

APR 29 1992

040-08980  
Extra  
SMB-1541

MEMORANDUM FOR: Ronald R. Bellamy, Chief  
Nuclear Materials Safety Branch, RI

FROM: John E. Glenn, Chief  
Medical, Academic, and Commercial  
Use Safety Branch  
Division of Industrial and  
Medical Nuclear Safety, NMSS

SUBJECT: TECHNICAL ASSISTANCE REQUEST: HERITAGE MINERALS INC.,  
DISPOSAL PLAN FOR MONAZITE

I am responding to your technical assistance request dated September 3, 1991 (Enclosure 1) and supplemental information provided by you dated January 9, 1992 (Enclosure 2) concerning Heritage Minerals Inc. disposal of monazite sands. The February 28, 1992 memorandum for John Hickey, Chief, Fuel Cycle Safety Branch, from John Austin, Chief, Decommissioning and Regulatory Issues Branch, (Enclosure 3) presents RESRAD computer results for intruder total effective dose equivalents and the recommendation to dispose of the monazite sands at a commercial disposal facility.

During an April 8, 1992 meeting with Mr. Robert M. Bernero, Director, Office of Nuclear Material Safety and Safeguards, the following was determined:

a. Based on the February 28, 1992 memorandum, dilution of the monazite sands with the "processed sands" is contrary to current policy and, in consideration of the projected total dose equivalent limits, could not be considered.

b. Heritage Minerals, Inc. should dispose of the licensed source material (monazite sands) at a commercial disposal site.

c. Prior to providing the information to the licensee, the Region, with a representative from Headquarters, should meet with the State of New Jersey to: 1) discuss the recommendations for proper disposal of the monazite sands and stabilization of the processed sands, 2) review the projected intruder dose assessments for monazite and processed sands, 3) explain the Commission policy and concern that any other decision would have set a precedence for this type of licensee, and 4) offer to assist the State in dialog with the licensee concerning the decisions. You should advise the State, as you have in the past, that the processed sands based on the computer dose assessment constitute a concern which is not under our jurisdiction and we are merely offering them limited technical assistance in the form of dose assessments for the processed sands.

136715

NMSS/RONI MATERIALS-002

APR 29 1992

If you have any additional questions, please contact Ms. Patricia Santiago at FTS (301) 504-2632.

15/

John E. Glenn, Chief  
Medical, Academic, and Commercial  
Use Safety Branch  
Division of Industrial and  
Medical Nuclear Safety, NMSS

Enclosures:

- 1. TAR, dtd 9/3/91
- 2. Memo, dtd 1/9/92
- 3. TAR, dtd 2/28/92

DISTRIBUTION: IMAB-575 Final Response

PSantiago	NRC File Center	TAR r/f
JEGlenn	RECunningham	JGreeves
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\*SEE PREVIOUS CONCURRENCE

OFC: IMAB*	:IMAB*	:IMAB	:OGC*	:IMSB*	:LLRB*
NAME: PSantiago	:MLamastra	:JEGlenn	:RFonner	:JHickey	:JAustin
DATE: 04/20/92	:04/20/92	:04/21/92	:04/28/92	:04/22/92	:04/28/92

If you have any additional questions, please contact Ms. Patricia Santiago at FTS 964-2632.

151

John E. Glenn, Chief  
Medical, Academic, and Commercial  
Use Safety Branch  
Division of Industrial and  
Medical Nuclear Safety, NMSS

Enclosure:  
Memorandum; dtd  
February 28, 1992

DISTRIBUTION - *IMAB 575 Final Response*

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JAustin, LLRB	JHickey	JSwift
YFaraz		

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NAME: PSantiago	:MLamastra	:JEGlenn	:RFonner	:JHickey	:JAustin
DATE: 04/10/92	:04/10/92	:04/10/92	:04/10/92	:04/22/92	:04/28/92

MEMORANDUM FOR: Charles Haughney, Chief  
Fuel Cycle Safety Branch  
Division of Industrial and  
Medical Nuclear Safety, NMSS

SEP 2 1991

Paul H. Lohaus, Chief  
Low-Level Waste Management Branch  
Division of Low-Level Waste Management  
and Decommissioning, NMSS

FROM: John E. Glenn, Chief  
Medical, Academic, and Commercial  
Use Safety Branch  
Division of Industrial and  
Medical Nuclear Safety, NMSS

SUBJECT: TECHNICAL ASSISTANCE REQUEST: HERITAGE MINERALS, INC.  
DISPOSAL PLAN FOR MONAZITE SAND

Enclosed is a copy of a Technical Assistance Request (TAR) from Region I regarding the Heritage Minerals, Inc., request which proposes on-site disposal of monazite mineral sands by returning the monazite material to the host material from which it was derived. Region I indicates the licensee also intends to place a deed restriction on the property, cover the sand with a layer of soil, and use the area as a golf course.

The mixing proposed will result in a final average concentration of approximately 130 pCi/gm. The mixing is contrary to current policy, however, we believe the proposal has merit and should be considered. The Fuel Cycle Safety Branch Technical Position Option 4 may allow approval of the licensee's request with submission of additional information. The additional information needed includes on-site characteristics, material sampling and analysis methods, depth of on-site burial and soil layer, State and local government view on the proposal, doses to members of the public, and projected costs of disposal options. After review of this additional information, we believe the action may meet the criteria for a categorical exclusion stated in 10 CFR 51.22(c)(14)(xvi).

We would appreciate your review of the information submitted and any recommendations you have regarding the licensee's request. Further, if you agree with the proposal, we would appreciate your comments on additional information needed.

If you have any questions, please contact Patricia Santiago on Ext. 20632.

~~Handwritten Signature~~  
John E. Glenn, Chief  
Medical, Academic, and Commercial  
Use Safety Branch  
Division of Industrial and  
Medical Nuclear Safety, NMSS

Enclosure: As stated

Distribution IMAB-575 PARTIAL RESPONSE

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09/ /91

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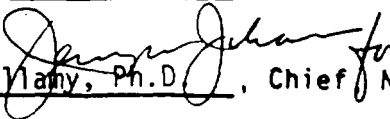
IMAB575

Enclosure 1

REQUEST FOR TECHNICAL ASSISTANCE

DATE: 9-3-91

TO: John E. Glenn, Ph.D., Chief, Medical, Academic, and Commercial  
Use Safety Branch, NMSS

FROM: Ronald R. Bellamy, Ph.D., Chief  Nuclear Materials Safety and  
Safeguards Branch, Region I

LICENSEE: Heritage Minerals, Inc. LICENSE NO.: SMB-1541

- Control No. \_\_\_\_\_ (enclosed)
- Letter dated \_\_\_\_\_ (enclosed)
- Suggested change in licensing procedure (enclosed)
- Other (see remarks)

Problem/Issue: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Action Required: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Alternatives Considered: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Recommended Alternative: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Remarks: See Attached Memo  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Regional Reviewer: Betsy Ullrich  
Reviewer Code: Q-5  
Reviewer Phone No.: FTS 346-5040



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION I  
475 ALLENDALE ROAD  
KING OF PRUSSIA, PENNSYLVANIA 19406-1415

SEP 03 1991

License No. SMB-1541  
Docket No. 040-08980  
Control No. 114515

MEMORANDUM FOR: John E. Glenn, Chief  
Medical, Academic and Commercial USC  
Safety Branch, NMSS

FROM: *for* John D. Kinneman, Chief *JDK*  
Nuclear Materials Safety Section B

SUBJECT: HERITAGE MINERALS, INC., DISPOSAL PLAN FOR MONAZITE  
(TECHNICAL ASSISTANCE REQUEST)

Heritage Minerals, Inc. discontinued operations in July 1990, and state they have decontaminated their building and equipment in accordance with their license. They estimate that 695 cubic yards of monazite rich sand remain on site. This monazite sand contains about 2,000 picocuries of thorium-232 per gram (based on analysis for actinium-228) and a dry density of the dry monazite sand is approximately 2.7 grams per cubic centimeter.

Heritage proposes in their letter dated February 28, 1991 that this sand be remixed with the estimated 102,500 cubic yards of processed sand located in the salvage storage, recycled tailings, and original new feed areas (also known as the blue and gray areas, after the coloring of maps they have previously submitted). The sand in these areas has an average concentration of 112 picocuries thorium-232 per gram and an average density of 1.5 grams per cubic centimeter. This processed sand is less than 0.05 percent source material by weight and is not licensed by the NRC.

The monazite sand resulted from separation of the monazite rich sands from previously processed sand from subsurface deposits. The licensee has been unable to sell the monazite sand and proposes on-site disposal by mixing it with the other sand tailings. The licensee intends to also submit a proposal to the State of New Jersey Department of Environmental Protection to place a deed restriction on the property, cover the sand with a layer of soil, and use the area as a golf course. This approach will dispose of both the NRC licensed sand and the sand of much lower thorium concentration about which NJDEP is concerned.

We see these alternatives:

1. Reject the proposal out of hand. "Dilution is no solution to pollution";
2. Request that the licensee submit the information required by 10 CFR 20.302;
3. Permit the activity with appropriate controls on the final concentration.

John E. Glenn

2

Region I favors the third option. The monazite sand came from the sand which the licensee proposes as a diluent. The final concentration in the 102,000 cubic yards will be increased by about 15 picocuries per gram to about 130 picocuries per gram. While this does not meet the Branch Technical Position, it is not different from the situation at the beginning of plant life.

We would appreciate policy guidance on this matter.

John D. Kinneman, Chief  
Nuclear Materials Safety Section B  
Division of Radiation Safety  
and Safeguards

Enclosure: Letter dated February 28, 1991

040-08980

*Heritage Minerals, Inc.*

ROUTE 70 MILE MARKER 41  
P.O. BOX 12, LAKEHURST, NJ 08733  
201-657-9022 FAX 201-657-5184

February 28, 1991

Mr. Frank Costello  
U. S. NUCLEAR REGULATORY AGENCY  
Region I, 475 Allendale Road  
King of Prussia, PA 19406

Re: U.S. NRC LICENSE # SMB-1541

Log	Ray 4 I
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Fee Category	14 2C
Type of Fee	AMD
Date Check R	
Date Complete	5/3/91
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Dear Mr. Costello:

Heritage Minerals has recently been issued the above referenced license for the possession of thorium, natural thorium, and uranium. Since this material was concentrated from non-source material as a byproduct of a minerals separation process which is no longer being performed, the 695 cubic yards currently on-site is the total amount Heritage Minerals will possess. The final disposal cost for this material was not considered in the design of our operation because a license was not issued at the onset, and we were not aware that our process would produce material of sufficient concentration to be categorized as source material. However, Heritage Minerals wants to comply in a responsible manner to all environmental, health and safety issues concerning the proper post-operational condition of our site.

Our operation has been shut down since July 1990 and we do not foresee any future work at this site which would produce additional source material. Therefore, we have prepared the attached "flow sheet" that will enable Heritage Minerals Inc. to dispose of the currently stockpiled thorium and uranium rich residual heavy minerals sand. This proposal for on-site disposal is subject to N.R.C. approval under the provisions of 10CFR 20.302.

In summary, our proposal entails returning the 695 cubic yards of monazite material to the 102,500 cubic yards of host material from which it was derived.

The operation is expected to take thirty weeks to complete.

The firm of Teledyne Isotopes of Westwood, New Jersey, will be retained to assist Heritage in the implementation of sampling procedures and they will generate all the required analyses.

On completion of this operational phase and all decontamination procedures, Teledyne Isotopes will conduct the required surveys and provide any necessary documentation for Heritage's N.R.C. license termination.

Should this proposal for on-site disposal of the monazite mineral sands meet with your approval, we will submit the N.R.C. form 313 for license amendment together with any additional information or criteria that you may require.

RECEIVED  
 91 APR 29 10 22  
 U.S. NUCLEAR REGULATORY COMMISSION

114515

MAR 18 1991



*Heritage Minerals, Inc.*



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ROUTE 70 MILE MARKER 41  
P.O. BOX 12, LAKEHURST, NJ 08733  
201-657-9022 FAX 201-657-5184

We thank you for your cooperation and efforts on our behalf and look forward to your response.

Yours truly,

Tony Cuculic, R.S.O.  
Chief Engineer

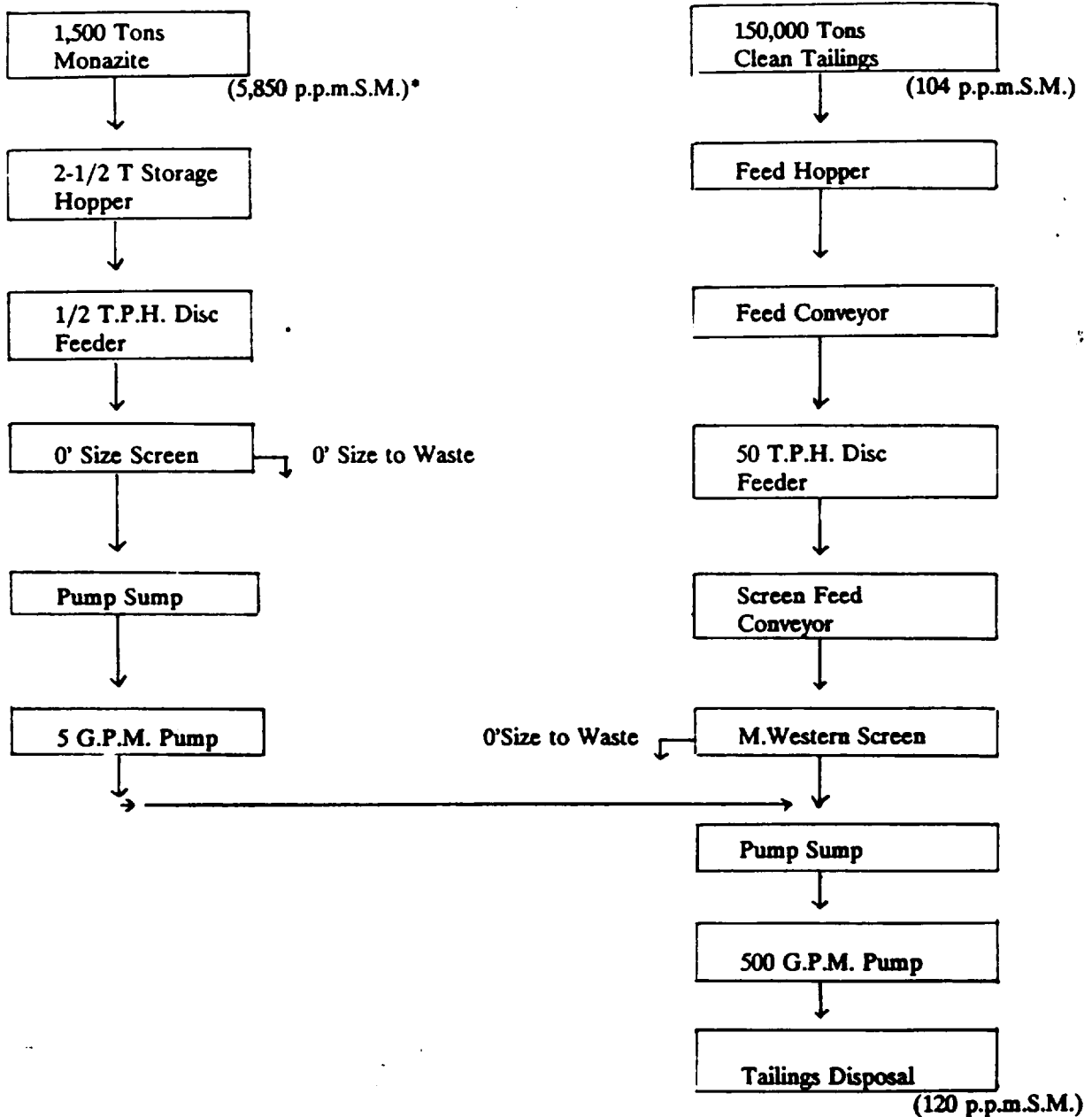
cc: Mr. Duncan White  
New Jersey Bureau of Environmental Radiation

# Heritage Minerals, Inc.

ROUTE 70 MILE MARKER 41  
P.O. BOX 12, LAKEHURST, NJ 08733  
201-657-9022 FAX 201-657-5184

HERITAGE MINERALS INC.

## HEAVY MINERAL SANDS BLENDING FLOWSHEET



\*S.M. source material (TH&U) analyses taken from N.R.C. inspection report No. 99990000/89-001



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION I  
475 ALLENDALE ROAD  
KING OF PRUSSIA, PENNSYLVANIA 19406-1415

*111 Heritage  
Action as  
appropriate*

JAN 09 1992

Docket No. 040-08980

License No. SMB-141

MEMORANDUM FOR: John E. Glenn, Chief  
Medical, Academic, and Commercial Use Safety Branch

FROM: John D. Kinneman, Chief *J. Correll*  
Research, Development, and Decommissioning Section  
Nuclear Materials Safety Branch, DRSS, RI

SUBJECT: CORRECTED INFORMATION FOR THE HERITAGE  
MINERALS, INCORPORATED DISPOSAL PLAN FOR  
MONAZITE (TECHNICAL ASSISTANCE REQUEST DATED  
SEPTEMBER 3, 1991)

Our memorandum dated September 3, 1991 requesting technical assistance in the review of a proposed plan for disposal of monazite sand at the Heritage Minerals', Inc. property contained an incorrect value of 112 picocuries per gram for the average concentration of thorium-232 in sands located in areas known as the salvage storage area, recycled tailings area, and the original new feed area (the blue and gray areas). The value should be 11 picocuries of thorium-232 per gram of sand from those areas. This number is based on ten composite samples that were collected on October 11, 1990 from these areas, and analyzed in the Region I laboratory using an intrinsic germanium detector and a multi-channel analyzer. The results are listed in our letter to Heritage Minerals dated March 22, 1991. The samples were analyzed for actinium-228 because the radioactive material in the sands is known to be thorium, assumed to be in equilibrium with its daughters. The average concentration of the ten samples is 11 picocuries of actinium-228 per gram of sand, which represents approximately 11 picocuries of thorium-232 per gram. This implies a concentration of approximately 22 picocuries of total thorium (thorium-228 and thorium-232) per gram of sand in these areas. The total volume of sand in these areas is approximately 102,500 cubic yards according to the letter from Heritage Minerals dated February 28, 1991. Using the density of 1.5 grams per cubic centimeter determined from the ten samples collected on October 11, 1991, the total mass of sand is calculated to be 1.2 E11 gram. The total quantity of thorium is calculated to be 2.6 E12 picocuries.

*ENCL 2*

The total volume of monazite sand is estimated by Heritage Minerals in their February 28, 1991 letter to be 695 cubic yards. The density is 2.7 grams per cubic centimeter as determined by a sample collected during a site visit on April 17, 1990. The total mass is calculated to be  $1.4 \text{ E}9$  grams. The monazite sand contains approximately 2000 picocuries of actinium-228 per gram of monazite sand, based on a sample collected on April 17, 1990 and analyzed in the Region I laboratory using an intrinsic germanium detector and a multi-channel analyzer. This represents approximately 4000 picocuries of thorium per gram of monazite sand. The total quantity of thorium in the monazite is  $5.7 \text{ E}12$  picocuries.

If the 695 cubic yards of monazite sand is mixed with the 102,500 cubic yards of other sand, the total mass of sand would be  $1.214 \text{ E}11$  grams and the total activity would be  $8.3 \text{ E}12$  picocuries of thorium. Therefore, if the two piles were mixed, the resulting total concentration of thorium would be 68 picocuries per gram of sand. Using a specific activity of  $2.2 \text{ E}-7$  curies per gram for natural thorium, (Table of Radioactive Isotopes, E. Brown and R. B. Firestone, 1986) the weight/weight concentration is  $3.1 \text{ E}-4$  grams thorium per gram sand, or  $0.03\%$ . This would not be considered source material.

Please note that the licensee supplied a flow chart in the February 28, 1991 letter which shows their plan to mix 1500 tons of monazite sand containing 5850 parts per million (ppm) source material with 150,000 tons of other sand containing 104 ppm source material to produce a mixture having a concentration of 120 ppm source material. If we assume that all the source material is thorium, the resulting mixture would be  $0.016\%$  thorium by weight, approximately half our calculated value. The difference with the calculated  $0.03\%$  is due to their estimate of 5850 ppm source material in the monazite, which is approximately 1300 picocuries of thorium per gram of mixed sand. No description of the method of their analysis was included.

*Francis M. Costello for  
John D. Kenneman*



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D C 20555

FEB 23 1992

MEMORANDUM FOR: John W. Hickey, Chief  
Fuel Cycle Safety Branch  
Division of Industrial and  
Medical Nuclear Safety, NMSS

FROM: John H. Austin, Chief  
Decommissioning and Regulatory  
Issues Branch  
Division of Low-Level Waste Management  
and Decommissioning, NMSS

SUBJECT TECHNICAL ASSISTANCE REQUEST (TAR 91-008):  
HERITAGE MINERALS, INC. - DISPOSAL PLAN FOR MONAZITE SAND

We have reviewed the Technical Assistance Request from Region I that was an enclosure to Charles Haughney's November 26, 1991, memorandum regarding Heritage Minerals' disposal of monazite sand.

In our review, we made the following assumptions that we consider to be consistent with R. Fonner's memorandum to J. Kinneman dated November 30, 1990:

1. The Nuclear Regulatory Commission (NRC) has licensing jurisdiction over the "monazite sand" fraction of the wastes (greater than 0.05 percent source material by weight).
2. The NRC will not assert jurisdiction over the "processed sand" fraction of the wastes (less than 0.05 percent source material by weight). The State of New Jersey would assume authority over this fraction.

We performed dose assessments using the 'RESRAD' code to determine intruder doses if the monazite sand is mixed with the processed sand under an unrestricted release scenario, and if deed restrictions are placed on the site to allow use only as a golf course. We also investigated, for use by the State of New Jersey, the doses if the monazite sand is removed and only the process sand remains in place.

The 'RESRAD' code uses conservative values for parameters such as mass loading for inhalation (200 ug/cu.m), 100% contaminated groundwater for irrigation, fraction of time spent outdoors at site as 25% continuously throughout the year, etc.

*Enclosure 3*

However, in reality actual annual average values may be much lower which may result in lower calculated dose rates. The following are the results:

<u>Scenario</u>	<u>DOSE (mRem/year)</u> (With Radon Pathway)	<u>DOSE (mRem/year)</u> (Without Radon Pathway)
1. Monazite sand shipped offsite and processed sand remaining onsite with a residence and no deed restrictions, and a change in the default value of the contaminated material thickness to 3 inches with insignificant erosion (and no cover)	72	61
2. Monazite sand shipped offsite and processed sand remaining on site with a golf course scenario, a deed restriction, a change in the default value of the contaminated material thickness to 3 inches, and a 10 cm cover added.	29	27
3. Monazite sand mixed with processed sand with a golf course scenario, a deed restriction, and a change in the default value of contaminated material thickness to 3 inches and a 10 cm cover added.	90	84
4. Monazite sand shipped offsite and processed sand remaining onsite with a golf course scenario and a deed restriction	91	88
5. Monazite sand shipped offsite and processed sand remaining onsite with a residence scenario and no deed restrictions	195	179
6. Monazite sand mixed with the processed sand with a golf course scenario and a deed restriction	280	271
7. Monazite sand mixed with the processed sand with a residence scenario and no deed restrictions	602	552

John W. N. Hickey

In the dose assessment with the exception of the following parameters, 'RESRAD' default values were used. In addition, in Scenario # 1, the contaminated zone erosion rate was insignificant (10<sup>-7</sup> m/year).

SCENARIO	TH-232 Conc. (pCi/gm)	DENSITY (gm/cc)	DRINKING WATER (l/yr)	PERCENTAGE (indoors %)	PERCENTAGE (outdoors %)
1	11	1.5	730	50	25
2	11	1.5	730	0	25
3	34	1.51	730	0	25
4	11	1.5	730	0	25
5	11	1.5	730	50	25
6	34	1.51	730	0	25
7	34	1.51	730	50	25

Based on the dose assessment, we would recommend shipping the monazite sand to a commercial disposal facility. The doses for mixing the monazite sand with the processed sand would substantially exceed our dose objectives for license termination. We also recommend that the results of the dose assessment be transmitted to the State of New Jersey, which would have the radiation protection responsibility for the processed sand. *10 m E/y*

We are enclosing copies of the 'RESRAD' printouts for your use. If you have any questions, please contact Larry Pittiglio at 504-3438 or Sam Nalluswami at 504-2502.

~~ORIGINAL~~

John H. Austin, Chief  
Decommissioning and Regulatory  
Issues Branch  
Division of Low-Level Waste Management  
and Decommissioning, NMSS

Enclosures: As stated

<u>Distribution:</u>	Central File#	NMSS r/f	LLDR r/f	LPittiglio
JAustin	PLohaus	JSurmeier	RBangart	TCJohnson
MWeber	SNalluswami	RFonner	WBrach	Hastwood

PDR YES  NO  Category: Proprietary  or CF Only   
ACNW YES  NO

SUBJECT TECHNICAL ASSISTANCE REQUEST (TAR 91-008):  
HERITAGE MINERALS, INC. -- DISPOSAL PLAN FOR MONAZITE SAND

\*See previous concurrence

CFC :LLDR*	:LLDR*	:LLDR*	:OGC*	:LLDR*
NAME:LPittiglio/cv	:SNalluswami	:TCJohnson	:RFonner	:JAustin
DATE:01/02/92	:01/02/92	:01/02/92	:01/07/92	:2/28/92

TAR 91-008

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