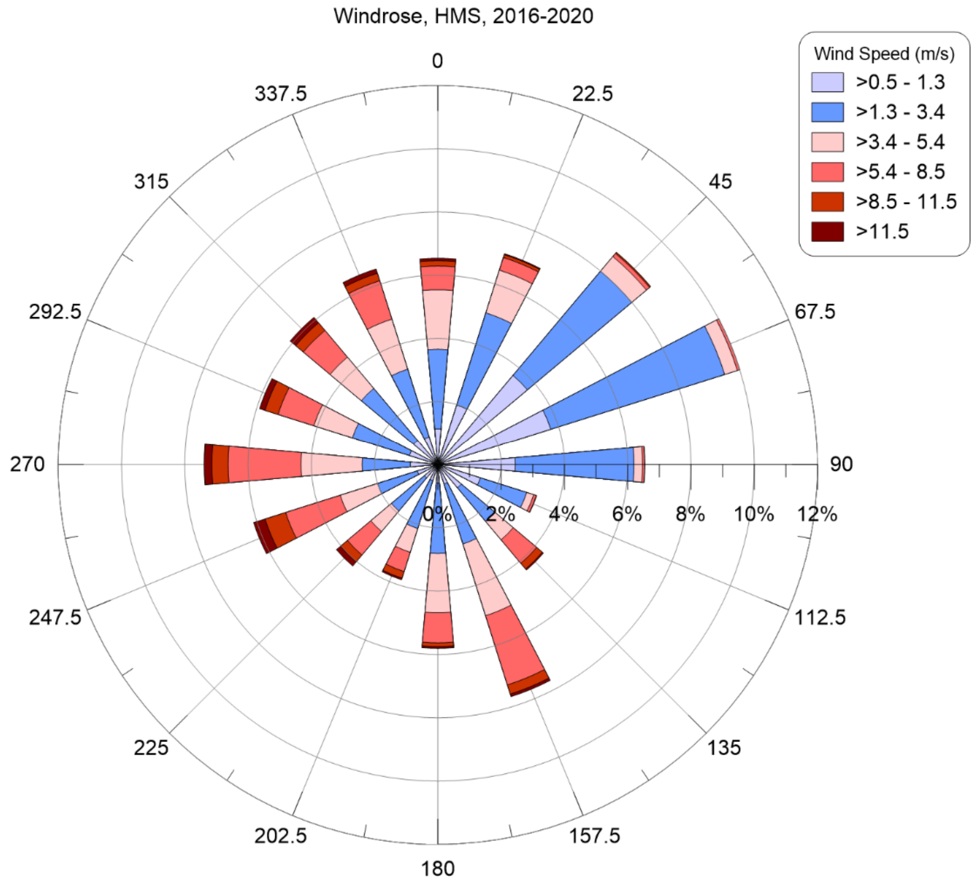


Figure 6. Wind rose for 2016-2020 at the HMC meteorological tower.

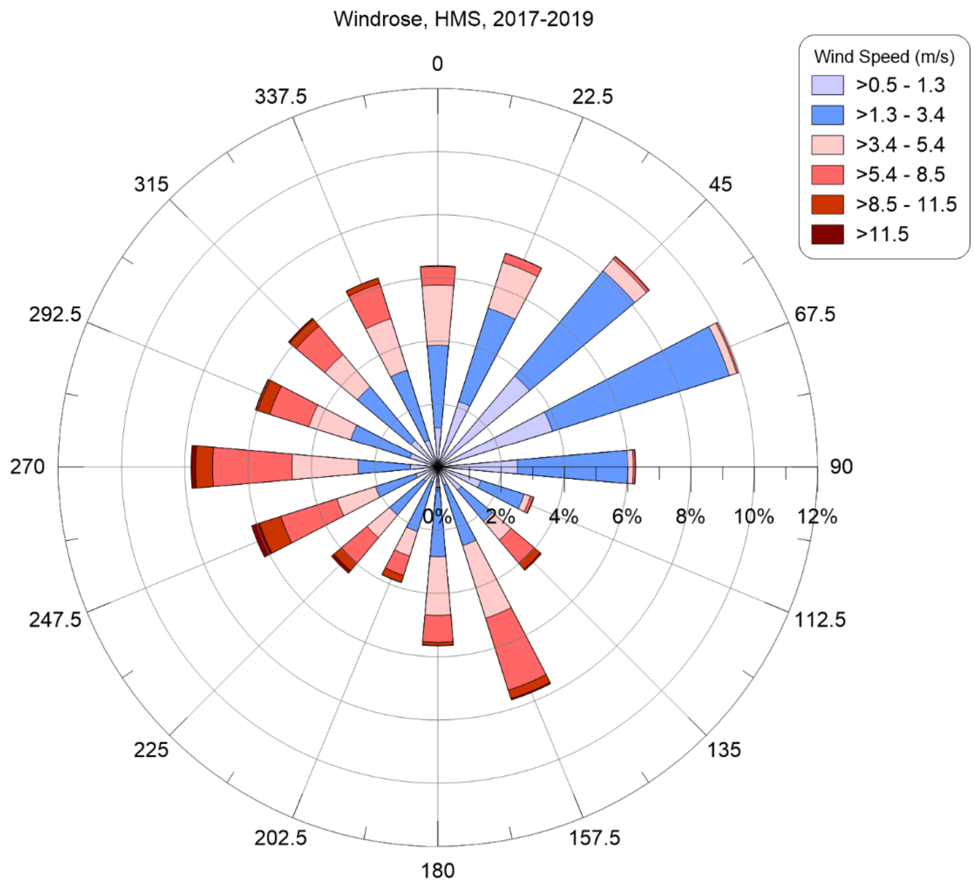


Figure 7. Wind rose for 2017-2019 at the HMC meteorological tower.

Frequency distributions of wind speed, wind direction, and stability class for the 2016-2020 data set and the 2017-2019 data set are shown in Figures 8 through 13. Frequency bar charts show that differences between the 5-year data set (2016-2020) and the three years used in the CALPUFF analysis were less than 5%. This degree of variability was considered acceptable by NRC staff for the Lost Creek ISR Project in Sweetwater County, Wyoming (NRC 2018).

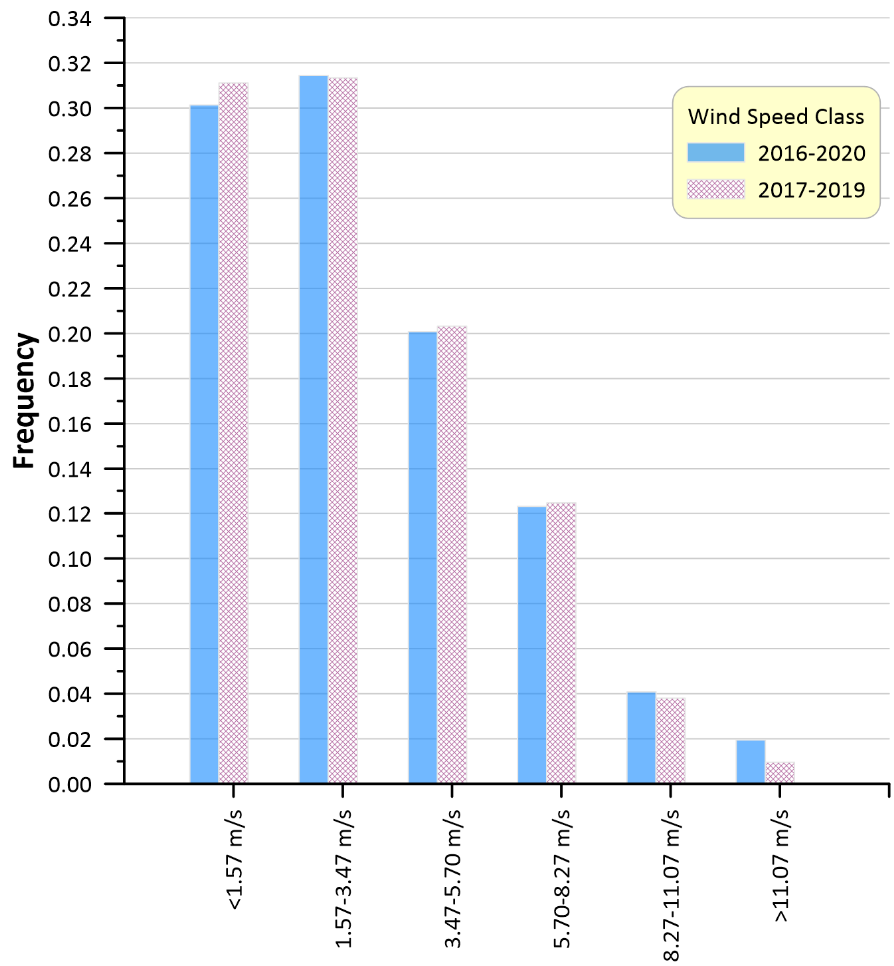


Figure 8. Frequency distribution of wind speed class.

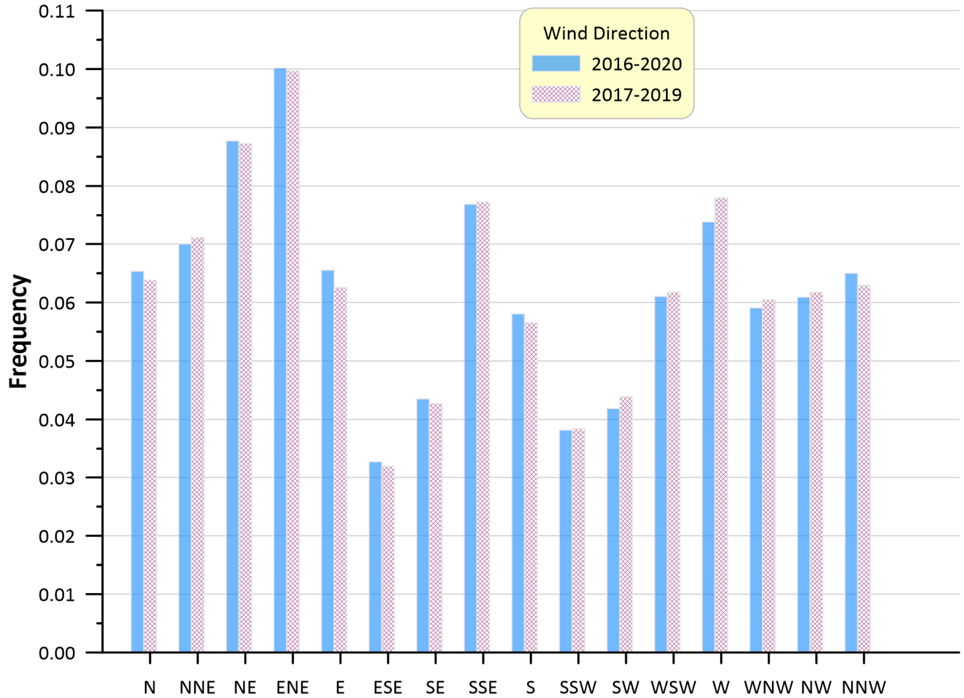


Figure 9. Frequency distribution of wind direction.

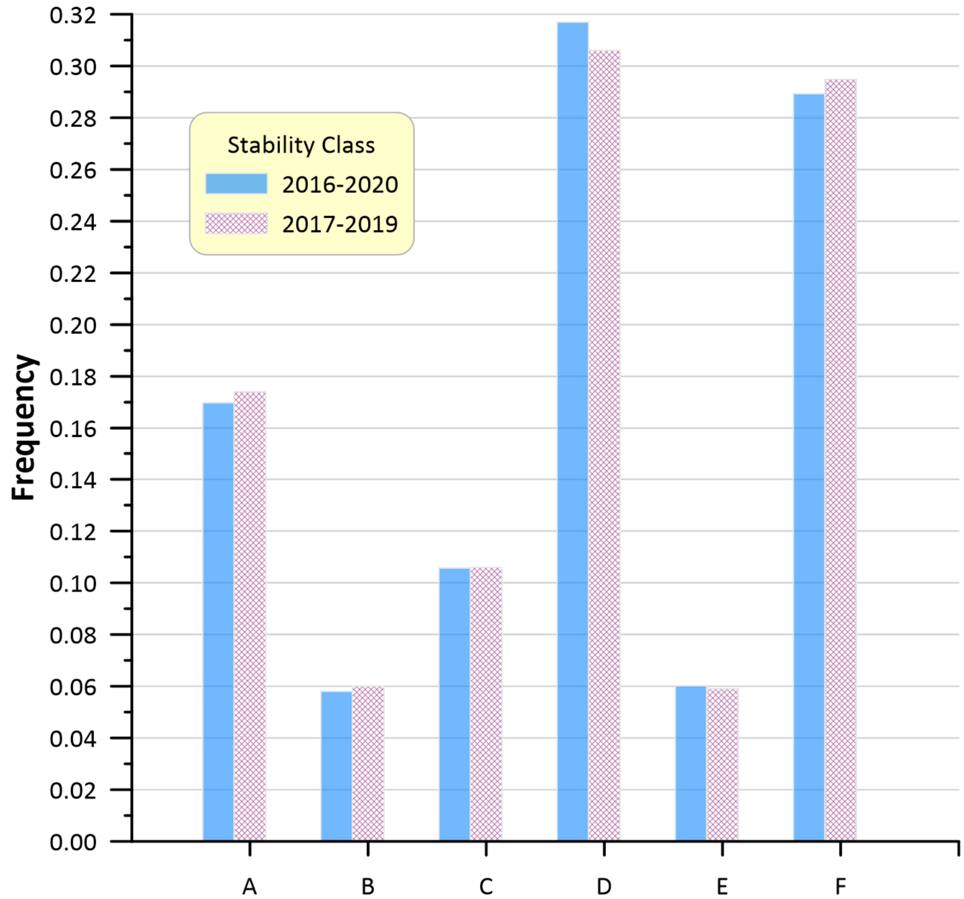


Figure 10. Frequency distribution of stability class.

The joint frequency distribution (JFD) for 2016-2020 and 2017-2019 is shown in Tables 2 and 3 respectively.

Table 2. Joint Frequency Distribution for the 2016-2020 data set.

Sector	Stability Class	WSC 1	WCS 2	WSC 3	WSC 4	WSC 5	WSC 6
N	A	0.00749	0.00793	0.00000	0.00000	0.00000	0.00000
NNE	A	0.01063	0.00633	0.00000	0.00000	0.00000	0.00000
NE	A	0.01625	0.00527	0.00000	0.00000	0.00000	0.00000
ENE	A	0.01261	0.00399	0.00000	0.00000	0.00000	0.00000
E	A	0.00853	0.00255	0.00000	0.00000	0.00000	0.00000

Sector	Stability Class	WSC 1	WCS 2	WSC 3	WSC 4	WSC 5	WSC 6
ESE	A	0.00508	0.00210	0.00000	0.00000	0.00000	0.00000
SE	A	0.00453	0.00316	0.00000	0.00000	0.00000	0.00000
SSE	A	0.00324	0.00571	0.00000	0.00000	0.00000	0.00000
S	A	0.00312	0.00472	0.00000	0.00000	0.00000	0.00000
SSW	A	0.00267	0.00342	0.00000	0.00000	0.00000	0.00000
SW	A	0.00281	0.00298	0.00000	0.00000	0.00000	0.00000
WSW	A	0.00368	0.00307	0.00000	0.00000	0.00000	0.00000
W	A	0.00489	0.00316	0.00000	0.00000	0.00000	0.00000
WNW	A	0.00489	0.00326	0.00000	0.00000	0.00000	0.00000
NW	A	0.00479	0.00458	0.00000	0.00000	0.00000	0.00000
NNW	A	0.00527	0.00708	0.00000	0.00000	0.00000	0.00000
N	B	0.00012	0.00371	0.00250	0.00000	0.00000	0.00000
NNE	B	0.00024	0.00234	0.00132	0.00000	0.00000	0.00000
NE	B	0.00125	0.00158	0.00057	0.00000	0.00000	0.00000
ENE	B	0.00231	0.00137	0.00026	0.00000	0.00000	0.00000
E	B	0.00135	0.00102	0.00026	0.00000	0.00000	0.00000
ESE	B	0.00038	0.00057	0.00045	0.00000	0.00000	0.00000
SE	B	0.00031	0.00118	0.00083	0.00000	0.00000	0.00000

Sector	Stability Class	WSC 1	WCS 2	WSC 3	WSC 4	WSC 5	WSC 6
SSE	B	0.00014	0.00279	0.00205	0.00000	0.00000	0.00000
S	B	0.00002	0.00307	0.00198	0.00000	0.00000	0.00000
SSW	B	0.00007	0.00135	0.00113	0.00000	0.00000	0.00000
SW	B	0.00024	0.00146	0.00092	0.00000	0.00000	0.00000
WSW	B	0.00026	0.00120	0.00116	0.00000	0.00000	0.00000
W	B	0.00021	0.00156	0.00196	0.00000	0.00000	0.00000
WNW	B	0.00045	0.00139	0.00163	0.00000	0.00000	0.00000
NW	B	0.00021	0.00203	0.00179	0.00000	0.00000	0.00000
NNW	B	0.00007	0.00246	0.00248	0.00000	0.00000	0.00000
N	C	0.00005	0.00061	0.00739	0.00092	0.00000	0.00000
NNE	C	0.00009	0.00137	0.00335	0.00043	0.00000	0.00000
NE	C	0.00054	0.00102	0.00137	0.00009	0.00000	0.00000
ENE	C	0.00128	0.00078	0.00061	0.00005	0.00000	0.00000
E	C	0.00085	0.00047	0.00066	0.00009	0.00000	0.00000
ESE	C	0.00012	0.00019	0.00094	0.00009	0.00000	0.00000
SE	C	0.00019	0.00028	0.00279	0.00033	0.00000	0.00000
SSE	C	0.00005	0.00057	0.01143	0.00151	0.00000	0.00000
S	C	0.00005	0.00130	0.00772	0.00047	0.00000	0.00000

Sector	Stability Class	WSC 1	WCS 2	WSC 3	WSC 4	WSC 5	WSC 6
SSW	C	0.00000	0.00045	0.00333	0.00050	0.00000	0.00000
SW	C	0.00007	0.00026	0.00404	0.00094	0.00000	0.00000
WSW	C	0.00009	0.00045	0.00699	0.00144	0.00000	0.00000
W	C	0.00005	0.00031	0.00987	0.00191	0.00000	0.00000
WNW	C	0.00012	0.00031	0.00597	0.00085	0.00000	0.00000
NW	C	0.00009	0.00047	0.00576	0.00097	0.00000	0.00000
NNW	C	0.00005	0.00052	0.00876	0.00109	0.00000	0.00000
N	D	0.00000	0.00236	0.00871	0.00517	0.00177	0.00106
NNE	D	0.00014	0.00413	0.00791	0.00295	0.00104	0.00033
NE	D	0.00064	0.00427	0.00347	0.00092	0.00033	0.00014
ENE	D	0.00177	0.00857	0.00262	0.00059	0.00002	0.00000
E	D	0.00092	0.00517	0.00142	0.00045	0.00012	0.00000
ESE	D	0.00028	0.00092	0.00087	0.00052	0.00017	0.00000
SE	D	0.00007	0.00130	0.00453	0.00739	0.00281	0.00054
SSE	D	0.00005	0.00357	0.01195	0.01731	0.00364	0.00099
S	D	0.00009	0.00347	0.00942	0.00706	0.00137	0.00066
SSW	D	0.00002	0.00208	0.00375	0.00468	0.00243	0.00059
SW	D	0.00014	0.00158	0.00418	0.00697	0.00305	0.00187

Sector	Stability Class	WSC 1	WCS 2	WSC 3	WSC 4	WSC 5	WSC 6
WSW	D	0.00009	0.00142	0.00567	0.01351	0.00723	0.00430
W	D	0.00014	0.00274	0.00836	0.01733	0.00574	0.00286
WNW	D	0.00021	0.00328	0.00555	0.00881	0.00482	0.00217
NW	D	0.00000	0.00368	0.00543	0.00831	0.00345	0.00246
NNW	D	0.00002	0.00248	0.00588	0.00945	0.00281	0.00149
N	E	0.00007	0.00217	0.00031	0.00000	0.00000	0.00000
NNE	E	0.00035	0.00288	0.00165	0.00000	0.00000	0.00000
NE	E	0.00213	0.00420	0.00050	0.00000	0.00000	0.00000
ENE	E	0.00350	0.00718	0.00045	0.00000	0.00000	0.00000
E	E	0.00196	0.00503	0.00017	0.00000	0.00000	0.00000
ESE	E	0.00073	0.00109	0.00007	0.00000	0.00000	0.00000
SE	E	0.00028	0.00137	0.00047	0.00000	0.00000	0.00000
SSE	E	0.00026	0.00194	0.00085	0.00000	0.00000	0.00000
S	E	0.00017	0.00260	0.00026	0.00000	0.00000	0.00000
SSW	E	0.00009	0.00179	0.00024	0.00000	0.00000	0.00000
SW	E	0.00005	0.00151	0.00031	0.00000	0.00000	0.00000
WSW	E	0.00021	0.00139	0.00045	0.00000	0.00000	0.00000
W	E	0.00014	0.00151	0.00123	0.00000	0.00000	0.00000

Sector	Stability Class	WSC 1	WCS 2	WSC 3	WSC 4	WSC 5	WSC 6
WNW	E	0.00031	0.00177	0.00059	0.00000	0.00000	0.00000
NW	E	0.00045	0.00241	0.00071	0.00000	0.00000	0.00000
NNW	E	0.00012	0.00170	0.00054	0.00000	0.00000	0.00000
N	F	0.00739	0.00560	0.00000	0.00000	0.00000	0.00000
NNE	F	0.01474	0.00779	0.00000	0.00000	0.00000	0.00000
NE	F	0.02905	0.01412	0.00000	0.00000	0.00000	0.00000
ENE	F	0.03164	0.02057	0.00000	0.00000	0.00000	0.00000
E	F	0.02243	0.01207	0.00000	0.00000	0.00000	0.00000
ESE	F	0.01237	0.00583	0.00000	0.00000	0.00000	0.00000
SE	F	0.00680	0.00437	0.00000	0.00000	0.00000	0.00000
SSE	F	0.00461	0.00423	0.00000	0.00000	0.00000	0.00000
S	F	0.00465	0.00586	0.00000	0.00000	0.00000	0.00000
SSW	F	0.00423	0.00536	0.00000	0.00000	0.00000	0.00000
SW	F	0.00399	0.00451	0.00000	0.00000	0.00000	0.00000
WSW	F	0.00482	0.00361	0.00000	0.00000	0.00000	0.00000
W	F	0.00564	0.00425	0.00000	0.00000	0.00000	0.00000
WNW	F	0.00730	0.00541	0.00000	0.00000	0.00000	0.00000
NW	F	0.00746	0.00586	0.00000	0.00000	0.00000	0.00000

Sector	Stability Class	WSC 1	WCS 2	WSC 3	WSC 4	WSC 5	WSC 6
NNW	F	0.00701	0.00571	0.00000	0.00000	0.00000	0.00000

Table 3. Joint Frequency Distribution for the 2017-2019 data set.

Sector	Stability Class	WSC 1	WCS 2	WSC 3	WSC 4	WSC 5	WSC 6
N	A	0.00801	0.00777	0.00000	0.00000	0.00000	0.00000
NNE	A	0.01170	0.00575	0.00000	0.00000	0.00000	0.00000
NE	A	0.01667	0.00462	0.00000	0.00000	0.00000	0.00000
ENE	A	0.01290	0.00385	0.00000	0.00000	0.00000	0.00000
E	A	0.00909	0.00260	0.00000	0.00000	0.00000	0.00000
ESE	A	0.00497	0.00190	0.00000	0.00000	0.00000	0.00000
SE	A	0.00455	0.00307	0.00000	0.00000	0.00000	0.00000
SSE	A	0.00350	0.00552	0.00000	0.00000	0.00000	0.00000
S	A	0.00350	0.00466	0.00000	0.00000	0.00000	0.00000
SSW	A	0.00260	0.00354	0.00000	0.00000	0.00000	0.00000
SW	A	0.00307	0.00315	0.00000	0.00000	0.00000	0.00000
WSW	A	0.00385	0.00326	0.00000	0.00000	0.00000	0.00000
W	A	0.00482	0.00365	0.00000	0.00000	0.00000	0.00000
WNW	A	0.00529	0.00326	0.00000	0.00000	0.00000	0.00000
NW	A	0.00544	0.00470	0.00000	0.00000	0.00000	0.00000

Sector	Stability Class	WSC 1	WCS 2	WSC 3	WSC 4	WSC 5	WSC 6
NNW	A	0.00560	0.00723	0.00000	0.00000	0.00000	0.00000
N	B	0.00012	0.00470	0.00284	0.00000	0.00000	0.00000
NNE	B	0.00019	0.00264	0.00148	0.00000	0.00000	0.00000
NE	B	0.00136	0.00148	0.00054	0.00000	0.00000	0.00000
ENE	B	0.00253	0.00101	0.00019	0.00000	0.00000	0.00000
E	B	0.00159	0.00082	0.00016	0.00000	0.00000	0.00000
ESE	B	0.00035	0.00051	0.00039	0.00000	0.00000	0.00000
SE	B	0.00035	0.00101	0.00093	0.00000	0.00000	0.00000
SSE	B	0.00023	0.00253	0.00194	0.00000	0.00000	0.00000
S	B	0.00000	0.00284	0.00194	0.00000	0.00000	0.00000
SSW	B	0.00000	0.00124	0.00117	0.00000	0.00000	0.00000
SW	B	0.00039	0.00159	0.00089	0.00000	0.00000	0.00000
WSW	B	0.00027	0.00117	0.00128	0.00000	0.00000	0.00000
W	B	0.00027	0.00163	0.00190	0.00000	0.00000	0.00000
WNW	B	0.00051	0.00159	0.00171	0.00000	0.00000	0.00000
NW	B	0.00035	0.00214	0.00167	0.00000	0.00000	0.00000
NNW	B	0.00008	0.00256	0.00299	0.00000	0.00000	0.00000
N	C	0.00000	0.00062	0.00715	0.00082	0.00000	0.00000

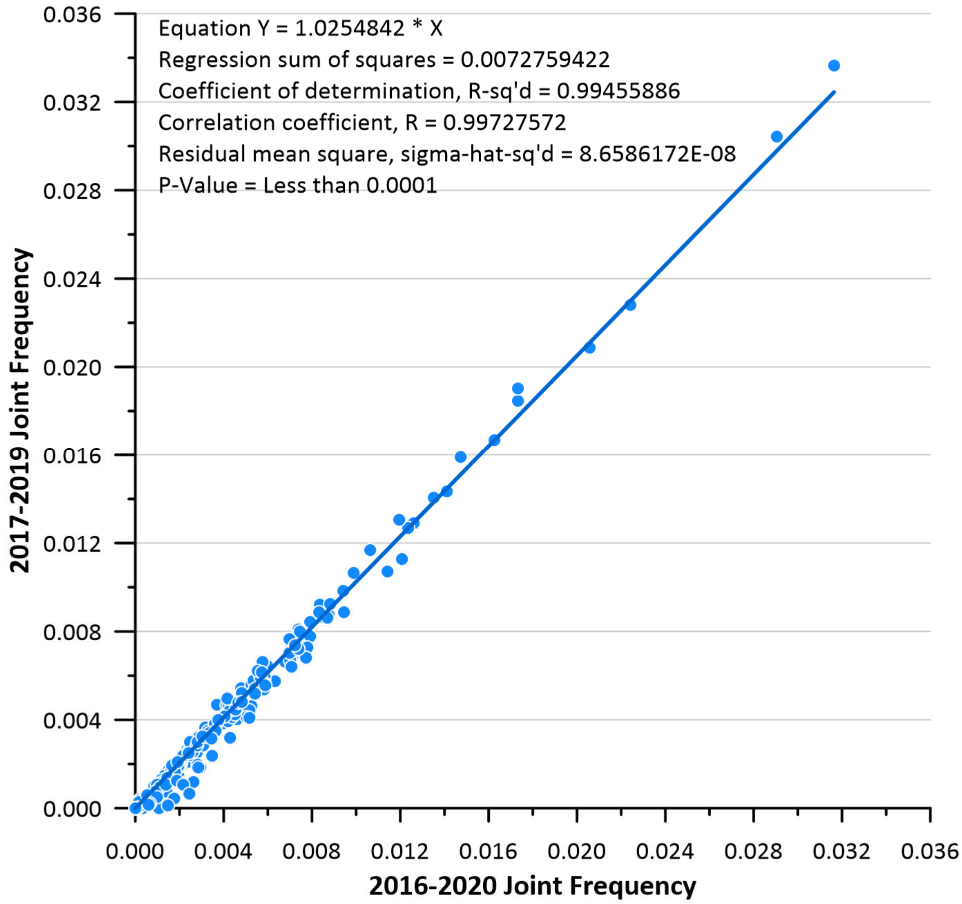
Sector	Stability Class	WSC 1	WCS 2	WSC 3	WSC 4	WSC 5	WSC 6
NNE	C	0.00004	0.00148	0.00342	0.00043	0.00000	0.00000
NE	C	0.00051	0.00105	0.00124	0.00008	0.00000	0.00000
ENE	C	0.00105	0.00066	0.00051	0.00004	0.00000	0.00000
E	C	0.00074	0.00035	0.00058	0.00012	0.00000	0.00000
ESE	C	0.00016	0.00019	0.00105	0.00012	0.00000	0.00000
SE	C	0.00023	0.00012	0.00284	0.00035	0.00000	0.00000
SSE	C	0.00008	0.00054	0.01073	0.00136	0.00000	0.00000
S	C	0.00004	0.00117	0.00680	0.00058	0.00000	0.00000
SSW	C	0.00000	0.00047	0.00323	0.00058	0.00000	0.00000
SW	C	0.00004	0.00035	0.00416	0.00109	0.00000	0.00000
WSW	C	0.00008	0.00054	0.00703	0.00136	0.00000	0.00000
W	C	0.00008	0.00039	0.01065	0.00210	0.00000	0.00000
WNW	C	0.00016	0.00039	0.00645	0.00101	0.00000	0.00000
NW	C	0.00016	0.00054	0.00661	0.00105	0.00000	0.00000
NNW	C	0.00004	0.00047	0.00874	0.00093	0.00000	0.00000
N	D	0.00000	0.00210	0.00863	0.00408	0.00043	0.00000
NNE	D	0.00019	0.00466	0.00843	0.00183	0.00016	0.00000
NE	D	0.00054	0.00443	0.00237	0.00074	0.00023	0.00004

Sector	Stability Class	WSC 1	WCS 2	WSC 3	WSC 4	WSC 5	WSC 6
ENE	D	0.00148	0.00863	0.00120	0.00039	0.00000	0.00000
E	D	0.00089	0.00443	0.00074	0.00043	0.00016	0.00000
ESE	D	0.00031	0.00078	0.00066	0.00054	0.00027	0.00000
SE	D	0.00008	0.00113	0.00447	0.00723	0.00299	0.00058
SSE	D	0.00004	0.00346	0.01306	0.01846	0.00350	0.00051
S	D	0.00012	0.00354	0.00983	0.00641	0.00105	0.00023
SSW	D	0.00000	0.00206	0.00400	0.00478	0.00249	0.00016
SW	D	0.00012	0.00163	0.00497	0.00766	0.00326	0.00124
WSW	D	0.00016	0.00136	0.00595	0.01407	0.00738	0.00319
W	D	0.00019	0.00311	0.00921	0.01904	0.00614	0.00183
WNW	D	0.00016	0.00350	0.00622	0.00925	0.00482	0.00105
NW	D	0.00000	0.00381	0.00517	0.00886	0.00315	0.00066
NNW	D	0.00000	0.00241	0.00556	0.00886	0.00198	0.00012
N	E	0.00004	0.00237	0.00031	0.00000	0.00000	0.00000
NNE	E	0.00039	0.00323	0.00194	0.00000	0.00000	0.00000
NE	E	0.00214	0.00393	0.00051	0.00000	0.00000	0.00000
ENE	E	0.00315	0.00723	0.00035	0.00000	0.00000	0.00000
E	E	0.00159	0.00412	0.00008	0.00000	0.00000	0.00000

Sector	Stability Class	WSC 1	WCS 2	WSC 3	WSC 4	WSC 5	WSC 6
ESE	E	0.00054	0.00101	0.00012	0.00000	0.00000	0.00000
SE	E	0.00027	0.00128	0.00051	0.00000	0.00000	0.00000
SSE	E	0.00019	0.00202	0.00093	0.00000	0.00000	0.00000
S	E	0.00016	0.00256	0.00035	0.00000	0.00000	0.00000
SSW	E	0.00008	0.00183	0.00039	0.00000	0.00000	0.00000
SW	E	0.00000	0.00167	0.00023	0.00000	0.00000	0.00000
WSW	E	0.00019	0.00113	0.00047	0.00000	0.00000	0.00000
W	E	0.00012	0.00171	0.00120	0.00000	0.00000	0.00000
WNW	E	0.00016	0.00175	0.00074	0.00000	0.00000	0.00000
NW	E	0.00043	0.00256	0.00078	0.00000	0.00000	0.00000
NNW	E	0.00016	0.00148	0.00066	0.00000	0.00000	0.00000
N	F	0.00808	0.00575	0.00000	0.00000	0.00000	0.00000
NNE	F	0.01589	0.00727	0.00000	0.00000	0.00000	0.00000
NE	F	0.03043	0.01434	0.00000	0.00000	0.00000	0.00000
ENE	F	0.03365	0.02087	0.00000	0.00000	0.00000	0.00000
E	F	0.02281	0.01127	0.00000	0.00000	0.00000	0.00000
ESE	F	0.01267	0.00536	0.00000	0.00000	0.00000	0.00000
SE	F	0.00661	0.00412	0.00000	0.00000	0.00000	0.00000

Sector	Stability Class	WSC 1	WCS 2	WSC 3	WSC 4	WSC 5	WSC 6
SSE	F	0.00404	0.00462	0.00000	0.00000	0.00000	0.00000
S	F	0.00482	0.00595	0.00000	0.00000	0.00000	0.00000
SSW	F	0.00400	0.00579	0.00000	0.00000	0.00000	0.00000
SW	F	0.00416	0.00424	0.00000	0.00000	0.00000	0.00000
WSW	F	0.00521	0.00381	0.00000	0.00000	0.00000	0.00000
W	F	0.00556	0.00439	0.00000	0.00000	0.00000	0.00000
WNW	F	0.00707	0.00540	0.00000	0.00000	0.00000	0.00000
NW	F	0.00801	0.00564	0.00000	0.00000	0.00000	0.00000
NNW	F	0.00668	0.00637	0.00000	0.00000	0.00000	0.00000

A regression analysis of the JFD for 2016-2020 and 2017-2019 (Figure 11) shows excellent correlation (r^2=0.9945, $p<0.0001$) between the 5-year data set and the dataset used in the CALPUFF modeling (2017--2019).



This analysis of the 5-year dataset and the 3-year dataset used in the CALPUFF modeling is consistent with NRC guidance in NRC 2017 and 2018 and demonstrates that the 2017-2019 dataset is representative of long-term meteorological conditions at the site.

2) See response to (1) which includes an analysis of stability class.

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