UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS TX 75202-2733

February 21, 2014

Mr. Jack Parrott
Senior Project Manager
Decommissioning and Uranium Recovery Licensing Directorate
United States Nuclear Regulatory Commission
Mail Stop T-8F5
11545 Rockville Pike
Rockville, MD 20852

RE: EPA Response to NRC Comments on the Draft Human Health Risk Assessment Report for the Homestake Mining Company Site, NM

Dear Mr. Parrott,

Please find attached the Environmental Protection Agency (EPA) responses to comments submitted by the Nuclear Regulatory Commission (NRC) on the draft Human Health Risk Assessment report. The responses will be available to the public on the EPA website at http://www.epa.gov/region6/6sf/newmexico/homestake_mining/index.html.

If you have any questions please contact me at 214.665.3126.

Sincerely,

Sai Appaji, Remedial Project Manager

Cc: Jesse Toepfer, Homestake Mining Company
Phyllis Bustamante, NMED

EPA Response to NRC Comments on EPA's draft Human Health Risk Assessment, Homestake Mining Co. Superfund Site, Cibola County, New Mexico
February 19, 2014

NRC Comment 1

The Human Health Risk Assessment (HHRA) does not meet the purpose and objectives of conducting the study.

The HHRA scope of work (SOW) states that the purpose is to address concerns raised by the public living adjacent to the Homestake Mining Company of California (HMC) site. The SOW, and Section 2.2 of the HHRA, state that the public is concerned that they are exposed to unacceptable levels of contaminants transported from the HMC site by:

- Spray mist from the evaporation ponds associated with remediation activities;
- Emissions from the large tailings pile (LTP);
- Emissions from the land application of contaminated water;
- Public use of contaminated ground water for cooking showering, washing, etc.;
- Consumption of produce irrigated with contaminated water;
- Consumption of livestock exposed to groundwater in the area; and
- Transport of contaminated soil from the HMC property during flooding.

The SOW also states that the objectives of the HHRA are to characterize and quantify where appropriate, the current and potential human health risks that would prevail if no further action is taken. Section 2.3 of the HHRA further states the environmental question to be addressed is:

What is the increase in lifetime cancer risk to the residents living near the Homestake Mining Site that is attributable to ongoing remediation at the site and can this risk be lowered by using alternate remediation methods or modifying existing remediation methods?

The HHRA does not meet the stated objectives because it does not:

- Estimate the increase in lifetime cancer risk to the residents living near the HMC site that is attributable to ongoing remediation at the site;

EPA Response

EPA disagrees with this comment. The draft report meets the stated objective of evaluating the attribution of risk from the HMC facility and from the background area. The draft HHRA did estimate the increase in lifetime cancer risk to the residents living near the HMC. On page 5-7, 2nd paragraph states "The estimated excess lifetime cancer risk from exposure to radionuclides of potential concern is 2.0×10^{-3}. Background risk was calculated to be 1.5×10^{-3}. This leaves an

excess cancer risk of 5.6 X 10^{-4} after subtracting risk from background exposures that could be site related. It should be noted that EPA evaluates risks with background risks included and not based on risks with background risks excluded. The subtraction of the background levels is for risk managers to distinguish the contribution of background risk to site risk. EPA is limited in its authority to clean up sites beyond background levels even if the risk from background is greater than the upper end of the acceptable risk range of 1 X 10^{-4}. Most of the risk was due to inhalation of outdoor Radon plus its progeny. As discussed in Section 5.2 (Radon Evaluation) of the DHHRA, sampling along a line from an area upgradient from the HMC facility towards to the residential area indicates that the HMC downgradient monitors are impacted by nearby sources of thoron gas (Rn-220), which is an isotope of Radon gas (Rn-222). Given that thoron gas has a half life of 55.6 seconds, it is likely coming from nearby sources such as the large tailing pile, Reverse Osmosis Unit or from water aerosol formed due to spraying of evaporation pond water high into the air.

NRC Comment 2

EPA did not describe how the lifetime cancer risk can be lowered by using alternate remediation methods or modifying existing remediation methods at the site.

EPA Response

The objective of the HHRA was not to identify how the lifetime cancer risk can be lowered by using alternate remediation methods or modifying existing remediation methods at the site, but to identify the current baseline risk. The results of the baseline risk assessment are used to determine whether remediation is necessary, to help provide justification for performing remedial action, and to assist in determining what exposure pathways need to be remediated. Subsequent steps in the Superfund process, namely the Feasibility Study and Record of Decision, focus on evaluating and identifying remedial actions which can be taken to address identified risks.

NRC Comment 3
EPA did not estimate the increase in lifetime cancer risk from spray mist from the evaporation ponds.

EPA Response

EPA disagrees with this comment. EPA determined that the excess cancer risk associated with exposure to radon gas coming from the site is 5 X 10^{-4} after subtracting background levels. The spray mist from the evaporation pond and the large tailings pile were identified as potential radon sources at the site. The purpose of the risk assessment is not to determine how much risk is coming from each separate source, such as the evaporation ponds, but to determine whether

site activities as a whole are attributable to the risk to the community.

NRC Comment 4

EPA did not estimate the increase in lifetime cancer risk from radon emissions from the LTP.

EPA Response

EPA disagrees with this comment. See response to comment 3.

NRC Comment 5

EPA did not estimate the increase in lifetime cancer risk from land application of contaminated water.

EPA Response

The radon air monitors did not show any significant impact from central pivot land application to the five subdivisions. The central pivot land application was identified as potential source for radon gas emission to the nearby subdivision. Source identification was essential for our sampling design to capture potential contaminants coming from these sources. Radon air monitors were placed strategically to pick up any radon gas emission from land application. Also soil samples from central pivot and flood irrigation areas were collected.

NRC Comment 6

Provide a conclusion regarding the transport of contaminated soil from the HMC property during flooding.

EPA Response

The investigation did find that substantial amounts of contaminants were not being transported by flooding from the facility to the residential area. EPA's investigation did not show a decreasing trend from the facility towards the residential area.

NRC Comment 7

As currently written, the report does not provide analyses or conclusions which are informative to the general public, the regulators, or the licensee. To be an informative report for the public, analyses should be performed to: (1) estimate the risk to the

public from background conditions; and (2) estimate the risk to the public from all sources (background plus HMC). The risk estimates should be presented as a range and should provide the results from realistic analyses addressing each of the objectives identified in the SOW.

EPA Response

The risk assessment estimated the risk to the public from all sources and contaminants found at the HMC site including background. It also estimated the risk to the public from background exposures and subtracted the background risk from that which is coming from the Site. This information was presented in Section 5.1.4 (Cancer Risks), Table 5.3 of the DHHRA. EPA followed its Radiation Risk Assessment Guidance for Superfund (RAGS), Part A Chapter 10 in developing this risk assessment. Risk calculations were based on a hypothetical reasonable maximum exposed individual.

NRC Comment 8

The NRC staff does not believe the U.S Environmental Protection Agency (EPA) collected sufficient data, nor performed the analyses required, to successfully achieve the stated purpose and objectives of the HHRA. The staff believes that comments on the details of the HHRA are of limited value because even if EPA addresses all of the detailed comments, the HHRA will not achieve the stated purpose and objectives.

EPA Response

EPA disagrees with this comment. The EPA collected over 1,500 radon samples, 744 soil samples, 26 water samples and 10 vegetable samples. These data were more than sufficient to develop the risk assessment for the site and fulfilled the objective of determining the risk from the ongoing remediation.

NRC Comment 9

The Executive Summary states that EPA considers 10^{-4} to 10^{-6} as an acceptable risk range by which it regulates carcinogens, but does not explain or define what the values in an acceptable risk range mean.

EPA Response

Under Feasibility Study section of the EPA National Oil and Hazardous Substances Pollution Contingency Plan 40 CFR § 300.430(e)(2)(i)(A)(2) it states that " For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response." The range is a one in ten thousand to one in a million probability for a hypothetical reasonable maximum exposed individual to develop cancer at any time during his/her lifetime due to exposure to

site contaminants. See Section 4 (Toxicity Assessment) and Appendix D for more information. The executive summary will be updated to clarify this information.

NRC Comment 10

The Executive Summary does not explain the significance of the calculated cancer risk values or how the calculated increased incidence of cancer risk compares to the national average or to the EPA's calculated cancer risks from the natural background in the vicinity of the HMC site.

EPA Response

EPA disagrees with this comment. The Draft Human Health Risk Assessment (DHHRA) for Homestake calculated a total increased cancer risk for an individual living in the five subdivisions adjacent to the HMC site as 2 in 1,000 (i.e., 2.04 X 10^{-3}). After subtracting risk from background of 1.5 in 1,000 (i.e., 1.48 X 10^{-3}) results in an additional site risk of 5.6 in 10,000 (i.e., 5.6 X 10^{-4}). This means that based on a hypothetical reasonable maximum exposure scenario (30 years of exposure), out of every 10,000 people exposed to site contaminants, there would be an additional probability of 5 to 6 people who may develop cancer in their lifetime that could be associated with the site if no long term action is taken. The EPA considers a probability of 1 in 1,000,000 increased incidence in cancer over a lifetime as a negligible risk. Excess cancer risk between 1 in 10,000 (1 X 10^{-4}) and 1 in 1,000,000 (1 X 10^{-6}) is considered generally acceptable. This language will be included in the Executive Summary.

The national average for the general U.S. population to develop cancer in their lifetime is 1 in 2 for males and 1 in 3 for females. The national average for dying from cancer is 1 in 4 for males and 1 in 5 for females according to U.S. National Cancer Institute's Surveillance Epidemiology and End Results Database for the years 2008 through 2010. This language will be added in the toxicity section of the DHHRA as supplemental information.

NRC Comment 11

The Executive Summary should provide conclusions based on data and analysis for each of the HHRA objectives and public concerns identified in the SOW and Section 2.2 of the HHRA.

EPA Response

EPA disagrees with this comment. The executive summary provided the estimated excess cancer risk from direct and indirect exposure to soil, indoor air and outdoor air and water. It included estimated risks for a current and future land use scenarios for a residential and agricultural land uses. The estimated

excess cancer risk from soil and air were included in the summary for the five subdivisions and the background areas and excess cancer risks that are associated with the site. The DHHRA as such has met all its objectives and purposes and answered the health concerns that the public are concerned about from exposure to contaminants in the soil, air and water and estimated the excess cancer risk associated with the Site.

NRC Comment 12

Section 2.1.3 – states that produce samples were collected from vegetable gardens to evaluate risk to homeowners consuming vegetables grown in "contaminated" soil. The HHRA does not specify whether the soil and vegetation samples were collocated. Further, the HHRA does not indicate whether the vegetation was washed or unwashed. It is important to know the analyte concentrations in the soil and plants to determine if the analyte is present from root uptake or surface deposition (e.g., wind erosion, water spray). The HHRA has not demonstrated whether the soil is "contaminated" from HMC activities or just contains natural U.

EPA Response

EPA will emphasize that soil, private well water and vegetable samples were collected from the same house in three out of six houses sampled. See table 2-22 page 2-33.

EPA will add that vegetable samples were washed before they were analyzed.

EPA will clarify in the DHHRA that it ran two types of analysis on the soil data. It ran statistical analysis and also calculated the exposure point concentration (EPC) on the soil data. The DHHRA found that for radionuclides there was no statistical significant difference between the five subdivisions soil and the background soil at the 95% confidence level. However, the calculated exposure point concentration which is the calculated 95% UCL on the arithmetic mean and is used to calculate risk, showed slight difference between the five subdivisions soil radionuclides levels and the background soil concentration. This slight increase in the calculated EPC concentration was attributed to the site.

NRC Comment 13

Section 2.1.3 – states that private well waters were sampled to evaluate additional risk to a future resident who may dig a well and use the water for domestic purposes. Evaluating risk from the use of well water is not justified because; (1) all residents have been hooked up to city water; (2) the HHRA is supposed to be limited to evaluating the risk to residents during remediation of the HMC site; and (3) any evaluation of risk to future residents should be based on water quality which will be present at the time of license termination.

EPA Response

EPA disagrees with this comment. Evaluating risk from the use of well water is justified because:

(1) There is a potential for a new resident moving into the community and installing his own private well and use it for domestic purposes. Although New Mexico Office of State Engineer issued a health advisory to prevent people from installing a private well it is possible that a future resident may install the well and use it for domestic purpose.

(2) The HHRA evaluates potential risk from activities that could change in the future. Such as a change of current land use or any future activity that might change current exposures.

(3) The EPA uses current water quality data and a reasonably maximum exposed individual to calculate future risks.

NRC Comment 14

Section 2.3 – The HHRA does not address the "environmental question being asked." Section 2.3 states that the "environmental question being asked" is, "What is the increase in lifetime cancer risk to the residents living near the Homestake Mining Site that is attributable to ongoing remediation activities at the site and can this risk be lowered by using alternate remediation methods or modifying existing remediation methods?" The report does not: (1) provide an estimate of lifetime cancer risk associated with exposures prior to initiating the current remediation activities; (2) estimate the increase in lifetime cancer risk to the residents living near the HMC Site that is attributable to ongoing remediation activities at the site; or (3) provide any conclusions about how the risk can be lowered by using alternate remediation methods or modifying existing remediation methods.

EPA Response

1) The draft HHRA based its evaluation of risk on currently available data from samples collected by EPA from both the five subdivisions and the background areas. In the DHHRA, background levels and its associated risks are used to represent levels or conditions before remediation and mill activities.

2) The draft HHRA estimated the increase in lifetime cancer risk to the residents living near the HMC. On page 5-7, 2nd paragraph states "The estimated excess lifetime cancer risk from exposure to radionuclides of potential concern is 2.0 X 10^{-3}. Background risk was calculated to be 1.5 X 10^{-3}. This leaves an excess cancer risk of 5.6 X 10^{-4} after subtracting risk from background exposures that could be site related. It should be noted that EPA evaluates risks with

background risks included and not based on risks with background risks excluded. The subtraction of the background levels is for risk managers to distinguish the contribution of background risk to site risk. EPA is limited in its authority to clean up sites beyond background levels even if the risk from background is greater than the upper end of the acceptable risk range of $1X10^{-4}$. Most of the risk was due to inhalation of outdoor Radon plus its progeny.
3) The results of the risk assessment inform the risk manager what are the current risks and projected future risks. Subsequent steps in the Superfund process especially in the feasibility study focus on evaluating and identifying actions which can be taken to address identified risks.

NRC Comment 15

Section 2.4 states that "[t]he purpose of this Project was to provide gamma count rates to help characterize the HMC site to help determine the extent of contamination and identify areas for further investigation." However, EPA provides no historical data for the site prior to HMC activities that supports a conclusion that the contamination has changed over time.

EPA Response

EPA disagrees with this comment, The purpose of this assessment was to find a trend over distance and not over time. The result of the ERGS scan project achieved its purpose by providing a good picture on the level of contamination downgradient from the site facility but still within HMC property and the extent of the spread of the contamination. The scan also met its purpose by answering the question of whether a concentration trend exist downgradient from the site. It did show that there was no decreasing trend of contamination concentration from the areas close to the sources of contamination down towards the areas close to residential areas. It also was used for further evaluation by directing our soil sampling along the highest four run scan counts. Historical soil data in the reclamation report was initially reviewed and found that it was not collected in a manner that would answer the decreasing contaminant concentration trend question. Therefore, due of unavailability of high quality data from prior to the initiation of remedial activities, not all historical data could be used in the risk assessment. Background levels and its associated risks are used to represent levels or conditions before remediation and mill activities.

NRC Comment 16

Section 2.4 – The conclusions are not consistent with the purpose for performing the ERGs survey. One of the stated purposes of the HHRA is to determine if the residences of the five subdivisions are exposed to unacceptable levels of contaminants transported from the HMC site by spray mist from the evaporation ponds associated with remediation activities.

On page 2-4 it says, "The study did not show a trend that would be consistent with the spraying of contaminated water into the air or mill tailings being carried down gradient or with an overtopping event of the retention/evaporation ponds." This conclusion statement is unclear.

EPA Response

EPA will clarify the statement made in the above comment in the DHHRA. EPA found that molybdenum in soil at the community could be traced back to the very high levels of molybdenum found in the evaporation ponds. Thus the practice of spraying water mist high up into the air is causing molybdenum to show up in the soil of the adjacent community. But the risk from molybdenum exposure was much below levels of concern.

There was no trend of concentrations decreasing over distance from the site close to the onsite sources of contamination (evaporation pond and Large Tailing pile) down to the fenceline of the neighboring communities. This initially showed that there was no trend in gamma scan over distance and indicated that contaminants from the site were not transported to the communities. However, based on soil samples, we found that molybdenum in soil at the community could be traced back to the evaporation pond. Thus the practice of spraying water mist high up into the air is causing molybdenum to show up in the soil of the adjacent community. Although molybdenum could be traced back to the evaporation ponds, the risk to the five subdivisions from exposure to molybdenum in soil was estimated at risk levels much below levels of concern.

NRC Comment 17

The data did not support the author's assumption that the spraying of contaminated water or the overtopping of the retention/evaporation ponds would result in radioactive contamination building up near the evaporation ponds. Nonetheless, the author concluded that the increased count rates are attributable to past milling activities even though the count rates were below 2x background. The background locations shown on the figure indicate that a large portion of the background area is above the 9800 cpm designated as background.

EPA Response

EPA disagrees with this comment. The scan did show that the gamma scan counts per minute were uniformly distributed in the scanned area indicating no trend of contamination over distance away from the sources. However, the increased count rate as compared to the background scanned area clearly show much higher counts per second in the area between the evaporation ponds and the fenceline area on HMC property than the background area. Also during the scan it was noticed that material brought to the surface (by burrowing activity of

gophers) resulted in discrete areas with elevated scans. This higher scan counts over background indicates contamination from previous milling activities just below the surface as a possible source of this continuous uniform higher scan levels.

The background locations shown on the figure averaged 9,800 counts per minute (cpm) and not above 9,800 cpm as stated in the above comment.

NRC Comment 18

Based on the scanning results, there is no evidence to suggest that evaporative spraying or surface water runoff has contaminated the neighborhoods down-wind and down-gradient of the HMC site.

EPA Response

EPA will clarify that although the gamma scan did not show a trend with distance away from the evaporation ponds. But on the other hand, the soil samples showed that molybdenum in soil could be traced back to the very high concentration of molybdenum in the evaporation ponds.

NRC Comment 19

There is no basis provided for selection of the soil background area discussed in this section. Further, it appears from the data that the background area selected has count rates up to 1.5-2 times background. The background area should not be 1.5-2 times background.

EPA Response

EPA disagrees with this comment. The background area averaged 9,800 cps and it was not 1.5 to 2 times background. The basis for the selection of the soil background area was addressed in the risk assessment. Section 2.8, page 2-24 says "The soil background area was selected based on its location. It is located further south from the residential five subdivisions area. It is close enough to have similar soil characteristics and make up as the five subdivision residential area but far enough not to be impacted by releases from the site."

NRC Comment 20

Section 2.5 – As stated in Section 2.4, the main purpose of gamma scanning was to determine if contamination from the HMC site was found off-site on residential property. As noted in Comment 10, scanning did not demonstrate that material from the HMC site was transported into the surrounding neighborhoods and therefore, there is no basis provided for calculating a Derived Concentration Guideline Level (DCGL) for

each residence.

Further, there is no mention of whether these DCGLs are based on the total uranium concentrations collected at the individual residences, or if background uranium concentrations were subtracted from the samples. This designation is needed to understand whether the HHRA is evaluating the uranium concentrations at the sites in general, or evaluating the increased concentrations associated with ongoing remediation activities at the HMC site.

EPA Response

Section 2.5 of the DHHRA included a summary of the Removal Assessment report for the five subdivisions and EPA will revise the text to emphasize that the purpose of the Homestake risk assessment is different from the removal assessment. The Superfund risk assessment does not calculate Derived Concentration Guideline Levels (DCGLs) but evaluates all available pertinent information and considers its use where needed. DCGLs are radionuclide-specific concentration limits used to guide clean-up of a decommissioning site to meet radiological criteria for license termination. It utilizes completely different models than the methods and models used in the Superfund risk assessment. The DHHRA added this section in its risk assessment to provide the risk manager with information from the removal assessment report. It provided information on mine waste material present in some residential yards and recommended soil removal at 48 residences. Note, further assessment by the removal group reduced the number of houses to 19 residences instead of 48 residences.

For more information on the DCGL used in the Removal Assessment report, refer to the following documents: The Removal Assessment Report for Homestake Mining Company, Grants, Cibola County, New Mexico (EPA, 2012) and Protocol for Uranium Homes Site Assessment, Grants Mineral Belt Uranium Project Cibola and McKinley Counties, New Mexico (EPA, 2009). They can be found at the following web address:
http://www.epa.gov/region6/6sf/newmexico/grants/nm_grants_index.html

These documents provide results from the portion of the removal project that applied to homes in the vicinity of the Homestake Uranium Mill. The objective of the removal task was to assess and remove uranium mine contamination from residences and properties in accordance with the process that is described in the EPA 2009. The DCGL was calculated as described in the EPA, 2009 document and was applied to all of the properties that were assessed. Additionally, a description of background considerations is included in EPA, 2009.

NRC Comment 21

Section 2.5 - states that analytical results from each of the 191 soil samples collected and analyzed for total uranium (chemical toxicity) were less than the EPA Regional

Screening Levels (RSLs) action level of 230 milligrams per kilogram (mg/kg). Any DCGL calculated should be based only on any HMC material transported to the soil around the house, not naturally occurring material in the soil.

Section 2.5 provides no demonstration that contaminated material was transported from the HMC site. It says 86 residential properties were sampled, and 48 of these properties had outdoor levels above the DCGL. As stated above, there is no basis for calculating a DCGL for each residence. However, the RA does not show where these properties are located, nor does it say what background was used to determine 15 mrem/yr, above background.

EPA Response

All calculated DCGLs were applied after accounting for background levels. Refer to EPA, 2009 report mentioned above in comment 20 for better description of background considerations.

A DCGL was not calculated for each residence but it was evaluated for each residence assessed. This was done to make sure the assumptions made in calculating the DCGL apply at each residence assessed. The Removal Assessment report provides information on the properties evaluated and their locations and it gives a good description on the background area used to determine a level of15 mrem/yr above background.

NRC Comment 22

Section 2.6.1 – The discussion does not state that radon may also enter residences from the outside air. Outdoor concentrations of radon provide a baseline for indoor concentrations of radon. According to UNSCEAR 2006, outdoor concentrations are affected by the magnitude of the release rate from the soil and atmospheric mixing. Turbulent air mixing will transport radon upwards and away from the ground, whereas atmospheric inversion will trap radon close to the ground. Ref: UNSCEAR, 2009. Effects of ionizing radiation, Volume II. Report to the general assembly with scientific annexe E. UNSCEAR 2006 Report. Vienna: United Nations Office.

EPA Response

EPA agrees with this comment. Additional descriptions will be added to stress the point of outdoor air radon levels and its impact on indoor air radon levels. EPA Region 6 monitored outdoor radon levels in residential yards of houses that were also tested for indoor radon levels. A total of 353 outdoor air monitors were placed in the five subdivisions residential yards. Section 5 of the risk assessment mentions that there are many sources of radon gas to the indoor radon levels in addition to outdoor air radon levels.

NRC Comment 23

Section 2.7.1 – states that the radon background area was selected based on the following criteria; (1) aerial reconnaissance, (2) geological features, (3) soil type, (4) site reconnaissance, (5) historical research, and (6) radiological scanning. Based on these criteria, EPA selected the Bluewater Community as the radon background area. If EPA's selection of the Bluewater Community is technically valid, then there is no technical basis for selecting a separate soil background area, especially since indoor and outdoor radon concentrations are based on geological features, soil type and atmospheric mixing conditions. Furthermore, this section should include the criteria detailed in the referenced draft memorandum evaluation report for the reader.

EPA Response

EPA disagrees with this comment. The soil at Bluewater Village community is not the best location for a background area to the soil at the five subdivisions. Therefore two separate locations were necessary to assess the air radon background level and the soil background level.

Indoor air radon is known to be extremely variable and depends on several factors in addition to soil type. Selecting an indoor air radon background location based solely on surface soil is not sufficient because there are additional radon sources transporting radon through the air. An indoor radon background requires assessing whether 1) the areas are in rural or urban locations, 2) the type of housing, 3) demographic makeup, 4) slab age and condition, 5) HVAC system, 6) house structure, 7) usage factors that influence indoor radon levels, and 8) distance from potential sources of radiation in addition to the geologic, radiochemical, soil gas transport. EPA thus developed the 6 criteria mentioned in your comment and applied the criteria to several communities studied, observed and visited to select the best available background area. The Bluewater Village was selected as the most appropriate indoor radon background location for the five subdivisions.

Because outdoor radon close to the houses represents one of the major sources to indoor radon, indoor monitors and outdoor radon monitors were placed simultaneously for each house that was tested at the five subdivisions and background communities.

To select a soil background location for the five subdivisions, a community of houses was not necessary as was it for the radon study. The soil background was not only for radon gas but also considered other types of exposures such as 1) incidental ingestion of soil, 2) inhalation of soil particulates, 3) external exposure to gamma emissions, 4) soil dermal contact and 5) indirect exposure through consumption of vegetables, meat and milk. Guidance requires that the soil background area should be close enough to the site to have the same soil characteristics but far enough to not be impacted by site related contaminants. The area south of the five subdivisions was selected as the best location for a soil background.

In appendix F of the DHHRA, EPA details the procedures and decisions followed in selecting the best air radon background for the five subdivisions. Reference to Appendix F will be provided in this section of the DHHRA.

NRC Comment 24

Section 2.7.2 – Thoron was only monitored for 2 quarters instead of 4 quarters as required by the sampling plan.

EPA Response

The sampling plan called for four quarters of radon sampling and not thoron sampling. The interest in measuring thoron was in determining the relationship between radon-222 gas and thoron gas, since thoron gas can largely interfere in radon-222 gas measurements. Thoron gas, which is an isotope of radon gas, is usually not tested for in an air radon investigation unless there is a specific reason to do so. By the second quarter of radon sampling, it was evident from incoming results that there was a thoron effect on the radon results. To study the effect of thoron gas on radon, an additional set of sampling was designed for that purpose. A set of radon air samplers, with thoron filters, were placed next to radon samplers without thoron filters. This was done for six months of continuous air monitoring. The DHHRA pointed out the purpose of sampling for thoron gas and presented the impact of thoron gas on both indoor and outdoor radon levels in the DHHRA report.

NRC Comment 25

In addition, no basis is provided for separating the radon data by subdivision. Unless each subdivision represents a separate sample population, the combined results for all subdivisions should be compared against the background data.

EPA Response

EPA will clarify this section to point out that the combined results for all subdivisions were compared to the background data for both indoor and outdoor radon. Section 5.2 page 5-28 for indoor air and page 5-32 for outdoor air details the tests done for combined results.

An analysis of variance (ANOVA) on the whole data set for outdoor radon did show a location effect. To further study which locations were causing the difference, further statistical analyses was done which gave a better understanding of the data and explained the location effect. One of the statistical analyses found that Murray Acre and Pleasant Valley showed a statistical significant difference for radon. Murray Acre and Pleasant Valley are areas

closest to the Large Tailings Pile. This provided one line of evidence that the Large Tailings Pile is contributing to the radon-222 air levels at these two communities, although the contribution is low.

Years of air monitoring by HMC at the fence line showed that there is radon gas over background coming towards the five subdivisions from the Homestake site but at levels which were within NRC radiation limits.

NRC Comment 26

Section 2.7.2 – The text in this section discusses the sampling of indoor radon in the residences of the five subdivisions as well as the background location. Samples were collected to look at both short-term (2 – 6 days) and long-term (1 year) radon concentrations. The HHRA references the descriptive results provided in Tables 2.1 through 2.3. It also states, "although short term radon levels give a good screening estimate of the level of radon in air, ... annual average air radon levels is a better estimate to represent long term exposure due to the inherent variability expected in air radon measurements." The data provided in Tables 2.1 through 2.3 do not differentiate between short-term and long-term data or designate that the data is associated with only one type of sample.

EPA Response

The tables are for the annual average air radon levels. Language will be added to emphasize the point. The annual average air radon levels are better estimate of the long term exposures which are used in the risk assessment.

NRC Comment 27

Section 2.7.2 – When discussing the descriptive statistics for the indoor radon analyses (Table 2-1) the HHRA compares the median indoor air radon data from the subdivisions (1.34 pCi/l) with the generic mean for indoor radon data in the background area (1.25 pCi/l). There is no basis provided for comparing two different statistics.

EPA Response

EPA will add more language to clarify the reason for comparing two differenct averages to the paragraph before Table 2-1 which describes the basis for comparing two different averages. EPA will add that the data were tested for its distribution type first and then based on this distribution the best averages of the two data sets were compared to each other.

NRC Comment 28

Section 2.7.3 – states that 122 radon samples were taken at the HMC fence line. Samplers were located on 12 posts with 2 samplers on each post. The report should specify how 12 post locations with 2 samplers on each post can produce 122 radon samples. Similarly, the report states that 120 samples were collected up- and down-gradient of the HMC site. Samplers were located on 9 posts with 3 samplers per post. The report should specify how 9 post locations with 3 samplers on each post can produce 120 radon samples.

EPA Response

There are 12 posts with 2 samplers per post collected over 4 quarters of sampling events. Fourteen samples were collected with thoron filters and 12 samplers were quality control samples. All add up to 122 samples. That is 12 X 2 X 4 = 96 + 14 + 12 = 122.

There are 9 posts with 3 samplers per post collected over 4 quarters of sampling events. That is 9 X 3 X 4 = 108 and the remaining 12 were quality control samples.

NRC Comment 29

Section 2.7.3 - The data in Tables 2-5, 2-6, and 2-7, do not match the number of outdoor samples taken. It appears that the indoor data was copied to these tables.

EPA Response

EPA disagrees with this comment. The indoor data was not copied to these tables. The outdoor radon at each residence is an average of four quarters of sampling. The total number of the averaged values is consistent with the number of houses sampled. The table contains all five subdivision houses that were sampled and a breakdown of the number of houses sampled in each subdivision. The number of houses that were sampled in the Bluewater Village (background area) were considered separately.

NRC Comment 30

Section 2.7.3 – The number of samples reported in Table 2-8 is not consistent with the text. The table shows 56 samples collected on top of posts and 52 samples collected on bottom of posts. The text says 122 samples were collected at the fence line on 12 posts.

EPA Response

EPA disagrees with this comment. Table 2-8 summarizes the descriptive statistics for the Fenceline monitors. The statistical program uses only valid numbers (i.e. it does not include missing values) before running statistics on

them. Response to comment 28 discusses the 122 samples collected from 12 posts.

NRC Comment 31

Section 2.7.3 – The last paragraph of this section discusses the outdoor data collected from various sites within the HMC property area. No statistical summary tables or conclusions associated with this data are provided as was done for the other outdoor radon sampling data.

EPA Response

EPA agrees with this suggestion and will address this comment in the report. The data were presented in table 5-27. EPA will also include this table in section 2.7.3 of the HHRA.

NRC Comment 32

Section 2.7.4 – It says that 14 groundwater samples were taken from residences that use groundwater for irrigation. Figure 2-4 only provides results for 11 residences.

EPA Response

Fourteen ground water samples were collected from 11 residences. As shown in figure 2-5, three water samples were collected from VV0016 and two samples collected from FA0052, for a total of 14 samples.

NRC Comment 33

The conclusion that the alluvial groundwater is contaminated with radon and therefore has the potential to contribute to indoor air radon levels is unjustified. First, the samples collected were from residences that use the GW [ground water] for irrigation not for domestic use.

EPA Response

Radon gas was measured in the sampled private well waters. Although ground water is currently not used for domestic purposes, at the time the samples were taken one residence was still using it for domestic purposes. In the draft HHRA, under potential future land use, it assumes that an individual might install a private well and use it for domestic purposes sometime in the future. (See response to comment 13). The DHHRA reported the radon levels in the private wells, if used for domestic purposes, could add slightly to the levels of indoor air radon levels.

NRC Comment 34

Second, no information is provided regarding the location of wells sampled – were samples taken in a contaminated area or in a reclaimed area?

EPA Response

Each well water sample has an identifier. For example FA 0052 is for Felice Acres subdivision and the 0052 identifies the house. The alluvial aquifer both under the site and in the five subdivisions was determined to be impacted by the site and is undergoing containment and remediation.

NRC Comment 35

Third, all residences have been connected to the municipal water supply and thus no residences are using contaminated groundwater for domestic purposes. Therefore, this source of potential dose should be removed from the study.

EPA Response

EPA disagrees with this comment. See response to NRC Comment 33.

NRC Comment 36

Section 2.7.5 – This section provides a breakdown of housing types in the five subdivisions. A total of 75 houses were characterized. The number of houses characterized is inconsistent with the number of houses used to collect indoor radon samples (79 houses). The report should be consistent.

EPA Response

EPA disagrees with this comment. EPA did not have data on four of the 79 houses; therefore, this data was not included.

NRC Comment 37

Section 2.8 – There is no basis for the selection of the soil background area. EPA selected Bluewater Village as the radon background area. Since soil type was one the six criteria used for the selection of Bluewater Village as the radon background why was Bluewater Village not considered valid for soil background?

EPA Response

EPA disagrees with this comment. See response to NRC Comment 23.

NRC Comment 38

Section 2.8.1 – The purpose of collecting vegetables from private gardens is to determine if the public is being exposed to unacceptable levels of contaminants transported from the HMC site. Given that the ERGs scan data (reported in Section 2.5) indicates that contamination from the HMC site has not been transported to the adjacent neighborhoods, what is the basis for collecting vegetables from home gardens without first determining whether soil in the garden is contaminated with material from the HMC site or whether the crops were irrigated with contaminated well water?

EPA Response

Section 2.8.1 (Vegetable Samples) discussed what vegetables were collected and what was detected. Section 2.2 (Problem Definition) stated that the purpose of the risk assessment was to address concerns raised by the public including concern from consumption of produce irrigated with contaminated ground water.

NRC Comment 39

Section 2.8.1 – states "Potassium 40 is the radionuclide of interest that did show up in the vegetable samples. Potassium 40 was found also in the soil samples and found in the background soil at the same concentrations." Given that Potassium 40 is not a contaminant from HMC activities (neither in the soil or private well water), then including Potassium 40 as a radionuclide of concern is not consistent with the stated scope and objectives of the HHRA.

EPA Response

EPA disagrees with this comment. The total risk from consumption of home grown vegetables was calculated to be 4.7 X 10^{-5} similar to the risk calculated from consumption of vegetables in background areas. Most of the calculated risk was due to the presence of Potassium 40 in the soil and vegetation of residential gardens. The relatively high concentration of potassium 40 is of interest to the public. In keeping with EPA's transparency policy and in accordance with EPA guidance, especially the Role of Background in the Risk Assessment 2002, EPA revealed that the radionuclide potassium 40 presented a relatively higher risk than other radionuclides in the DHHRA. EPA clearly pointed out that potassium 40 is not site related and is naturally occurring in soil.

NRC Comment 40

Section 2.8.2 – states "About 26 water samples were collected from private wells in the residential area, evaporation pond and collection pond." "About 26" is really not precise enough for a scientific study. Further, Tables 2-19 through 2-21 do not provide data for 26 water samples or even "about 26" water samples.

EPA Response

EPA will remove the word "about" and replace it with EPA collected 27 water samples. There were 14 private well water samples, 5 water samples from collection ponds, 5 water samples from evaporation ponds and 3 from animal water bins for a total water sample of 27. Tables 2-19 through 2-21 did not include water results from the collection ponds and animal water bins.

NRC Comment 41

Section 2.8.3 – states, "Some hazardous chemicals or radionuclides which are known to be associated with the history of operations at the site were not eliminated from the list of potential concern and were included in the risk assessment." There is no valid technical basis for identifying a chemical or radionuclide as a potential concern unless it meets the criteria. If a chemical or radionuclide is present, but at levels lower than in the background area, the chemical or radionuclide should not be included in the risk assessment because the purpose of the study is to determine the risk due to HMC reclamation activities.

EPA Response

EPA disagrees with this comment. EPA has followed its guidance to perform this risk assessment. EPA guidance requires that chemicals or radionuclides which are known to be associated with the history of operations should be retained in the risk assessment. EPA's Risk Assessment Guidance for Superfund (RAGS) Part A section 5.9.1 says under Historical Information, "Chemicals reliably associated with site activities based on historical information generally should not be eliminated from the quantitative risk assessment, even if the results of the procedures given in this section indicate that such an elimination is possible."

The Role of Background in the CERCLA Cleanup Program (April 2002) guidance and policy says "In some cases, the same hazardous substance, pollutant, and contaminant associated with a release are also a background constituent. These constituents should be included in the risk assessment, particularly when their concentrations exceed risk-based concentrations. In cases where background levels are high or present health risks, this information may be important to the public."

NRC Comment 42

Section 2.8.3 – states "The maximum detected value for each of the chemicals or radionuclides were compared with the cancer or noncancer screening value. The screening value is based on the media concentration associated with a one in a million cancer risk or a hazard quotient of 1. If the maximum value is below the screening level, the risk associated with this chemical or radionuclide was considered negligible. However, if the maximum level was higher than the screening level, then each detected chemical or radionuclide was statistically compared to the same compound in the background or reference area." Given the criteria for consideration as a potential concern, why has EPA not determined background values for all chemicals and radionuclides in Tables 2.1.1, 2.1.2 and 2.1.3 of Appendix A?

EPA Response

Table 2.1.1 is for air concentrations. The contaminants of concern in air were determined to be radon and thoron gas. Therefore air was monitored for radon and thoron only and those results were included in the table along with their background levels.

Table 2.1.2 is for well water data. EPA decided not to include ground water background since ground water was found to be impacted by site related contaminants and is currently undergoing containment and remediation to upgradient groundwater contaminant levels. The DHHRA determined the risk from exposure to contaminants in private well waters which includes background levels, to a future resident who decide to install well water in the five subdivisions and start using it for domestic purposes.

Table 2.1.3 is data for measured contaminants in produce samples. No background produce samples were collected because there was no produce in the soil background area. Furthermore, risk from consumption of produce was based on modeling uptake from soil through the roots into plant in the five subdivisions. Risk from background produce consumption was also based on background soil modeling.

NRC Comment 43

Section 3.1.1 – states "In 1990, the mill closed and was decommissioned and demolished. During 1993–1995, the Nuclear Regulatory Commission (NRC) supervised surface reclamation activities at the site." This is incorrect. The mill ceased operations in 1990. The mill operating facilities were decommissioned and demolished between1993 and 1995. The NRC did not "supervise" surface reclamation activities at the site. In 1993 the NRC and EPA signed a Memorandum of Understanding (MOU) designating NRC as the lead regulatory agency for site reclamation and closure activities. HMC decommissioned the mill operating facilities in accordance with NRC License SUA-1471.

EPA Response

Thank you for the clarification. Your suggestion will be considered in our final review.

NRC Comment 44

Section 3.1.8 – states "An area south of the five residential subdivisions was selected as a soil background area to the residential communities. The area is close enough to have same geological and surface soil make up as the five subdivisions but far enough to be impacted by the HMC site related contaminants." There appears to be a typo in the second sentence. The sentence should likely read, "The area is close enough to have same geological and surface soil make up as the five subdivisions but far enough not to be impacted by the HMC site related contaminants."

EPA Response

Agree. This will be corrected.

NRC Comment 45

There is no technical basis for the selection of a soil background area which is different from the radon background area. EPA selected Bluewater Village as the radon background area based on a number of factors including geological features, soil type, and radiological scanning. The report should provide the technical basis for not using Bluewater Village as the soil background area.

EPA Response

EPA disagrees with this comment. See response to NRC Comment 23.

NRC Comment 46

Section 3.1.9 – states, "The sources of contamination to the surrounding communities are the Tailing Piles, Reverse Osmosis Unit, evaporation pond, irrigation fields, and mechanical spraying of contaminated water at the central pivot area. "This statement is not entirely correct. The tailing piles, Reverse Osmosis unit, evaporation ponds, and irrigation fields are potential sources of chemical and radiological constituents of concern from the HMC site. However, based on the sample data provided in the report, there is no basis to conclude that the RO unit, evaporation ponds or irrigation fields have provided contaminants to the surrounding communities. As stated in the Objectives of the HHRA, chemicals and radionuclides present in concentrations at or below background levels are not "contaminants" transported from the HMC site and should not be included in the risk assessment.

EPA Response

EPA disagrees with this comment. Initially EPA identified potential sources of radon emission in developing its sampling design for the radon investigation. The plan identified the tailing piles, reverse osmosis unit (RO), evaporation pond, irrigation fields, and mechanical spraying of contaminated water at the central pivot area as potential sources of radon emission.

The evaporation pond, especially when contaminated water is sprayed into the air, could be contaminating the soil at the five subdivisions. EPA sampling has detected molybdenum coming from the evaporation pond towards the five subdivisions. However, the concentration of molybdenum in the soil at the five subdivisions did not exceed a hazard index of 1 and thus risk from molybdenum was considered negligible.

As for the potential sources of radon emission such as the RO unit, large tailing piles and evaporation ponds, the HMC air monitoring data measured over the past several years consistently show excess radon gas, over background levels, at the fence line monitors closest to the residential units. The HMC reports also show that the levels detected at the fenceline are within NRC limits. EPA's DHHRA determined that a slight increase in the radon risk over background indicates onsite sources such as the RO, large tailing pile and the practice of force spraying of evaporation pond water high into the air are all collectively potential sources of the excess radon into the air.

NRC Comment 47

Section 3.2 – states, "As shown in the tables above in section 2, elevated levels of contaminants were found in yard soil, indoor air, produce private well waters and ambient air." This statement is incorrect. The tables in Section 2 show that chemicals and radionuclides are present in the air, soil and water in concentrations exceeding EPA's screening toxicity values. However, as noted in Comments 19 and 20 above, EPA has not demonstrated that all of the chemical and radionuclides of concern are present in concentrations exceeding background values. For example, in Section 2 it states that indoor air and produce had chemical and radionuclide concentration levels consistent with background and are thus not "contaminants" from the HMC site.

EPA Response

EPA disagrees with this comment. Levels of contaminants above the EPA screening toxicity value are considered elevated and retained in the risk assessment for further evaluation.

EPA policy on background "Role of Background in the CERCLA Cleanup Program" OSWER 9285.6-07P May 2002 states "In some cases, the same hazardous substance, pollutant, and contaminant associated with a release is also a background constituent. These constituents should be included in the risk assessment, particularly when their concentrations exceed risk-based concentrations. In cases where background levels are high or present health risks, this information may be important to the public. Background information is important to risk managers because the CERCLA program, generally, does not clean up to concentrations below natural or anthropogenic background levels." The statement made in section 3.2 is correct and appropriate.

NRC Comment 48

Section 3.2 – states, "Also almost all houses are connected to the Milan municipal water. However, in this risk assessment we evaluate a future resident who might install a private well and use it for domestic purposes. Thus inhalation of volatiles and dermal contact with water is evaluated too." This position is not justified since all residences have been connected to the municipal water supply, so there is no risk from consumption of well water or through inhalation or dermal contact with well water. The HHRA should not consider a future resident scenario because the scope of the HHRA is to evaluate the risk during remediation activities.

EPA Response

EPA disagrees with this comment. Section 6.2.2 page 6-7 of the Risk Assessment Guidance for Superfund (RAGS) part A Volume 1, address this specific situation. It says "Determine if any activities associated with a current land use are likely to be different under an alternate future land use. For example, if ground water is not currently used in the area of the site as a source of drinking water but is of potable quality, future use of ground water as drinking water would be possible." Even if there are institutional control to prevent digging wells for domestic uses at the five subdivisions, the risk assessment guidance requires that EPA develop the potential risk to an individual who might move to the neighborhood and install a well for domestic uses. Although currently New Mexico Office of State Engineer issued a health advisory to prevent people from installing a private well it is possible that a future resident may install the well and use it for domestic purpose. Also remediation has been going on for almost 30 years and will continue.

NRC Comment 49

Section 3.2.1 – states, "Current and potential future residential exposure conditions in the five subdivision areas are expected to be essentially the same. All of the potential exposures considered in this risk assessment may occur at existing

residences and could continue to occur at residences in the future; therefore, no fundamental changes in the types of exposure that may occur are expected." This assumption is incorrect and results in an unrealistic dose to the public in the future. When groundwater reclamation is complete (currently scheduled for completion in 2022), the final cleanup standards will reduce radon emissions from the tailings piles due to the installation of the final radon barrier and cover, and the reduce groundwater contaminant levels in the alluvial and Chinle aquifers to the levels provided in License Condition 35 of NRC License SUA-1471.

EPA Response

EPA disagrees with this comment. The risk assessment does not consider effects of remedial activities on the site. This can be measured later when remediation is completed and confirmation sampling indicates the site met its remedial action objectives. The data collected from the site is used to find current risk and is projected 30 years in the future for a residential land use scenario. The remediation activities have been going on for almost 30 years will continue. See previous response regarding the application of EPA guidance and the characterization of potentially exposed population for current and potential future land use.

NRC Comment 50

In addition, EPA's determination of future risk is inconsistent with the objective of the HHRA which is to evaluate the risk to public health during remediation activities at the HMC site. Based on the current reclamation schedule for the HMC site, the exposure durations assumed for a resident (30 years) and for a farmer (40 years) have no technical basis.

EPA Response

EPA disagrees with this comment. See response to comments 48 and 49.

NRC Comment 51

Section 3.2.2.1 – states, "Because the exposure point concentrations calculated for some of the COPC and ROPCs for the Five subdivisions area were close to or below the exposure point concentration for the reference background area, the exposures and risks were calculated for residents of both the five subdivisions and for a hypothetical reference area located further south of the five subdivisions for comparisons. EPA guidance RAGS-HHEM (EPA 1989) recommends that the 95% upper confidence limit (UCL) of the arithmetic mean concentration be used as a conservative estimate of the average concentration in an exposure area for the purpose of estimating reasonable maximum exposures and risks." Did EPA use 95% upper confidence limit (UCL) of the arithmetic mean concentration to calculate the hypothetical risks to members of the reference area for comparison with the five subdivisions? If not, please provide the

technical justification for not following the guidance in RAGS-HHEM (EPA 1989).

EPA Response

Yes EPA used the 95% upper confidence limit of the arithmetic mean concentration to calculate the hypothetical risks to members of the reference area.

NRC Comment 52

Section 3.2.2.1 – states, "Evaluation of risk was calculated for a future resident who moves into the community and decides to dig a well and use its water for domestic purposes." EPA's evaluation of future risk is outside the scope of the RA. Further, any evaluation of the risk to public health after remediation is complete should be based on lower emissions from the tailings piles and reduced concentrations of contaminants in the groundwater.

EPA Response

EPA disagrees with this comment. See response to comment No. 33.

NRC Comment 53

Section 3.2.2.2 – states, "The reasonable maximum exposure duration for a resident is assumed to be 30 years which is the 90th percentile length of time people live in the same residence and for agricultural scenario the RME exposure duration is assumed to be 40 years. For the age-integrated receptor, 6 of those years are assumed to be as a young child, 1 to 6 years of age, the remaining 24 years are assumed to be as an adult in a residential scenario or 34 years in an agricultural scenario." EPA's determination of future risk is inconsistent with the objective of the HHRA which is to evaluate the risk to public health during remediation activities at the HMC site. Based on the current reclamation schedule for the HMC site, the exposure durations assumed for a resident (30 years) and for a farmer (40 years) have no technical basis.

EPA Response

EPA disagrees with this comment. See response to comment No. 33.

NRC Comment 54

Section 3.2.3 – indicates that the equations for radionuclides of potential concern (ROPCs) are from the Preliminary Remediation Goal (PRG) for Radionuclides calculator at http://epa- prgs.ornl.gov/radionuclides/. The HHRA should note that the equations associated with the PRG for Radionuclides are not exactly the same as the

formulas used in the HHRA and that modifications to the equations are needed in order to perform the necessary calculations.

EPA Response

EPA disagrees with this comment. The equations are the same. However, they are readjusted to calculate the risk instead of the PRGs. All equations that were used in the exposure calculations were included in section 3.

NRC Comment 55

Section 3.3 - From the perspective of the general public, it is difficult to understand how the "Intake/Exposure Concentration" values are calculated for each of the radionuclides and each of the pathways. A list of radionuclide-specific decay constants (identified as λ [lambda]) and area concentration factors (ACF) are not provided. In order to aid the public in understanding how the cancer risk is calculated, the HHRA should include both the radionuclide decay constants and the ACFs used as well as provide an example of how the formulas are used to calculate the cancer risk. It should also be noted that the values listed for "Intake/Exposure Concentration" for most pathways have the units pCi and are technically not concentrations.

EPA Response

EPA disagrees with this comment. All data and parameters used in the equations are provided in the report or are referenced to their original sources. An example of how the formulas are used to calculate cancer risk will be presented.

NRC Comment 56

Section 3.4 – The link provided for the Radionuclide ARAR Dose Compliance Concentrations (DCCs) for Superfund calculator (http://epa-dccs.ornl.gov/radionuclides/) does not work. Access was obtained by using the link: http://epa-dccs.ornl.gov/cgi- bin/dose. This broken link was also included in Section 5.1.6 of the HHRA.

EPA Response

EPA will recheck and make sure that the link is functional. The following link http://epa-dccs.ornl.gov/ will also redirect the user to the DCC calculator.

NRC Comment 57

Section 5.1.2 – states, "Government agencies typically regard cancer risks less than 1 x 10^{-6} as de minimis and consider risks between 1 x 10^{-6} and 1 x 10^{-4} to be within a

generally acceptable range. These regulatory risk levels have been adopted by the EPA Superfund program." Please define which government agencies EPA is referring to. These are not the accepted levels of risk to NRC.

EPA Response

EPA National Oil and Hazardous Substances Pollution Contingency Plan 40 CFR § 300.430(e)(2)(i)(A)(2) states that " For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response." The report reflects EPA's acceptable risk range for CERCLA sites.

NRC Comment 58

Section 5.1.3 – The table showing risk summary for residents living in the subdivisions includes exposure from private well water. All residents are connected to municipal water supply so there is no exposure from private well water use. Further, if EPA must include exposure from well water use, exposure from background well water use should also be evaluated and subtracted from the risk to the public living near the HMC site.

EPA Response

EPA disagrees with this comment. The shallow alluvial groundwater under the HMC site and the HMC neighborhood downgradient from the site was found to be contaminated with radionuclide and metals associated with the HMC site and from areas upgradient of the HMC site. In the DHHRA it states that for groundwater exposure, residences in the neighborhood of the HMC site are currently connected to city of Milan municipal water system and there is no exposure to groundwater. Under the future exposure scenario, the DHHRA assumes the potential exposure to a new resident moving into the community and installing private water well for domestic uses. This is done to inform the public about the level of risk associated with using well water for domestic purposes. Although New Mexico Office of State Engineer issued a health advisory to prevent people from installing a private well it is possible that a future resident may install the well and use it for domestic purpose. (See also response to comment 48).

NRC Comment 59

Section 5.1.4.1 – states, "The risk was primarily due to external exposure to radium - 226+D (Ra-226 plus its daughters) which posed a risk by itself of 1.9×10^{-4} (Table 5-1)." Progeny is not included. In the background area, RA-226 plus daughters plus progeny is used. No technical basis is provided for including progeny in the background area.

EPA Response

EPA disagrees with this comment. EPA has used Ra-226 plus its daughter products in both areas. Section 5.1.4.1 page 5-6 says that in the background area, "Ra-226 plus its daughters or progeny . . ." The word "daughters" and the word "progeny" means the same thing.

NRC Comment 60

43. Section 5.1.4.1 – states that "... the purpose of this risk assessment which also evaluates potential future risk ..." as a justification for considering exposures associated with groundwater from private wells. This HHRA, however, was developed to consider risks associated with current activities, as mentioned in Sections 2.2 and 2.3. It should also be noted that, aside from dose calculations provided with the RESRAD results, no other data or conclusions related to future risks associated with other potential exposure pathways (e.g., inhalation, ingestion, consumption of food products, etc.) are discussed in the HHRA.

EPA Response

EPA disagrees with this comment. In the Superfund program, the exposure assessment involves developing reasonable maximum estimates of exposure for both current land use conditions and potential future land use conditions at each site. The exposure analysis for current land use conditions is used to determine whether a human health or environmental threat may be posed by existing site conditions. The analysis for potential exposures under future land use conditions is used to provide decision-makers with an understanding of exposures that may potentially occur in the future. The feasibility study will use information given in the risk assessment for considering remedial action at the site. Section 3.1.6 of the DHHRA says that future land use is expected to continue to be the same as is currently used and notes that there is one residence in Valle Verde that was still using private well water for domestic purposes. Although New Mexico Office of State Engineer issued a health advisory to prevent people from installing a private well it is possible that a future resident may install the well and use it for domestic purpose. (See also response to comment 48)

The risk from exposure to contaminants through the inhalation, ingestion and consumption of produce was evaluated based on the assumption that current conditions will remain the same into the future. However, reduction of contaminant concentrations due to radionuclide specific decay constants was considered in the exposure equations.

NRC Comment 61

Section 5.1.4.1 – With regards to exposures associated with groundwater from private wells, the HHRA should have addressed the decreased contaminant concentrations that will exist in the future as a result of current remediation activities on the site.

EPA Response

EPA disagrees with this comment. See response to comment 35.

NRC Comment 62

Section 5.1.5 - Further clarification is needed regarding the role Potassium-40 (K-40) plays on the dose received and the cancer risk to the public in the five subdivisions. As noted in Table 2-22, K-40 is identified as a radionuclide of potential concern (ROPC), but it was not included in the RESRAD analyses performed by the EPA. Section 5.1.5 discusses the use of the EPA Radionuclide PRG calculator to estimate the risk from ingestion of home grown produce. Results show that the total cancer risk from ingestion of home grown produce in the five subdivisions was 4.7×10^{-5} with K-40 posing the highest risk (3.4×10^{-5}). However, the results from evaluating the background site show that the risk from ingestion of home grown produce is 5.1×10^{-5} with K-40 posing a risk of 3.8×10^{-5}. A comparison of these results show that the cancer risk attributed to K-40 is higher at the background location as is the overall cancer risk from all ROPCs. Based on these results further justification for including K-40 in the HHRA is needed or it should be removed from consideration as a ROPC.

EPA Response

EPA disagrees with this comment. One of the health problems that the public were concerned about was the consumption of homegrown vegetables from their home gardens. We clearly indicate in the DHHRA that the risk from consumption of homegrown vegetables is slight and it is similar to what is expected from background areas. Potassium 40 was identified as the radionuclide of concern to the public and its risk is associated with its background levels. EPA in its policy on background "Role of Background in the CERCLA Cleanup Program" (OSWER 9285.6-07P) states "In cases where background levels are high or present health risks, this information may be important to the public. EPA, even if the public did not ask for it, is morally obligated to reveal to the public the type of exposures that might pose a potential risk to human health even if it was associated with their background risks. EPA acknowledges the risk from background but cannot cleanup site below its background level.

NRC Comment 63

Section 5.2 – states "... the average radon at the fenceline and at the communities monitors were slightly higher than the upgradient monitors, the statistical tests were unable to pick up the difference at the 95% confidence interval ... This shows that the

impact of the thoron gas coming from the site towards the residential communities is very slight." If there is no statistical difference, what is the basis for concluding that there are any impacts from thoron gas?

EPA Response

The upgradient outdoor radon air monitor locations were selected along a line. The line represents the major potential path along the drainage area towards the HMC site. Radon gas usually follows the drainage pathway and is expected to have the highest levels of radon in that area.

The DHHRA divided outdoor radon into three categories. The purpose of the third category sampling was to compare upgradient outdoor radon air monitor results, which were placed in the highest expected radon levels, to the downgradient outdoor air radon levels from sample locations on the HMC property. These downgradient air monitors did show a significant difference at the 95% confidence interval from the upgradient air monitors indicating a source of radon/thoron coming from the site.

Further statistical analyses were done to compare all outdoor radon data at different locations. Although the statistical analyses did not show a significant difference between upgradient samples and the fenceline samples at the 95% confidence interval level, the average values provide additional information that is used to compare the upgradient to downgradient air monitors. Actually average values are what usually are used to compare levels at the fenceline with a federal standard. Currently HMC is using average values of its radon air monitoring sample results at the fenceline to compare it to NRC acceptable limits. The average values of three upgradient air radon levels in EPA radon study for the DHHRA were slightly less than the average radon value at each of five fenceline air monitors closest to residential areas.

The other line of evidence is the downgradient air monitors which are on HMC property. These downgradient air monitors showed site related sources of radon/thoron upgradient from the fenceline monitors. This finding is consistent with data collected by HMC and reviewed by NRC over the past several years which clearly indicate that there is radon gas coming from the site towards the fenceline but that the levels are below NRC standards.

NRC Comment 64

Appendix A - There are two tables labeled Table 6.4 (see pages A-40 and A-41).

EPA Response

Comment is noted and will be corrected.

NRC Comment 65

Appendix A - The last column in Table 2.1, "Rationale for Selection or Deletion (S)" only provides a basis for excluding a chemical of potential concern; no basis is provided for including the chemicals identified as being of potential concern.

EPA Response

This will be added in the last column in Table 2.1. Selection was based on comparing the maximum value to the screening level. If maximum value is greater than the screening value the compound was selected and if the maximum value is less than the screening value, it was excluded.

Comments Specific to the RESRAD Analyses

NRC Comment 66

The RESRAD (onsite) analyses include modifications to default parameter values for the radionuclide dose conversion factors for ingestion and inhalation as well as the precipitation and irrigation rates. No basis for these modifications is provided.

EPA Response

EPA disagrees with this comment. The precipitation was input as 0.27 meters/yr, which is equivalent to the average precipitation of 10.4 inches per year for the area as mentioned in section 3.1.5 of the draft human health risk assessment. The irrigation rate was assumed to be equivalent to the precipitation rate. No changes were made for the dose conversion factors for ingestion or inhalation. The current and base values for these parameters were consistent with the default values for the RESRAD model.

NRC Comment 67

A review of the RESRAD (onsite) results provided in the HHRA show that analysis of the five subdivisions resulted in peak doses of 1.78E+02 mrem/yr when including radon and background radionuclide concentrations, 4.03E+01 mrem/yr when excluding the radon exposure pathway, and 4.79E+01 mrem/yr when excluding background radionuclide concentrations. No data or RESRAD analyses were provided to show that these values are different from what an individual would have received prior to initiating the current remediation activities.

EPA Response

EPA disagrees with this comment. The RESRAD analyses were based on current soil radionuclide concentrations measured by EPA at the five subdivisions and

the background areas. Background samples were collected for the purpose of presenting conditions before any remedial activities or start up of milling activities.

NRC Comment 68

Doses calculated using RESRAD (onsite) are based on contaminant concentrations and specific parameter values at a specific point in time. Increases or decreases in contaminant concentrations, changes in parameter values associated with various processes that may impact exposure (e.g., contaminant deposition, erosion rate, food consumption rates, etc.), and future activities associated with a specific site are not considered in an individual RESRAD analysis. Taking this into consideration, a review of the RESRAD (onsite) results provided in the HHRA show that analysis of the five subdivisions without including the background concentrations or without including the radon pathway result in peak doses that are calculated to occur at approximately 72 and 23 years, respectively. These time periods are beyond the anticipated 2022 closure date for the site (in 9 years). RESRAD (onsite) doses calculated after 9 years were less than the peak doses discussed above. To more accurately assess the doses to residents of the five subdivisions beyond 9 years, additional samples should be collected and the appropriate RESRAD parameters adjusted. However, this is beyond the scope of the HHRA.

EPA Response

EPA disagrees with this comment. No additional samples are needed for the risk assessment. The RESRAD analysis model runs were based on soil radionuclide concentrations in the five subdivision community and in the background areas. Nuclear Regulatory Commission (NRC) Subpart E section §20.1401 (d) states that "When calculating TEDE to the average member of the critical group the licensee shall determine the peak annual TEDE dose expected within the first 1000 years after decommissioning". Therefore it is expected that NRC will run the RESRAD for the HMC site at the anticipated 2022 closure date. The site has been in a long term remediation state for almost 30 years. EPA ran the RESRAD for 1 year, 3 years, 10 years, 30 years, 100 years, 300 years and 1000 years time intervals (see appendix C). Graphs representing the doses at different time intervals up to 1000 years were provided in the draft human health risk assessment as figures 5-1 and 5-2 which take into consideration the decay of the parent radionuclide concentrations over the years. EPA decided to include RESRAD analysis for NRC and DOE benefit.

NRC Comment 69

In Section 5.1.6.1 EPA estimates the dose (with and without the radon pathway) to the residents of the five subdivisions by subtracting the RESRAD-calculated dose for the background location from the RESRAD-calculated dose for the five subdivisions. This calculation is inaccurate. It does not consider the difference in the radionuclide concentrations and daughter products being used in the RESRAD calculations as well

as the fact that these two peak doses occur at different times. For the scenario in which the radon pathway was suppressed, which is used in the HHRA, the peak dose for the five subdivisions occurred after approximately 73 years while the peak dose for the background area occurred after approximately 2 years. A more accurate way of performing this calculation would be to run the RESRAD analysis subtracting the background radionuclide concentrations from the radionuclide concentrations measured in the five subdivisions and using the difference as the RESRAD input value.

EPA Response

EPA disagrees with this comment. This type of analysis was done In Appendix C page C-88. EPA ran the RESRAD analysis by first subtracting the background radionuclide concentrations from the radionuclide concentrations measured in the five subdivisions and using the difference as the RESRAD input value. The maximum Tdose (t) was 47.9 mrem/year at t = 23.10 years. Most of the dose (79%) was contributed by radon gas. Plant consumption contributed 11% and external ground exposures contributed 9% of the dose. This language can be added in the body of the risk assessment report.