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May 6, 2003

Mr. Ronald R. Bellamy, Chief
Decommissioning Laboratory Branch
Division of Nuclear Materials Safety
Region I
United States Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

040-08980
SMB-1541

Dear Mr. Bellamy:

On January 8, 2003, representatives of Heritage Minerals, Inc. (HMI) and the Nuclear Regulatory Commission's (NRC's) Region I office met in King of Prussia, PA to discuss potential options for completing final decommissioning and decontamination (D&D) activities at HMI's site in Lakehurst, NJ (the "HMI site"). Then, on January 17, 2003, NRC Region I issued a letter requesting that HMI provide a proposed plan and schedule for final D&D activities at the HMI site within 60 days. Pursuant to this request, on March 10, 2003, HMI and its radiological contractor, SENES Consultants, Ltd., submitted a proposed plan and schedule describing the manner in which HMI proposed to conduct final D&D activities at the HMI site in accordance with NRC regulations and HMI's approved D&D plan. On April 9, 2003, representatives of HMI and NRC Region I participated in a telephone conference during which the March 10, 2003 proposed plan and schedule submitted by HMI were discussed. As a result of this telephone conference, modifications to portions of the March 10, 2003 proposed plan and schedule were agreed to by HMI and NRC representatives, which are memorialized in this letter. It was also agreed that HMI should move forward with final D&D activities as soon as possible. HMI hereby provides NRC with this modified plan and schedule which proposes that final D&D activities commence immediately. Indeed, as of the date of this letter, soil sampling and removal has begun at the site.

First, HMI reaffirms that the demolition and decontamination of the wet and dry mill buildings will be done in accordance with the parameters set forth in HMI's March 10, 2003 proposed plan and schedule. HMI has retained a second radiological contractor, Enercon Services, Inc. (ENERCON), located in Murrysville, PA, to manage all decontamination activities associated with the final D&D of the wet and dry mill buildings. HMI plans to provide NRC Region I representatives with regular updates on the mobilization of ENERCON's personnel to the HMI site.

Second, with respect to the fugitive *licensable* source material "pockets" inside the footprint of the former monazite pile storage area, HMI proposes to modify its March 10, 2003 plan and schedule in the following manner. HMI proposes to excavate and ship off-site the fugitive *licensable* source material from the "pockets" identified in the April 10, 2002 ORISE report and the characterization report prepared by Radiation Science, Inc. (RSI) which was submitted to NRC in November, 2002. After removal of the fugitive *licensable* source material in these "pockets," the soils at the bottom of these "pockets" will meet the NRC Branch Technical Position (BTP) standard of 10 pCi/g for total uranium and 10 pCi/g for total thorium as delineated in HMI's approved decommissioning plan. ENERCON will sample the excavated areas after the fugitive *licensable* source material is removed from these "pockets" to ensure that soil concentrations meet the BTP standard.

With respect to the remainder of the surface soils within the monazite pile storage area, HMI asserts that the BTP standard is no longer relevant since all of the *licensed* source material and all collateral surface contamination therefrom have been removed to satisfy the BTP standard. Remaining surface contamination, which was already present prior to the placement of the monazite-rich *product* in the monazite pile storage area, is the result of pre-NRC licensing operations. In support of this assertion, HMI submits the following:

a. Initially, HMI placed 1,400 tons of *licensed* monazite-rich *product* within the confines of the monazite pile storage area prior to complete shutdown of mineral processing operations. This *product* was in drums or under tarpaulins in a fenced-in area. HMI contracted with Environmental Rail Solutions (ERS) to remove and ship all 1,400 tons of monazite-rich *product* to International Uranium (USA) Corporation's (IUSA's) NRC-licensed uranium mill in Blanding, Utah for processing and disposal. During the removal of the *licensed* monazite-rich *product*, the ERS manager, David Ardito, observed that there was a distinct color difference between the monazite-rich *product* and the underlying soils at the HMI site.[1] After the monazite-rich *product* was removed, pursuant to directions from RSI personnel on-site, ERS removed additional soils which, although not having the same color as the *licensed* monazite-rich *product*, nevertheless registered elevated levels of radionuclides and packaged such soils for shipment to IUSA. As a result, approximately 2,630 tons of *licensed* monazite-rich *product and* additional *unlicensed soils* containing monazite were shipped to IUSA. Even assuming that typically contaminated soil removal operations will generate 10-20% more material for removal (i.e., 1,600 tons), a simple *mass balance* calculation suggests that HMI removed a significant amount of material in excess of the *licensed* monazite-rich product placed in the monazite pile storage area by HMI.

b. In order to assess the possible reasons for this significant differential, HMI prepared a Process History which was submitted to NRC in December, 2002. This Process History demonstrates that the soils beneath the former monazite pile storage area

[1] *See* Letter from David Ardito, Environmental Rail Solutions, to Anthony J. Thompson, Counsel to HMI (March 21, 2003)

contained elevated levels of radionuclides before any *licensed* monazite-rich *product* was placed there. These soils were placed on the ground south of the dry mill building, including in the area which would later become the monazite pile storage area, as a result of milling activities over the 13 year operating history of the mills which involved moving millions of tons of material around the site, by slurry, by front-end loaders and graders, as well as by the Mill Shutdown Avoidance Procedures performed by both ASARCO and HMI prior to NRC licensing. With respect to the latter, as explained in the Process History, when any one component of the *dry* mill process malfunctioned or required repair or replacement, both ASARCO and HMI would shut down that portion of the process and feed any in-process material through holes in the wall of the *dry* mill onto the ground and store such material there until it could be re-introduced into the milling circuits or placed in the waste piles by front-end loader. The remaining soils were graded and regraded onto and into the surface and subsurface soils. As a result of this practice, soils containing elevated levels of radionuclides were left in the areas south of the dry mill, including within the footprint of the monazite pile storage area, before any *licensed* monazite-rich product was placed within that footprint.

c. Further, HMI asserts that none of the radioactivity remaining in soils within the footprint of the monazite pile storage area could have been caused by the *licensed* monazite-rich *product* placed there as a result of NRC-licensed activities because the monazite contained in the heavy mineral fraction processed at the HMI site is insoluble and could not have leached into the surface and subsurface soils on which the *licensed* monazite-rich *product* was placed. SENES has prepared a short report, which is attached to this letter, describing the insolubility of these heavy minerals, including the fact that it is very difficult to mobilize these heavy minerals in acid solutions and, for all practical purposes, impossible for them to be mobilized in the natural environment by infiltrating precipitation. Finally, given that no chemicals were used in heavy mineral fraction processing at the HMI site, which could change the natural insolubility of the heavy minerals, no *licensed* monazite-rich *product* placed in the monazite pile storage area by HMI leached into the surface and subsurface soils on which this *product* was placed.

Therefore, based on the mass-balance differential between the amount of *licensed* monazite-rich *product* placed in the monazite pile storage area and the amount of material excavated and sent to IUSA from the monazite pile storage area, the distinguishing color differential between the *licensed* monazite-rich *product* and the underlying soils in the monazite pile storage area reported by Mr. Ardito, the Process History of the HMI site, and the SENES' report regarding the insolubility of the heavy mineral fraction processed, HMI asserts that, after removal of the fugitive *licensable* source material from the "pockets" and satisfaction of the BTP standard in such "pockets," no further remedial action is necessary within the monazite pile storage area and adjacent grids.

Third, with respect to the fugitive *licensable* source material "pockets" south of the dry mill building and outside the footprint of the former monazite pile identified in the aforementioned ORISE and RSI Reports, HMI proposes to modify its March 10, 2003 plan and schedule to allow for the removal of these fugitive *licensable* source material

"pockets" so that soil concentrations at the bottom of these "pockets" satisfy the NRC BTP standard of 10 pCi/g for total uranium and 10 pCi/g for total thorium as delineated in HMI's approved decommissioning plan.

As stated above, HMI has commenced final D&D activities at the HMI site in accordance with its March 10, 2003 plan and schedule and the modifications to that plan and schedule set forth herein. HMI requests that NRC review these proposed modifications and, if NRC finds these modifications acceptable, issue written approval, for the record, as soon as possible. Please feel free to contact me at (202) 496-0780 if you have any questions. Thank you for your time in this matter.

Sincerely,

Anthony J. Thompson, Esq.
COUNSEL TO HMI

Enclosures

environmental rail solutions, inc.

March 21, 2003

Mr. Anthony J. Thompson PC
1225 19th Street NW
Washington, DC 20036

Ref: Heritage Minerals

Dear Mr. Thompson:

Environmental Rail Solutions, Inc. (ERS) was contracted by Heritage Minerals, Inc. (HMI) during the summer of 2001 to excavate, load and transport monazite from a monazite storage pile at its Lakehurst, New Jersey facility. ERS also provided air monitoring and survey analysis on trucks and other equipment for release purposes.

For purposes of ERS' excavation and transportation effort at the HMI site, the amount of monazite material and soil excavated and shipped from the HMI site to International Uranium (USA) Corporation's (IUSA's) site in Blanding, Utah was based on the measurements (in tons) yielded by scales at the IUSA site. These measurements were used by ERS to compile its final transportation charges and by IUSA to compile its final recycling fees for submission to HMI. Based on the measurements from these scales, the excavation of monazite material and soils at the Lakehurst site generated over 2,630 tons of materials. Initially, ERS craft labor was able to identify monazite material requiring removal from the monazite storage pile area because of its distinct color difference from that of soils surrounding and below the monazite material. Craft labor would excavate to the color change line, which was at different levels throughout the monazite storage pile area. After removal of the monazite material, HMI's radiological contractor, Radiation Science, Inc. (RSI) directed the removal of additional soils in and around the monazite storage pile area based on soil sampling.

Please feel free to contact me at (732) 212-8140 should you require further information.

Sincerely,

David A. Ardito
Vice President
Environmental Rail Solutions, Inc.

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22 April 2003

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Attn: Anthony J. Thompson, Esq.

Re: Solubility of the Heavy Mineral Sands at the Heritage Minerals Inc. (HMI) Lakehurst, NJ Site

Dear Mr. Thompson:

This letter is in response to your question about information on the solubility of the heavy mineral sands at the HMI site. I understand that this relates to the issue of potential environmental exposure pathways (if any) to the naturally occurring radioactivity (uranium and thorium series) associated with these materials.

In brief, the heavy mineral fraction of the sands, which contains virtually all of the naturally occurring radionuclides, contains very stable compounds such that the radionuclides are unavailable for transport through the environment (e.g. leaching to groundwater or chemical uptake by vegetation). Similarly, relative to potential air exposure pathways, the release of radon from the heavy mineral fraction is much lower than the release of radon from typical soils (Kerrigan and O'Connor 1990, Harrington 1993).

Solubility/Stability of Heavy Minerals

The heavy minerals at the HMI site (e.g. monazite, zircon, rutile, ilmenite, leucoxene) are of a type(s) which are stable chemically and physically such that, after their initial formation, the contained radionuclides do not leave the mineral structure under normal environmental conditions. The minerals zircon, rutile, and monazite are primary minerals that form in igneous or metamorphic environments associated with orogenesis or mountain building. The latest mountain building event in the Appalachian region ceased around 250 million years ago. These minerals originated from this latest orogeny at least 250 million years ago and were subsequently transported and deposited as marine sand. The fact that these minerals still exist in their primary form demonstrates their stability.

The mineral zircon is noted for its stability and is used to date orogenic events as it does not change with time. Zircon minerals can be dated more than 2 billion years into the past based on the relationship between the activities of uranium and lead radionuclides within the zircon. Zircons are

even resistant to chemical breakdown in hydrochloric acid and often require the more aggressive hydrofluoric acid to dissolve minerals and release radionuclides. Titanium bearing minerals, particularly titanium oxides such as rutile, are commonly recognized by geochemists as being immobile. As a result, titanium abundances are used to normalize against alteration, weathering and metal mobility under that premise that as other minerals undergo alteration, titanium oxides remain unchanged. The method, known as Gresens method, allows quantitative study of the volume change and the mass transfer of chemical components in rocks during alteration processes (Gresens 1967) and has also been applied to acid mine drainage settings (Appleyard and Blowes 1994). The minerals ilmenite and leucoxene are secondary minerals composed mainly of secondary iron oxides such as goethite and titanium oxides such as rutile. Goethite, the most common iron oxide in soils, is extremely stable under atmospheric conditions.

These heavy minerals are therefore considered stable under environmental conditions and are not available for chemical uptake by vegetation or leaching to groundwater. This is consistent with the NRC's statement that heavy minerals at the HMI site are stable and that water samples show no increase in radioactive contamination (NRC 1993). More recent groundwater measurements at the HMI site show radionuclide concentrations at background levels and, therefore, it can be concluded that the dissolution of radionuclides is not occurring (CDM 1998).

The insolubility of heavy minerals results in secular equilibrium of the radioactive decay series with the radionuclides remaining within the matrix. Thorium series equilibrium was investigated in a typical Western Australian monazite, and it was concluded that secular equilibrium could be assumed when estimating individual radionuclide activity in monazite from the gross alpha activity (Kerrigan and O'Connor 1990).

Finally, it should be remembered that the heavy minerals were separated from the sands in which they occurred by physical processes only including gravity separation, electrostatic and electromagnetic methods. The heavy mineral sands have never been chemically processed or altered relative to their original, natural setting.

I trust that this information is sufficient. Please contact us if you require further information or have any questions on the material presented in this letter.

Yours truly,

SENES Consultants Limited

Leo M. Lowe, Ph.D
Principal, Senior Health and
Environmental Physicist

Cc: E. Hovnanian, HMI

REFERENCES

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