Homestake Mining Company of California

Grants Reclamation Project

David W. Pierce
Closure Manager

March 31, 2020

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555–0001

Mr. Ron Linton, Project Manager
Project Manager, Materials Decommissioning Branch (Mail Stop: T-8F5)
Decommissioning, Uranium Recovery & Waste Programs
Office of Nuclear Materials Safety and Safeguards
U.S. Nuclear Regulatory Commission
MS T-5A10, 11545 Rockville Pike
Rockville, MD 20852

RE: Homestake Mining Company of California – Grants Reclamation Project – 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) is submitting this request to the U.S. Nuclear Regulatory Commission (NRC) to amend NRC License SUA-1471 for the Grants Reclamation Project (Site) with respect to a proposed change in location for the background environmental monitoring station for ambient radon and gamma radiation at the HMC Grants Reclamation Project (Site). Specifically, this license amendment request (LAR) proposes a change in license condition (LC) number 10 to eliminate specification of background monitoring station HMC-16 and replace it with station HMC-1OFF as the approved location for routine monitoring of ambient background radon and gamma radiation levels at the Site.

Technical justification for the proposed change is provided in the attached report entitled "Assessment of Background Radon Monitoring Locations" (ERG, 2020). The report (Attachment 1) builds on a previous multi-year background radon study (ERG, 2013) to include evaluation of additional radon gas and progeny data from routine monitoring and several relevant studies (NMED, 1985; ERG 2018a), along with new gamma radiation survey data collected in offsite background areas within and adjacent to the floor of the San Mateo Creek (SMC) basin in which the Site is situated (ERG, 2018b and 2020). Because background radon appears to co-vary spatially with local gamma radiation levels, it is proposed that background for both monitoring parameters be defined at location HMC-1OFF.

This request has implications for annual calculation of public dose and demonstration of compliance with the public dose limits given in 10 CFR 20.1301. As such, this request is integral to HMC's proposed method for annual determination of radon dose to the nearest member of the public as described in HMC's revised response to NRC's July 31, 2018 "*Request for Additional Information – Compliance of Homestake Grants, New Mexico Site with 10 CFR 20.1301 and 20.1302*" (HMC, 2020). The technical validity of the proposed method is dependent upon NRC approval of this LAR to change the background radon monitoring location because conditions at station HMC-16 are not representative of background radon conditions at the Site. This circumstance is fundamentally inconsistent with applicable specifications in the NRC's Interim Staff

Guidance (ISG) "*Evaluations of Uranium Recovery Facility Surveys of Radon and Radon Progeny in Air and Demonstrations of Compliance with 10 CFR 20.1301*" (USNRC, 2014 and 2019), and places HMC at risk of routinely exceeding 10 CFR 20.1301 public dose limits due to a non-representative background radon monitoring location.

Please note that a signed copy of NRC Form 313 is included in Attachment 2 to this submittal.

Thank you for your time and attention on this matter. If you have any questions, please contact me via e-mail at dpierce@barrick.com or via phone at 505.238.9701.

Respectfully,

David W. Pierce
Closure Manager
Homestake Mining Company of California
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Copy To:

M. McCarthy, Barrick, Salt Lake City, Utah (electronic copy)
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D. Lattin, Barrick, Elko, Nevada (electronic copy)
R. Whicker, Environmental Restoration Group, Albuquerque, New Mexico (electronic copy)

REFERENCES:

Environmental Restoration Group, Inc. (ERG). 2013. Basis for Selection of a Representative Background Monitoring Location for the Homestake Uranium Mill Site, SUA-1471. September.

Environmental Restoration Group, Inc. (ERG). 2018a. Occupational Radiation Exposures Study – Final Report. Radiation Protection Program, HMC Grants Reclamation Project, Cibola County, New Mexico. August 20, 2018.

Environmental Restoration Group, Inc. (ERG). 2018b. Final Status Survey Report for Release of Former Land Application Areas. Grants Reclamation Project, Cibola County, New Mexico. July 2, 2018.

Environmental Restoration Group, Inc. (ERG). 2020. Assessment of Background Radon Monitoring Locations. HMC Grants Reclamation Project. March 31, 2020.

Homestake Mining Company of California (HMC). 2020. Revised HMC response to NRC's "Request for Additional Information – Compliance of Homestake Grants, New Mexico Site with 10 CFR 20.1301 and 10 CFR 20.1302." Docket No. 040-08903, License No. SUA 1471. March 31, 2020.

Enclosures: Attachment 1 – Report: Assessment of Background Radon Monitoring Locations
Attachment 2 - NRC Form 313

ATTACHMENT 1

Report: Assessment of Background Radon Monitoring Locations

Environmental Restoration Group, Inc.
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ph: (505) 298-4224
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REPORT	
To: David Pierce (HMC)	**Date**: March 31, 2020
From: Randy Whicker (ERG)	**Project**: HMC Grants Reclamation Project
Direct: 970-556-1174	**Task(s)**: Health Physics Support
Cc: Adam Arguello (HMC); Brad Bingham (HMC); Chuck Farr (ERG)	
Subject: Assessment of background radon monitoring locations.	

Dear Mr. Pierce,

This Report provides a review of relevant data and an assessment of a more representative offsite background radon monitoring location with respect to annual determination and reporting of radiological dose to the nearest member of the public as required by 10 CFR 20.1301, 10 CFR 20.1302 and 10 CFR 40.65. The information evaluated includes long-term data from the Site's routine environmental monitoring program, data from special radon monitoring studies (NMED, 1985; ERG, 2013 and 2018b), and data from gamma radiation surveys of representative portions of the San Mateo Creek alluvial plain and surrounding areas. This information has implications for annual reporting of effluent radon releases and corresponding estimates of public dose under U.S. Nuclear Regulatory Commission (USNRC) regulations.

Please let me know if you have questions or need more information regarding this matter.

Thanks,

Randy Whicker

Randy Whicker, CHP
Radiation Safety Officer
HMC Grants Reclamation Project

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Assessment of Background Radon Monitoring Locations

Contents

Figures

Assessment of Background Radon Monitoring Locations

1. Introduction

The historic (and current) environmental monitoring station for ambient background radon-222 gas (radon) levels at the Homestake Mining Company of California (HMC) Grants Reclamation Project (Site) is identified as HMC-16 as shown in Figure 1. Questions regarding the representativeness of HMC-16 with respect to true background radon levels at the Site have previously been raised both by HMC and the U.S. Nuclear Regulatory Commission (NRC). This radon monitoring station has been used to represent background conditions throughout the Site's history, yet there is no documented basis as to why it was established in an area where geomorphic/geological characteristics differ significantly from the floor of the San Mateo Creek (SMC) valley in which the Site is situated.

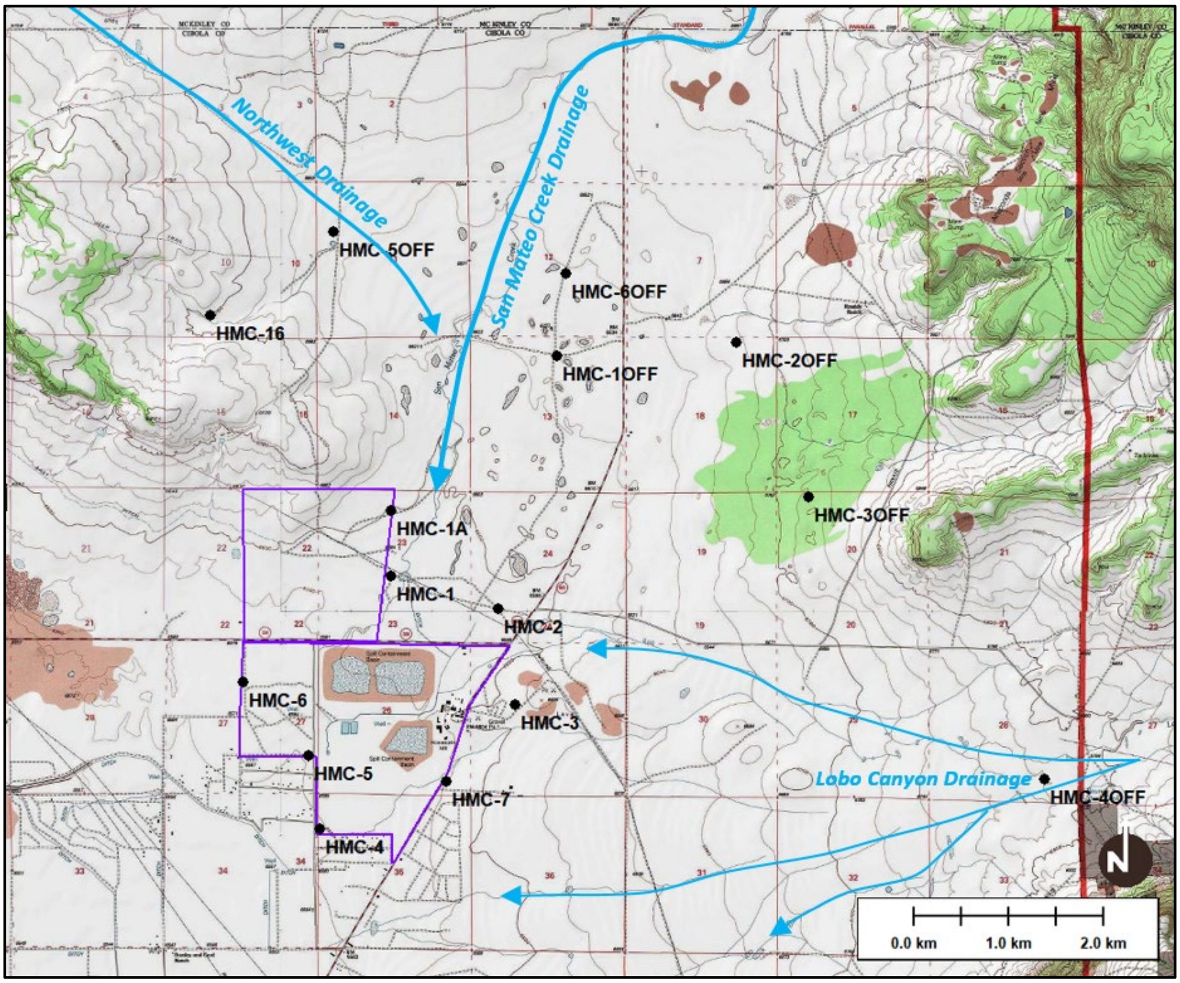


Figure 1: Topographical Site map with radon monitoring locations and generalized drainage flow patterns.

In 2013, HMC submitted a license amendment request (LAR) to move the background radon monitoring station to a new offsite location (HMC, 2013), identified in Figure 1 as HMC-1OFF. The request included a report on a study designed to inform the selection of a representative background radon monitoring

location (ERG, 2013). After several years of regulatory review and a second round of technical review comments from the NRC, HMC withdrew the LAR.

In 2017 HMC was cited by the NRC with a notice of violation (NOV) for failing to meet the 10 CFR 40, Appendix A, Criterion 6 standard for radon flux (20 pCi/m^2-s) on top of the large tailings pile (LTP). HMC informed the NRC that placement of additional interim cover or the final radon barrier are not possible without plugging/abandoning hundreds of wells that are still needed for groundwater restoration efforts at the Site. HMC was advised that a request for an interim variance (exemption) from the radon flux standard was needed, and for this objective, HMC must show that doses to the public from radon will not exceed the 100 mrem/yr public dose standard as required by 10 CFR 20.1301. Based on 2016 radon flux measurements for both tailings piles [the LTP and small tailings pile (STP)], HMC modeled the atmospheric transport of respective radon releases with the MILDOS-AREA (MILDOS) computer code (ANL, 2016), and results indicate that a conservative estimate of the maximum dose from radon effluents to the nearest member of the public is on the order of 47 mrem/yr.

While modeling indicates compliance with public dose limits, NRC's Interim Staff Guidance (ISG) "*Evaluations of Uranium Recovery Facility Surveys of Radon and Radon Progeny in Air and Demonstrations of Compliance with 10 CFR 20.1301*" (USNRC, 2019a) indicates that if modeling is to be used to demonstrate compliance with 10 CFR 20.1301 public dose limits, measurements to "confirm or compare" with modeling results are also expected. MILDOS modeling indicates that for any given year, net (above background) radon concentrations at the Site's boundary monitoring stations that are attributable to effluent releases from the tailings piles are likely too small to be statistically distinguishable from the variability in background concentrations (e.g. <0.1 pCi/L). More importantly, the average background radon concentration at HMC-16 is typically on the order of 50-60% of average background radon concentrations that occur along the SMC drainage in which the Site is situated.

Under this circumstance, measurements from which background is subtracted to determine a net concentration (conceptually representing radon attributable to facility emissions) will not be comparable to MILDOS modeling results, and if measurements alone are used in conjunction with conservative assumptions regarding receptor occupancy times and radon equilibrium ratios as cited in the "ISG Radon Guidance" referenced above (USNRC, 2019a), HMC is at risk of routinely exceeding 10 CFR 20.1301 public dose limits due to due to a non-representative background radon monitoring location. This highlights the importance of selection of a new background location in an area that meets the criteria cited in the ISG Radon Guidance:

- "*A background location typically would need to be close to the monitoring locations, with geology similar to the site geology, so that the background location is representative of the monitoring location. But the background location should also be far enough from the facility that the radon concentration is not significantly affected by radon releases from the facility*."
- *"…determining appropriate background location(s) is complicated by spatially and temporally varying concentrations; impact of varying geology on the natural emissions of radon from soil into air; effects of topography on wind patterns, especially on patterns of low speed winds (e.g., down valley drainage)…".*

Based both on environmental monitoring data and MILDOS modeling results, the previously proposed background monitoring station HMC-1OFF meets all of the above criteria, but NRC has previously expressed reservations about use of this location alone because some Site perimeter monitoring locations have slightly lower average radon concentrations than those observed at HMC-1OFF. As discussed later in this Report, there is analytical evidence that can explain this circumstance as “background” radon levels tend to vary spatially as a function of the radiological characteristics of local surface soils, and past remediation of windblown soil contamination beyond the tailings piles and excavation of borrow materials in the vicinity of SMC north of the Site appears to have lowered average radon levels in respectively disturbed areas (see Section 3.3, Figure 5).

This Report provides an assessment of the representativeness of radon monitoring Station HMC-1OFF as an offsite background location with respect to annual calculation and reporting of radiological dose from radon to the nearest member of the public as required by 10 CFR 20.1301 and 10 CFR 40.65. The information evaluated includes data from HMC’s routine environmental monitoring program and various radon-related studies (NMED, 1985; ERG, 2013; ERG, 2018a and 2018b), along with gamma surveys of representative portions of the SMC alluvial plain and adjacent areas north (upgradient) of the Site (Section 3.3, Figure 5). Consideration was also given to previous requests for additional information (RAI’s) from NRC regarding the 2013 LAR to move the background radon monitoring location to station HMC-1OFF (HMC, 2013), including NRC review of an attached technical report supporting selection of this monitoring location to represent background radon conditions at the Site (ERG, 2013). EPA review comments on the supporting technical report were also considered. The information presented in this Report has implications for annual calculation and reporting of effluent radon releases and corresponding estimates of public dose under NRC regulations.

2. Conceptual Site Model

Radon is a heavy gas (much heavier than air), and it is well known that outdoor radon concentrations are highest under stable atmospheric conditions with little or no wind (e.g. in the early morning hours) (NCRP, 1987). Under these conditions, radon tends to pool near the ground surface in low-lying areas, and radon migration is driven primarily by topography and gravitational forces that cause cooler, denser air masses to flow downgradient (e.g. along runoff drainages) (UNSCEAR, 2000). Down-drainage wind directions and low windspeeds in the early morning hours are characteristic of the Site (based on meteorological monitoring data), as are diurnal fluctuations in radon levels with substantially higher levels in the early morning hours (ERG, 2013 and 2018b).

In addition, geomorphic deposits of unconsolidated and semi-consolidated alluvial, aeolian and fluvial terrace materials form a large alluvial plain spanning the width of the SMC valley in the vicinity of the Site (Section 3.3, Figure 5). Averaging in the range of 50-100 feet deep in the lower SMC basin, alluvial plain deposits exhibit different radiological characteristics versus adjacent upland areas, and ambient radon concentrations at any given location are influenced locally by Ra-226 concentrations in underlying soils due to radioactive decay, emanation of radon gas, and exhalation of radon gas from the soil surface.

This conceptual Site model (CSM) for local sources and behavior of radon in the vicinity of the Site is supported both by Site monitoring data and air transport modeling results (ERG, 2013, 2018a, 2018b;

Section 3.3, Figure 5). As discussed in detail later in this Report, the evidence clearly indicates that HMC-16 is not a representative background radon monitoring location with respect to the HMC Site. Located in hilly terrain about 80 feet above the SMC alluvial plain, HMC-16 is well outside the low-lying influences of the Northwest and SMC drainages (Figure 1) and the radiological properties of local geology and associated soils differs from the alluvial materials underlying most of the Site.

Some Site perimeter monitoring stations within the SMC alluvial plain tend to have slightly lower radon levels than upgradient background conditions at HMC-1OFF. This circumstance appears related to large-scale removal of windblown soil contamination beyond the tailings piles in the early 1990's (HMC, 1995), along with excavation of select borrow materials (with suitable clay mineral content) from old paleo channels of the SMC drainage that occur north of Site facilities (Section 3.3, Figure 5).

The locations of the nearest public resident and adjacent monitoring stations (HMC-4 and HMC-5) all lie in the approximate center of the SMC alluvial plain downgradient of the tailings piles (see Section 3.3, Figure 5). As indicated by gamma surveys and soil sampling across nearby land application irrigation areas (ERG, 2018a), locations within the alluvial plain south of the tailings piles have slightly higher soil Ra-226 levels and associated gamma exposure rates, and similarly elevated levels have been documented in alluvial plain deposits upgradient of the Site (HMC, 1988; Section 3.3, Figure 5). In addition to drainage migration from upgradient source areas, background radon levels across the SMC alluvial plain appear to be influenced by Ra-226 levels in surficial deposits of the alluvial material itself.

3. Previous Radon Monitoring Studies

3.1 2013 Basis for Radon Background Study

The CSM for downgradient drainage flow of radon gas from distant source areas as described in the 2013 study of background radon locations (ERG, 2013) is adopted for this assessment, but a factor not evaluated in previous studies is the influence of Ra-226 levels in local surface soils as a spatially variable source of local radon gas emissions. This factor is a recognized in the ISG Radon Guidance as a consideration for selection of a representative background radon monitoring location (USNRC, 2019a). The results of the 2013 radon study (Figure 2) are spatially consistent with long-term Site monitoring results (see Section 3.3, Figures 4 and 5), and while both data sets are consistent with an assumption of drainage flow as a primary mechanism for transport of radon gas from distant source areas, the additional influence of Ra-226 concentrations in surface soils as a localized source of radon gas emissions is also considered in this updated assessment of background monitoring locations. The 1985 NMED study data presented in Section 3.2, along with more recent Site monitoring data presented in Section 3.3, collectively provide evidence that the radiological characteristics of surface soils in the vicinity of each monitoring location play a significant role in the relative magnitude of local background radon concentrations.

As previously mentioned, HMC's 2013 LAR to move the background radon monitoring location to offsite station HMC-1OFF was withdrawn from further regulatory consideration in 2016 (HMC, 2016). At the time of the withdrawal, there were outstanding Requests for Additional Information (RAIs) from NRC (USNRC, 2016) and review comments from EPA (USEPA, 2013) that had not been addressed by HMC. Because the technical report for the 2013 background radon study (ERG, 2013), as submitted in support

of the 2013 LAR, was considered in this current evaluation, NRC has requested a response to the orphaned RAIs/comments from NRC and EPA.

HMC has reviewed the orphaned regulatory comments and noted that respective concerns were primarily focused on issues surrounding the accuracy of the atmospheric transport modeling, along with the meteorological (MET) station data used to support the modeling. As explained in HMC's 2014 response to the initial RAIs from NRC (HMC, 2014), the objective of the original modeling was to understand the mechanism of radon transport in complex terrain (the conceptual model) and to use this information to inform selection of appropriate monitoring locations for the background radon study. In effect, the modeling was intended to qualitatively support the conceptual model for air flow dynamics and spatial radon migration patterns, not to quantitatively predict the magnitude of radon levels at prospective background study locations.

Much is now known about the latter objective (quantification, both spatial and temporal) based on actual monitoring data generated during the 2013 background radon study and beyond, and the additional monitoring and radiological survey data evaluated in this Report continues to support the conceptual model for atmospheric transport as postulated in the 2013 background radon study. As suggested in the ISG Radon Guidance (NRC, 2019), measurements are generally preferred over modeling (unless the modeling can be validated with measurements), and new measurement data obtained since the 2013 study support both the original conceptual model for atmospheric transport and expansion of the model to include spatial variations in soil Ra-226 concentrations as a locally variable source of background radon emissions.

Given the above considerations, HMC believes that the technical issues raised in the orphaned regulatory review comments are of little practical significance to the current evaluation as the conclusions reached in this Report are largely based on measurement data. While addressing the orphaned regulatory comments might reduce uncertainty in the original modeling results, this would not change the technical validity of the conclusions drawn in the 2013 background radon study, nor the conclusions reached in this Report.

Finally, the current LAR to move the background monitoring location from station HMC-16 to HMC-1OFF is narrowly focused on determination of compliance with the public dose limit at the location of the nearest actual member of the public, not other "points of compliance" for hypothetical public receptors as mentioned in the orphaned RAIs/comments from NRC and EPA. Long-term radon monitoring data at Site boundaries support expectations that on average, stations HMC-4 and HMC-5 are representative of conditions for the maximally exposed member of the public. Determination and reporting of compliance with public dose limits at other locations is unnecessary as the maximum public exposure to effluent radon from the Site provides a bounding calculation of public radon dose, and there are no actual members of the public that reside near other Site boundary monitoring locations.

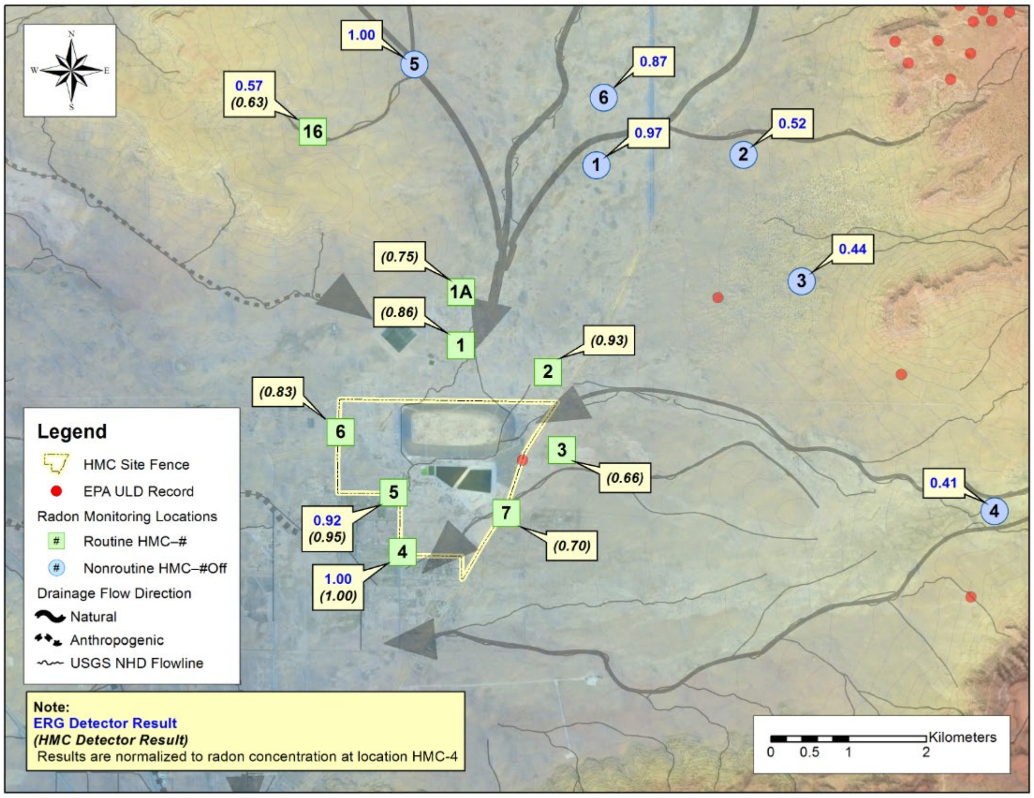


Figure 2: HMC Site background radon study results, normalized to the average radon concentration at monitoring station HMC-4 (adopted from ERG, 2013).

3.2 NMED Radon Monitoring Study

Between 1978-1980, the New Mexico Environment Department (NMED) conducted a special study of ambient outdoor radon and indoor radon decay product (progeny) concentrations in the Grants mining/milling district, including areas associated with the Anaconda and HMC mill sites [Figure 3(A)], as well as mills and mines in the Ambrosia Lake mining district to the north of the HMC facility. As described in the NMED report (NMED, 1985), the objective of the study was to determine whether effluent radon emissions from active uranium mines and mills in this part of New Mexico were contributing to ambient radon concentrations in excess of regional background levels, and if so, whether such levels exceeded applicable health standards in place at the time of the study.

Because regulatory health standards for radon do not include radon from background sources, selection of appropriate background monitoring locations was a key element of the study design. Results from 10 representative background locations across these districts were used to determine a single regional average background concentration to use for general evaluation of impacts from uranium mines and milling facilities. Selection of each individual background monitoring station was based on distance from local mines and/or milling facilities, prevailing wind directions, and topographical setting relative to mining/milling locations.

The location selected in the NMED study to represent local background relative to the HMC Site was station 201 as shown in Figure 3(A). Situated within the SMC drainage, the location of station 201 was

close to the current location of monitoring station HMC-1OFF. The NMED study revealed that at that time (circa 1980), radon levels close to the tailings piles (e.g. stations 203, 204 and 205) were elevated relative to background at station 201 [Figure 3(B)], and measured gamma radiation at these same monitoring locations (203, 204 and 205) was also elevated [Figure 3(C)] due to windblown soil contamination beyond the tailings piles. Radon monitoring data collected in these same areas since removal of soil contamination in the early 1990's indicate that radon levels have decreased to concentrations slightly lower than those observed at upgradient background station HMC-1OFF (see Section 3.3, Figures 4 and 5).

Although placement of cover materials to stabilize and isolate the tailings from the environment in the 1990's may also have contributed to subsequent reductions in ambient radon levels in these areas, this factor alone does not explain reductions in radon concentrations to levels lower than those observed at upgradient background station HMC-1OFF. The data suggest that large-scale removal of windblown soil contamination beyond the tailings piles had a significant influence on the observed reductions in local radon levels.

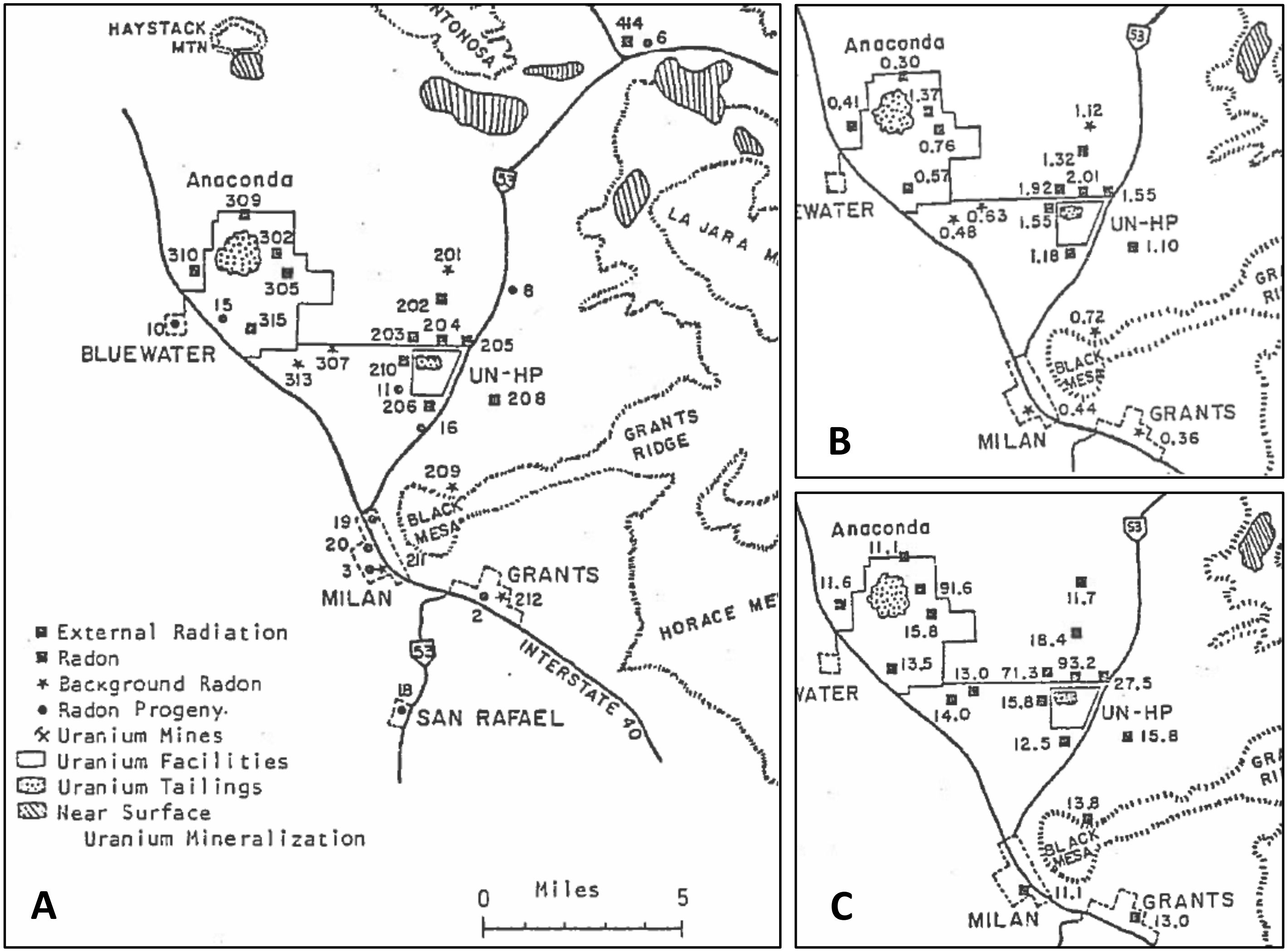


Figure 3: (A) 1985 NMED radon study design and locations near HMC facility, (B) mean radon values (pCi/L in study year 1), and (C) mean gamma radiation exposure rates (µR/hr) during the study period (adapted from NMED, 1985).

3.3 HMC Site Monitoring Data

Over most of the Site's history, passive alpha track-etch detectors have been used to measure long-term average radon concentrations at Site perimeter monitoring stations, though as previously noted, radiological conditions at some monitoring locations have changed since milling facilities were demolished and windblown soil contamination adjacent to the tailings piles was cleaned up (HMC, 1995). To evaluate spatial variability in radon concentrations over the past decade (2009-2019), available radon monitoring data were compiled to produce a map of long-term average radon concentrations near Site boundaries and across upgradient offsite areas (Figure 4).

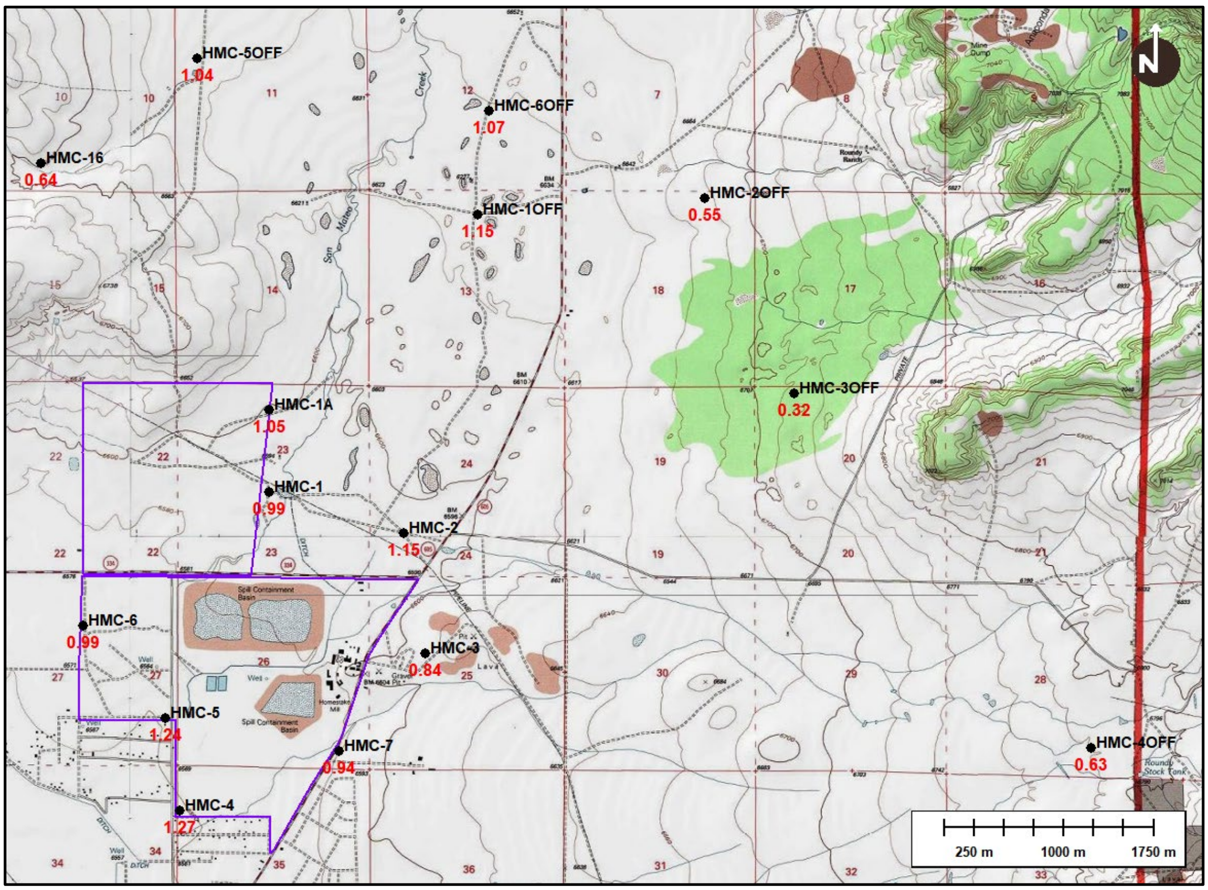


Figure 4: Radon monitoring station locations with annotated average radon concentrations (pCi/L) (red font) between 2009 and 2019 (note some offsite stations not operated over the entire 10-year period).

A spatial relationship is apparent between monitoring stations with average radon concentrations in excess of 1 pCi/L and alluvial deposits in low-lying areas within the SMC alluvial plain. Outside of the alluvial plain, average radon concentrations tend to decrease below 1 pCi/L as a function of increasing distance from, and/or elevation above, the alluvial plain. Based on gamma radiation surveys of representative portions of the alluvial plain and adjacent upgradient areas near HMC-1OFF, HMC-2OFF, HMC-5OFF and HMC-16 (Figure 5), spatial trends in background radon levels can also be qualitatively correlated with spatial variations in gamma radiation and associated Ra-226 levels in local surface soils.

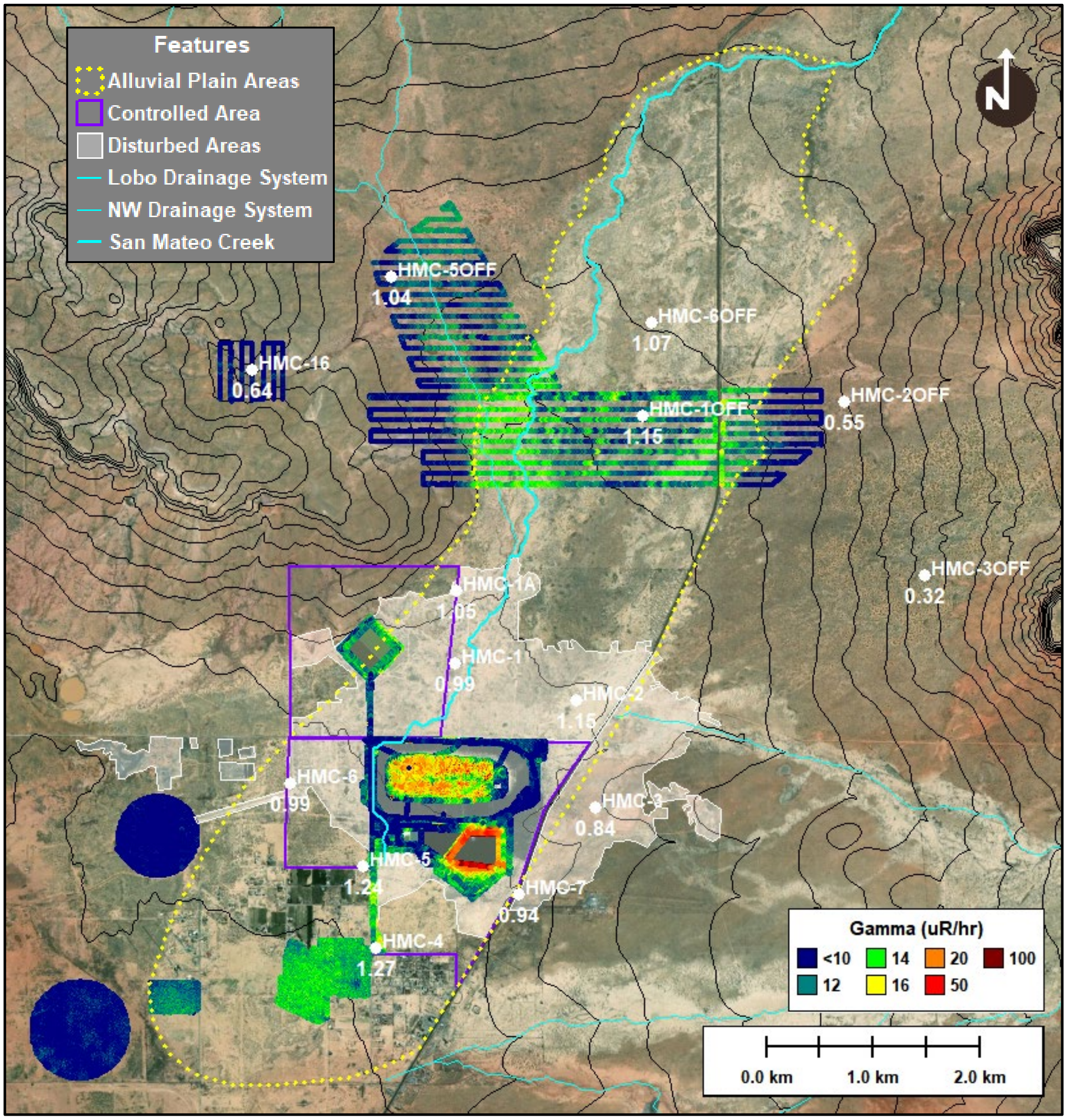


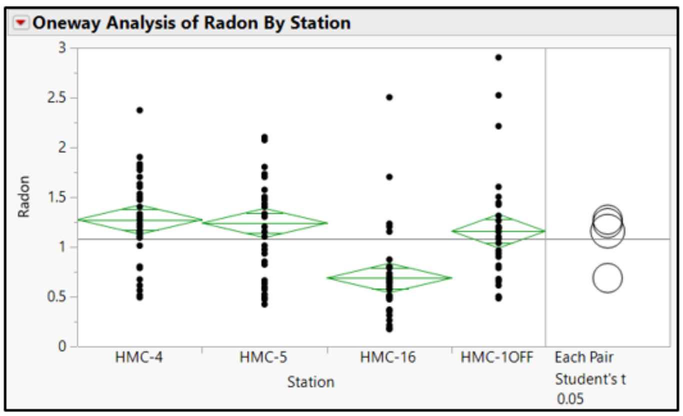
Figure 5: Radon monitoring locations and average airborne radon concentrations (pCi/L) in relation to apparent alluvial plain areas and associated gamma radiation levels.

Gamma radiation levels across the SMC alluvial plain in the vicinity of HMC-1OFF are generally elevated relative to areas beyond the alluvial plain, and this relationship extends to downgradient areas south of the Site [note that the areal extent of the SMC alluvial plain is evident from topographical information and visual indications in the aerial imagery (Figure 5)]. In addition, slightly elevated gamma radiation is apparent in alluvial deposits along the northwest drainage in the vicinity of station HMC-5OFF (Figure 5). As postulated in previous studies (NMED, 1985; HMC, 1988; ERG, 2013; EPA, 2016), erosion of nearby surficial outcrops of mineralized geologic formations (e.g. Todilto Limestone and Poisson Canyon Sandstone) over geologic time scales is likely responsible for naturally elevated background levels of uranium and its decay products in alluvial deposits (averaging 50-100 feet deep) underlying the HMC Site. While radiological impacts from historic upgradient uranium mining that took place within the last 70 years may also be present, such impacts are likely limited to a relatively thin veneer of surface deposits

near current drainage channels. Regardless of origin, under the CSM described in Section 2, distant upgradient radon levels represent background conditions relative to effluent radon emissions from the HMC Site.

3.3.1 Statistical Comparisons

Statistical comparisons of semiannual radon monitoring data collected over the past decade at Site perimeter stations HMC-4 and HMC-5, along with background data collected from stations HMC-16 and HMC-1OFF (Figure 6), indicate that radon levels at HMC-16 belong to a different population of background values relative to the three stations located within the alluvial plain. Parametric T-tests and non-parametric Wilcoxon Rank Sum (WRS) tests indicate statistically significant differences in radon concentrations between station HMC-16 and each of the other three stations (P-values < 0.05). Although differences between upgradient background at HMC-1OFF and levels measured at downgradient stations HMC-4 and HMC-5 are not statistically significant (P-values > 0.05), small numerical differences in mean values (on the order of 0.1 pCi/L higher at the downgradient stations) are apparent over the past decade. These small differences in average measured values are reasonably consistent with modeled (MILDOS) predictions of ambient radon levels at HMC-5 due to effluent radon releases from the tailings piles.



Station	Station	Parametric P-value	Non-Parametric P-value
HMC-4	HMC-16	<0.0001	<0.0001
HMC-5	HMC-16	<0.0001	<0.0001
HMC-1OFF	HMC-16	<0.0001	<0.0001
HMC-4	HMC-1OFF	0.3097	0.0731
HMC-5	HMC-1OFF	0.4742	0.1760
HMC-4	HMC-5	0.7449	0.7325

Figure 6: Statistical comparisons of mean measured radon concentrations (pCi/L) over a 10-year period of record.

Based on the above analyses, and given the CSM described in Section 2, it is reasonable to assume that numerical differences between average radon levels at downgradient stations HMC-4 and HMC-5 and the upgradient background station HMC-1OFF (approximately 0.1 pCi/L over the past decade) provide a reasonably accurate measure of increased radon at stations HMC-4 and HMC-5 due to emissions from the tailings piles and groundwater treatment/evaporation facilities. Conversely, if "background" continues to be defined by radon levels measured at station HMC-16, the net measured difference at station HMC-4

or HMC-5 will grossly overestimate true effluent concentrations and respectively calculated estimates of public dose from radon.

A consideration for any background monitoring location along the floor of the SMC basin is that public dose from radon is estimated/reported annually based on only four quarters of data, and in any given year, respectively measured net effluent radon levels may variably be inconsistent with expectations based on long-term averages. On an annualized basis, temporal and spatial variability in local background levels, along with analytical uncertainty associated with alpha track-etch detectors, may have a significant impact on the calculated annual average effluent radon concentration at locations of interest with respect to public dose estimation (HMC-4 and HMC-5).

3.4 2018 Occupational Radiation Exposure Study

Between December 2017 and May 2018, additional radon monitoring data were obtained as part of a special occupational radiation exposure study at the Site (ERG, 2018b). Because the radiological dose from radon is primarily attributable to short-lived radon decay products (progeny), and the objectives of the study included estimation of occupational dose from radon, the study included outdoor monitoring for both radon gas and radon progeny using special instruments and air sampling methods. Specifically, the study included the following monitoring design elements:

- Paired radon gas/progeny measurements performed at three key locations: 1) upgradient from the LTP at air station HMC-1OFF, 2) on top of the LTP, and 3) downgradient from the LTP at air station HMC-5. Paired radon progeny/gas measurements were taken concurrently at each study location to permit data pairing for proper calculation of radon progeny/gas equilibrium ratios.

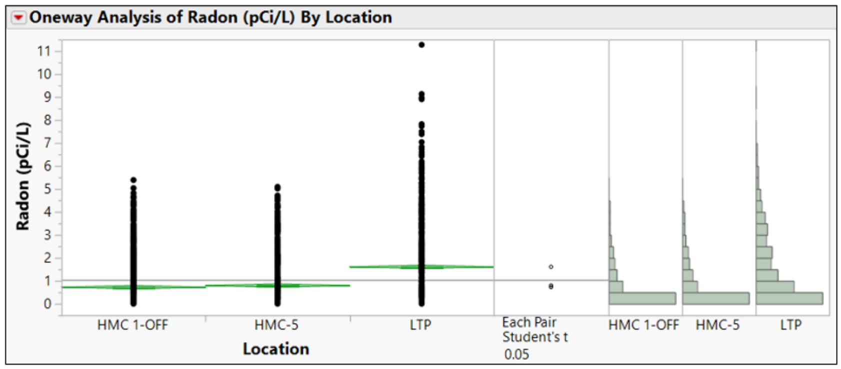
- Continuous monitoring of ambient airborne radon gas levels was conducted with a powered Durridge RAD7 radon gas monitoring instrument. Average measured radon values were recorded every 30 minutes.

- Solid-phase airborne radon progeny was measured with routine grab samples of air collected with a lapel-type breathing zone (BZ) air sampler and subsequent analysis of filter samples with the modified Kusnetz method. Progeny measurements were collected twice per day, three days per week at the same locations as the RAD7 continuous radon gas monitors.

Assuming the CSM described in Section 2, data collected with the above methods provide a direct quantitative measure of the impact of radon emissions from the LTP at monitoring station HMC-5, one of two locations used for annual calculation of public dose. Aside from NRC questions regarding the quality of radon gas measurement data with the RAD7 instrument (USNRC, 2019b)[1], average measured radon gas levels were highest on top of the LTP, and differences between the LTP and the upgradient/downgradient

[1] NRC noted in its review of the Study Report that during the monitoring period, outdoor temperatures in the area fell below the 32° F minimum operating temperature range specified for the RAD7 instrument. However, these instruments were housed in small enclosures with electrical heat blankets inside, there was no evidence of pump diaphragm malfunction (the main concern during freezing temperatures), and spatial/temporal trends reflected in the data are consistent with expectations based on HMC's conceptual site model for radon behavior in the vicinity of the Site (see Section 2). HMC believes that the RAD7 radon gas data are of suitable quality for characterization of relative differences in radon equilibrium ratios between locations.

monitoring stations (Figure 7) were statistically significant under both parametric and nonparametric testing methods (p-values < 0.001). Statistical differences between radon gas levels at upgradient station HMC 1-OFF and downgradient station HMC-5 cannot be inferred by parametric T-test at the 95% confidence level, though a numerically slight yet statistically significant difference in median values can be inferred based on non-parametric WRS testing.



Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
HMC 1-OFF	1086	0.72164	0.03764	0.6478	0.7954
HMC-5	1088	0.79738	0.03761	0.7236	0.8711
LTP	1086	1.60677	0.03764	1.5330	1.6806

Std Error uses a pooled estimate of error variance

Ordered Differences Report

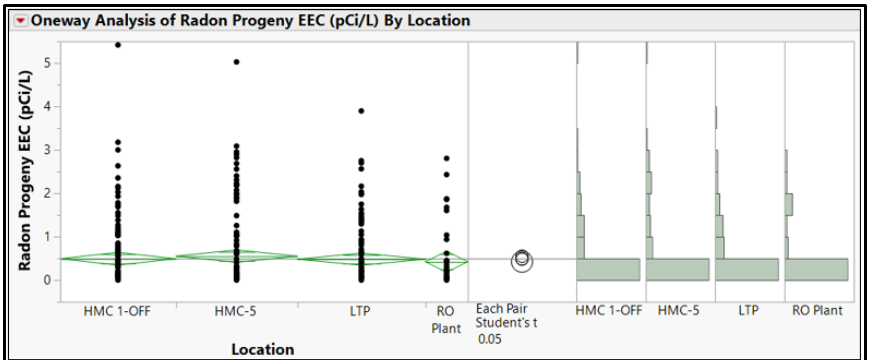
Level	- Level	Difference	Std Err Dif	Lower CL	Upper CL	p-Value
LTP	HMC 1-OFF	0.8851281	0.0532371	0.780747	0.9895098	<.0001*
LTP	HMC-5	0.8093855	0.0532127	0.705052	0.9137192	<.0001*
HMC-5	HMC 1-OFF	0.0757426	0.0532127	-0.028591	0.1800763	0.1547

Nonparametric Wilcoxon Comparisons

Level	- Level	Score Mean Difference	Std Err Dif	Z	p-Value
LTP	HMC 1-OFF	500.9015	26.90815	18.61523	<.0001*
LTP	HMC-5	462.6839	26.91865	17.18823	<.0001*
HMC-5	HMC 1-OFF	63.4508	26.89029	2.35962	0.0183*

Figure 7: Statistical comparisons for three-way paired continuous radon gas monitoring data.

Statistical comparisons of radon progeny measurements at HMC-1OFF, the LTP and HMC-5 during the study are shown in Figure 8. While the average radon progeny concentration at HMC-5 was numerically slightly higher than at HMC-1OFF, none of the differences between these stations were statistically significant. The calculated maximum annual occupational dose to a hypothetical worker from radon progeny was 91 mrem/yr at station HMC-5, and with a calculated hypothetical background dose of 82 mrem/yr from radon progeny at station HMC-1OFF, the inferred net progeny dose at HMC-5 attributable to effluent radon releases from Site facilities was on the order of 10 mrem/yr. Given the differences in assumed occupancy (exposure duration) for Site workers versus public receptors, this measurement-based occupational dose estimate is reasonably comparable (same order of magnitude) to the radon dose predicted by MILDOS modeling for a hypothetical public receptor at the same location (e.g. 47 mrem/yr based on 2016 radon flux measurements for the tailings piles).



Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
HMC 1-OFF	120	0.491552	0.07519	0.34376	0.63935
HMC-5	126	0.551773	0.07338	0.40754	0.69601
LTP	133	0.482394	0.07142	0.34201	0.62278
RO Plant	44	0.422806	0.12417	0.17873	0.66688

Std Error uses a pooled estimate of error variance

Ordered Differences Report

Level	- Level	Difference	Std Err Dif	Lower CL	Upper CL	p-Value
HMC-5	RO Plant	0.1289672	0.1442311	-0.154540	0.4124738	0.3717
HMC-5	LTP	0.0693797	0.1023964	-0.131895	0.2706544	0.4984
HMC 1-OFF	RO Plant	0.0687456	0.1451614	-0.216590	0.3540808	0.6360
HMC-5	HMC 1-OFF	0.0602215	0.1050601	-0.146289	0.2667320	0.5668
LTP	RO Plant	0.0595875	0.1432453	-0.221982	0.3411565	0.6776
HMC 1-OFF	LTP	0.0091581	0.1037027	-0.194684	0.2130004	0.9297

Nonparametric Wilcoxon Comparisons

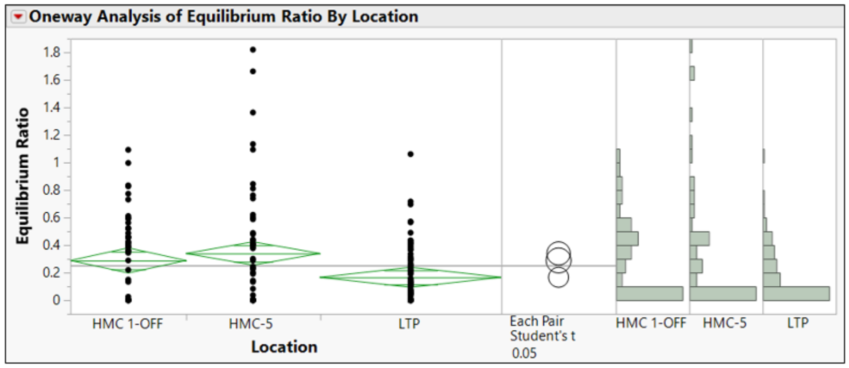
Level	- Level	Score Mean Difference	Std Err Dif	Z	p-Value
LTP	HMC 1-OFF	2.599749	9.055433	0.2870928	0.7740
RO Plant	HMC 1-OFF	2.562500	8.249697	0.3106175	0.7561
RO Plant	HMC-5	2.192460	8.514979	0.2574828	0.7968
HMC-5	HMC 1-OFF	1.277183	8.924927	0.1431029	0.8862
RO Plant	LTP	0.680537	8.797622	0.0773546	0.9383
LTP	HMC-5	0.579574	9.169373	0.0632076	0.9496

Figure 8: Statistical comparisons of radon progeny by location.

Figure 9 shows statistical comparisons for calculated radon progeny/gas equilibrium ratios by location. As expected, the average equilibrium ratio for airborne radon on top of the LTP was lower than the other two locations as radon gas from the tailings is "fresh" and free of radon progeny when first released to the atmosphere from the soil surface (progeny from the radioactive decay process have not yet "grown in"). Radon equilibrium ratios at HMC-5 were higher than the other two monitoring locations, which is consistent with a CSM assumption that radon progeny will grow-in as radon gas emissions from the LTP migrate downgradient towards HMC-5. Average measured equilibrium ratios at all stations were relatively low (ranging from 0.17 for the LTP to 0.34 at HMC-5).

Assuming the CSM described in Section 2, the data and observations described in this Section also support use of Station HMC-1OFF as an appropriate background radon monitoring location for annual calculation of public dose for the following reasons:

- The nearest member of the public, along with the two radon monitoring stations used to estimate public dose (HMC-4 and HMC-5), are all located downgradient of the tailings piles in the approximate middle of southern portions of the SMC alluvial plain. These locations do not appear to have been physically disturbed or radiologically influenced by past remediation of windblown soil contamination.



Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
HMC 1-OFF	51	0.288134	0.04619	0.19701	0.37926
HMC-5	59	0.338937	0.04295	0.25422	0.42366
LTP	80	0.165836	0.03688	0.09308	0.23859

Ordered Differences Report

Level	- Level	Difference	Std Err Dif	Lower CL	Upper CL	p-Value
HMC-5	LTP	0.1731004	0.0566086	0.061427	0.2847739	0.0026*
HMC 1-OFF	LTP	0.1222980	0.0591087	0.005692	0.2389036	0.0399*
HMC-5	HMC 1-OFF	0.0508024	0.0630712	-0.073620	0.1752250	0.4216

Nonparametric Wilcoxon Comparisons

Level	- Level	Score Mean Difference	Std Err Dif	Z	p-Value
HMC-5	HMC 1-OFF	-0.5301	5.871764	-0.09028	0.9281
LTP	HMC-5	-8.0985	6.727344	-1.20382	0.2287
LTP	HMC 1-OFF	-10.1140	6.632661	-1.52487	0.1273

Figure 9: Statistical summary/analysis for radon equilibrium ratios by location.

- The proposed upgradient background station HMC-1OFF is located near the middle of northern portions of the alluvial plain, distant enough to preclude measurable impacts from the Site, yet close enough to be representative of the geologic/geomorphic setting in which the Site is situated.
- Measured differences in radon gas levels between upgradient station HMC-1OFF and downgradient station HMC-5 are reasonably consistent with predicted impacts at station HMC-5 based on MILDOS modeling of effluent radon releases from the tailings piles (as defined by direct radon flux measurements).
- The relative magnitudes of measured radon progeny/gas equilibrium ratios between upgradient station HMC-1OFF, the top of the LTP, and downgradient station HMC-5, are generally consistent with MILDOS modeling results as well as expectations under the CSM described in Section 2.

4. Summary Discussion

Routine Site radon monitoring data (Section 3.3) and data from the 2013 radon monitoring study (Section 3.1) indicate that background radon concentrations at HMC-16 are typically on the order of 50-60% that of background radon concentrations that occur across the SMC alluvial plain in which the Site is situated. If background radon concentrations for the Site continue to be defined by monitoring results at historic background station HMC-16, and conservative exposure parameters (occupancy and radon equilibrium ratios) are used to calculate public dose from radon in accordance with the ISG Radon Guidance (USNRC, 2019a), HMC is at risk of routinely exceeding 10 CFR 20.1301 public dose limits due to a non-representative background monitoring station.

Selection of an appropriate background radon monitoring station requires knowledge of radon sources and an understanding of the environmental behavior/fate of radon once released to the atmosphere. The CSM described in Section 2 provides a conceptual framework for understanding spatial radon patterns in the vicinity of the Site, and observed radon monitoring and gamma survey data reveal patterns consistent with two basic CSM assumptions, summarized as follows:

1. As a heavy gas, radon concentrations are highest under stable atmospheric conditions with little wind (typically in the early morning hours), and migration of maximum diurnal radon concentrations from distant source areas is driven primarily by topography and gravitational forces that cause cooler, denser air masses to flow downgradient and to pool in low-lying areas (NCRP, 1987; UNSCEAR, 2000).

2. Radon concentrations at any given location are also influenced locally by Ra-226 concentrations in underlying soils and geologic materials due to radioactive decay, emanation of radon gas, and exhalation of radon gas from the soil surface. Because the Ra-226 content of soils and geologic materials varies spatially, higher radon concentrations tend to be spatially correlated with higher Ra-226 levels in local surface soils.

The first CSM assumption predicts that higher radon concentrations are possible in low-lying alluvial plain areas, even where Ra-226 levels in local soils are relatively low. The second CSM assumption predicts that areas with higher gamma radiation will tend to have higher radon concentrations. The latter circumstance is apparent across most upgradient background areas (see Section 3.3), though drainage flow from distant sources may also contribute to average local radon levels within the SMC alluvial plain (e.g. note results for station HMC-5OFF as shown in Figure 5).

Consistent with the ISG Radon Guidance (USNRC, 2019a), the background radon monitoring station should be located close enough to the Site to be representative of the geology and topographical setting, yet also upgradient and sufficiently distant to preclude measurable radon associated with releases from the tailings piles and groundwater treatment/evaporation facilities. The current background radon monitoring station (HMC-16) is sufficiently distant from Site facilities, but fails to meet criteria for similarities in geology and topographical setting. The proposed background station HMC-1OFF meets all of these criteria. Statistical comparisons indicate that radon levels at HMC-16 belong to a different population of background values relative to stations located within the alluvial plain (Section 3.3.1).

Both NRC and EPA have previously suggested that station HMC-1OFF alone may not be representative of Site background conditions as some Site perimeter monitoring stations have lower average radon concentrations than those observed at HMC-1OFF (USNRC, 2016; USEPA, 2013). Weighted averaging of results for multiple offsite monitoring locations has been suggested to address this issue. However, slightly lower concentrations at perimeter monitoring stations can be linked to past cleanup of windblown soil contamination and/or excavation of borrow materials in these same areas (see Sections 3.2 and 3.3). Because station HMC-1OFF and the two downgradient stations used to estimate public dose (HMC-4 and HMC-5) are located outside areas of past remedial disturbance (Figure 5), each of these stations are centrally located within the width of the alluvial plain, and each of these stations have similarly elevated terrestrial gamma radiation levels, it follows that the average radon concentration at station HMC-1OFF

alone should provide a more representative measure of true background radon with respect to annual public dose estimation and reporting per 10 CFR 40.65 requirements.

The net differences between long-term average measured radon concentrations at upgradient background location HMC-1OFF and downgradient station HMC-5 are reasonably comparable to the results of MILDOS modeling to estimate effluent radon levels at HMC-5 based on measured radon flux from the tailings piles. This comparison is consistent with the ISG Radon Guidance to "confirm or compare" measurement and modeling results, and the observed degree of agreement should support a decision to move the background station to location HMC-1OFF. The numeric discrepancy between measured and modeled values will be much larger if HMC-16 continues to be used as the background monitoring station, and to a lesser extent, the same is true if weighted averaging with other offsite stations is used to artificially dilute (lower) the applicable background radon concentration for calculation of public dose.

Finally, because public dose from radon is estimated/reported annually based on only four quarters of monitoring data, and given the expected temporal/spatial variability in local background levels along with the inherent uncertainty in passive track-etch detector technology, in any given year, measured net effluent radon levels may be inconsistent with expectations based on long-term averages, and calculated public doses from radon may be affected.

5. Conclusions

- The CSM described in Section 2 is well supported by current/historical data from routine radon monitoring, data from special radon studies, and data from recent gamma radiation surveys. The CSM includes two generalized assumptions concerning sources and behavior of radon in the vicinity of the HMC Site:
    - Migration of the highest diurnal concentrations of radon from distant source areas is driven primarily by topography and downgradient air flow under stable atmospheric conditions.
    - Radon concentration varies spatially as a function of Ra-226 concentrations in underlying soils and geologic materials.
- Located in hilly terrain about 80 feet above the SMC alluvial plain, current background radon monitoring station HMC-16 is well outside of the low lying influences of the Northwest and SMC drainages, and the radiological properties of local geologic materials differs from the alluvial materials underlying most of the Site. Statistical comparisons indicate that radon levels at HMC-16 belong to a different population of background values relative to stations located within the SMC alluvial plain.
- The proposed upgradient background station HMC-1OFF is located near the middle of northern portions of the alluvial plain, distant enough to preclude measurable impacts from the Site, yet close enough to be representative of the geologic/geomorphic setting in which the Site is situated.

- The nearest member of the public, along with the two radon monitoring stations used to estimate public dose (HMC-4 and HMC-5), are all located downgradient of the tailings piles in the approximate center of southern portions of the SMC alluvial plain.

- Net differences between average measured radon concentrations at upgradient background location HMC-1OFF and downgradient station HMC-5 are reasonably comparable to modeled radon levels at HMC-5 due to effluent releases from the tailings piles (i.e. calculated estimates based on annual radon flux measurements).

- Based on the above findings, moving forward the average radon concentration at station HMC-1OFF should be used to represent background conditions with respect to annual public dose estimation (based on net differences with monitoring results for stations HMC-4 and HMC-5).

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ATTACHMENT 2

NRC Form 313

NRC FORM 313 (10-2017) 10 CFR 30, 32, 33, 34, 35, 36, 37, 39, and 40

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR MATERIALS LICENSE

APPROVED BY OMB: NO. 3150-0120 **EXPIRES: 06/30/2019**

Estimated burden per response to comply with this mandatory collection request: 4.3 hours. Submittal of the application is necessary to determine that the applicant is qualified and that adequate procedures exist to protect the public health and safety. Send comments regarding burden estimate to the Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0120), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

INSTRUCTIONS: SEE THE CURRENT VOLUMES OF THE NUREG-1556 TECHNICAL REPORT SERIES ("CONSOLIDATED GUIDANCE ABOUT MATERIALS LICENSES") FOR DETAILED INSTRUCTIONS FOR COMPLETING THIS FORM: http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/. SEND TWO COPIES OF THE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

APPLICATION FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

MATERIALS SAFETY LICENSING BRANCH
DIVISION OF MATERIAL SAFETY, STATE, TRIBAL AND RULEMAKING PROGRAMS
OFFICE OF NUCLEAR MATERIALS SAFETY AND SAFEGUARDS
U.S. NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS:

IF YOU ARE LOCATED IN:

ALABAMA, CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, FLORIDA, GEORGIA, KENTUCKY, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, NORTH CAROLINA, PENNSYLVANIA, PUERTO RICO, RHODE ISLAND, SOUTH CAROLINA, TENNESSEE, VERMONT, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA,

SEND APPLICATIONS TO:

LICENSING ASSISTANCE TEAM
DIVISION OF NUCLEAR MATERIALS SAFETY
U.S. NUCLEAR REGULATORY COMMISSION, REGION I
2100 RENAISSANCE BOULEVARD, SUITE 100
KING OF PRUSSIA, PA 19406-2713

IF YOU ARE LOCATED IN:

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

MATERIALS LICENSING BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION III
2443 WARRENVILLE ROAD, SUITE 210
LISLE, IL 60532-4352

IF YOU ARE LOCATED IN:

ALASKA, ARIZONA, ARKANSAS, CALIFORNIA, COLORADO, HAWAII, IDAHO, KANSAS, LOUISIANA, MISSISSIPPI, MONTANA, NEBRASKA, NEVADA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, OREGON, PACIFIC TRUST TERRITORIES, SOUTH DAKOTA, TEXAS, UTAH, WASHINGTON, OR WYOMING,

SEND APPLICATIONS TO:

NUCLEAR MATERIALS LICENSING BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
1600 E. LAMAR BOULEVARD
ARLINGTON, TX 76011-4511

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S. NUCLEAR REGULATORY COMMISSION JURISDICTIONS.

1. THIS IS AN APPLICATION FOR *(Check appropriate item)*
   - [ ] A. NEW LICENSE
   - [x] B. AMENDMENT TO LICENSE NUMBER SUA-1471
   - [ ] C. RENEWAL OF LICENSE NUMBER

2. NAME AND MAILING ADDRESS OF APPLICANT *(Include zip code)*

Homestake Mining Company of California
P.O. Box 98
Grants, NM 82070

3. ADDRESS WHERE LICENSED MATERIALS WILL BE USED OR POSSESSED

Homestake Mining Company of California
560 Anaconda Road
Route 605
Milan, NM 87021

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

David W. Pierce

BUSINESS TELEPHONE NUMBER: (505) 287-4456 ext. 34

BUSINESS CELLULAR TELEPHONE NUMBER: (505) 238-9701

BUSINESS E-MAIL ADDRESS: dpierce@homestakeminingcoca.com

SUBMIT ITEMS 5 THROUGH 11 ON 8-1/2 X 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5. RADIOACTIVE MATERIAL
   a. Element and mass number; b. chemical and/or physical form; and c. maximum amount which will be possessed at any one time.
6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.
7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE.
8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.
9. FACILITIES AND EQUIPMENT.
10. RADIATION SAFETY PROGRAM.
11. WASTE MANAGEMENT.
12. LICENSE FEES (Fees required only for new applications, with few exceptions*)
   (See 10 CFR 170 and Section 170.31)
   ***Amendments/Renewals that increase the scope of the existing license to a new or higher fee category will require a fee.**

FEE CATEGORY: AMOUNT ENCLOSED $

PER THE DEBT COLLECTION IMPROVEMENT ACT OF 1996 (PUBLIC LAW 104-134), YOU ARE REQUIRED TO PROVIDE YOUR TAXPAYER IDENTIFICATION NUMBER. PROVIDE THIS INFORMATION BY COMPLETING NRC FORM 531: https://www.nrc.gov/reading-rm/doc-collections/forms/nrc531info.html.

13. CERTIFICATION. *(Must be completed by applicant) THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.*

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, 36, 37, 39, AND 40, AND THAT ALL INFORMATION CONTAINED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.
WARNING: 18 U.S.C. SECTION 1001 ACT OF JUNE 25, 1948 62 STAT. 749 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

CERTIFYING OFFICER -- TYPED/PRINTED NAME AND TITLE	SIGNATURE	DATE
David W. Pierce Closure Manager	David W. Pierce	31 MAR 2020

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	AMOUNT RECEIVED	CHECK NUMBER	COMMENTS
			$		
APPROVED BY				DATE	