FOR: The Commissioners

FROM: Luis A. Reyes
Executive Director for Operations

SUBJECT: RESULTS OF THE STAFF'S EVALUATION OF POTENTIAL DOSES TO THE PUBLIC FROM MATERIAL AT THE HERITAGE MINERALS INC. SITE IN MANCHESTER TOWNSHIP, NEW JERSEY

PURPOSE:

To obtain Commission approval to terminate the NRC license for the former-SDMP site, Heritage Minerals Inc. (HMI), and to release the site for unrestricted use.

BACKGROUND:

When the License Termination Rule (LTR) (10 CFR 20 Subpart E) was published (62 FR 39088), a provision was included to exempt certain "grandfathered" sites from the rule. Sites with License Termination Plans (LTPs) or Decommissioning Plans (DPs) submitted to the NRC before August 20, 1998 and approved by the NRC by August 20, 1999 are not required to comply with the LTR. The LTP/DP approval date was extended to August 20, 2000 for 12 sites, including Heritage Minerals, in SECY-99-195. Grandfathered sites were managed under the former Site Decommissioning Management Plan (SDMP), which is now part of the Comprehensive Decommissioning Program. Decommissioning of grandfathered sites is performed in accordance with the SDMP Action Plan (SECY-92-106), under which cleanup criteria is based on residual contamination levels. Remediation is considered to be complete when the actions described in the approved LTP/DP are completed, although the resultant dose impact of the site is evaluated to compare against the LTR. In SECY-04-0024, "Recommended Changes to Nuclear Regulatory Commission's Decommissioning Program and Annual Decommissioning Program Report", the staff was directed to seek Commission approval prior to releasing former-SDMP sites when the dose from residual radioactivity after completing decommissioning exceeds the unrestricted release provision in the LTR. In March, 2005, HMI completed the decommissioning activities described in their approved DP, and requested termination of their NRC license. A dose assessment of the NRC licensed areas indicates that the resultant dose to an average member of the critical group is greater than the 25 mrem per year bounded by the LTR.

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DISCUSSION:

The Heritage Minerals site is a former minerals mining and processing facility located in Manchester Township, Ocean County, New Jersey, within the New Jersey Pine Barrens. The site occupies almost 7000 acres, although mining and processing operations took place on less than 300 acres, and NRC licensed material was concentrated on less than 1 acre. The area is characterized by sandy soil, gravel, and clay, that was found to contain recoverable quantities of heavy minerals, namely titanium and zirconium. The soils also contain measurable quantities of natural thorium and natural uranium.

From 1972 to 1990, the site was used for dredging of native sand and recovery of the saleable heavy minerals through mechanical separation that initiated in a Wet Mill and was further refined in a Dry Mill. After the light silica component of the sands was removed, the heavy minerals and natural thorium and uranium was concentrated in the remaining material. Further processing to remove the desired minerals concentrated the natural radioactive material even more within the waste soil. Initial processing of native sands that occurred between 1972 and 1989 did not result in > 0.05% concentration of uranium and/or thorium (the definition of source materia l in 10 CFR 40.4). In 1989, however, Heritage Minerals began reprocessing of the heavy waste soils to extract any possible remaining zirconium and titanium. This further processing led to the inadvertent concentration of licensable source material in the resultant waste sand.

The NRC license issued in 1991 licensed the pile of waste source material created by Heritage, as well as the processing facility after the point where the source material was concentrated (i.e. the entire Dry Mill and a portion of the Wet Mill). The mill buildings and the waste pile are the only portions of the site affected by NRC-licensed source material, and were the only locations the NRC required HMI to remediate. However, these locations, as well as much of the surrounding site affected by mining operations, contain elevated concentrations of thorium and uranium from the earlier (1972-1989) processing (i.e. < 0.05% concentration). In 1992, HMI was designated as a Site Decommissioning Management Plan (SDMP) site.

The HMI Decommissioning Plan, approved in September 1999, committed to meet Option 1 of the Branch Technical Position "Disposal or Onsite Storage of Thorium or Uranium Wastes from Past Operations" for soil remediation of the source material storage area and to meet the contamination levels for thorium specified in FC 83-23, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material" for surface contamination of buildings and equipment. Decommissioning activities occurred between 1990 and 2005, and consisted of decontamination, followed by eventual dismantling and removal of the mill buildings and equipment, as well as shipment of the pile of waste source material. HMI submitted a Final Status Survey (FSS) in November 2001.

NRC confirmatory surveys performed in December 2001 and April 2002 identified pockets of soil containing source material concentrations > 0.05% in the footprint of the former source material storage area and around the mill building pads. The pockets outside the footprint of the former source material storage area were not located within the boundaries of the NRC-licensed area. Instead, these pockets were in locations around the site where concentrated waste material from past operations (1972-1989) had been stored and occasionally re-graded. Indeed, the soils surrounding the pockets also contain elevated concentrations of thorium and uranium, however not in amounts exceeding 0.05%. It was determined that these pockets of source material had likely originated from the earlier operations. Even so, NRC required HMI to remediate the pockets to meet the contamination levels specified in the Branch Technical Position (5 pCi/g total thorium and 5 pCi/g total uranium). Following remediation of the soil pockets, HMI and NRC performed a walkover survey of the licensed areas and their surrounds and

identified no remaining licensed material onsite.

The current radiological condition of the site is impacted by: residual contamination on the Wet and Dry Mill pads, contamination below the remediation levels in the footprint of the former source material storage area and in the remediated pockets, and elevated concentrations of thorium and uranium in the surrounding soils from past operations (1972-1989) that did not exceed 0.05%.

NRC performed a dose assessment of the licensed areas (the Mill pads and the former source material storage area) to determine the dose impact from the remaining residual radioactivity. The mill pads were modeled with the conservative assumption of reuse of the structures for residential occupancy. The highest resultant dose, assuming an individual is continuously on either pad for 75% of a year, is 1.6 mrem/year, which would occur in the first year. The former source material storage area was modeled using two potential scenarios to remain consistent with the realistic scenarios approach discussed in SECY-03-0069 "Results of the License Termination Rule Analysis," May 2, 2003. The most likely reuse scenario for the Heritage site is the construction of a suburban housing development, based on licensee documented intent and development trends for the surrounding area. A "Suburban Resident" scenario assumes an individual is impacted by direct radiation exposure, inhalation and ingestion of re-suspended soil, and ingestion of produce grown in a private garden. The highest resultant dose from this scenario is 43 mrem/year, occurring in the first year. The other scenario examined for the contaminated soil is the "Resident Farmer", which is impacted by all the factors affecting the Suburban resident, with the addition of: contaminated irrigation water, ingestion of animals raised onsite using feed and water from potentially contaminated sources, ingestion of fish from a potentially contaminated pond, ingestion of a greater amount of produce, and ingestion of contaminated drinking water. Although a residential farm is deemed an unlikely future for the HMI site, it was evaluated as a conservatively-bounding scenario. The highest resulting dose in this case is 77 mrem/year occurring in the first year.

The staff dose assessment only considered the exposure to the public from the residual radioactivity within the boundary of the NRC-licensed areas. The average concentration of thorium-232 (the greatest contributor to radiation exposure) within this area is 2.3 pCi/g. The soil surrounding the NRC-licensed areas contains measured thorium concentrations ranging from well-below 1 pCi/g to greater than 44 pCi/g. Source material concentrations surrounding the NRC-licensed areas may exist up to just below 0.05%. The dose to the public from the concentrated natural thorium and natural uranium over the rest of the site is expected to be much higher than the calculated dose within the licensed area. Because this material originated from unlicensed activities, and never reached the defined concentration of source material, NRC did not require its remediation. Decommissioning of the remainder of the site falls under the jurisdiction of the State of New Jersey. Heritage Minerals has provided the New Jersey Department of Environmental Protection (NJDEP) with its proposed plan for remediation of the entire site to the state cleanup levels. NRC staff discussions with the HMI owner indicate that this cleanup will occur over the next ten years.

NRC staff has held numerous discussions with NJDEP staff regarding the licensing and decommissioning of the Heritage Minerals site. NJDEP has disagreed with NRCs licensing of only the source material and the plant structures and equipment affected by it. The state has documented its position that NRC should extend its jurisdiction over the whole site, and require that this entire area be remediated. The NRC staff position continues to be that NRC-jurisdiction at the Heritage site only extends to the soil that was concentrated to meet the definition of source material and the equipment and structures where this concentrating occurred. Earlier operations at the site concentrated the native natural thorium and natural uranium in the soil to levels that are elevated, but do not meet the definition of source material. The elevated thorium and uranium concentrations in this soil would exist at the site even if HMI had not inadvertently concentrated source material and been required to obtain an NRC license. The remaining

material at the site falls under the state jurisdiction, and NRC cannot require its remediation.

Although the NRC-licensed area at the Heritage site does not meet the dose criteria of the License Termination Rule, the licensee was grand-fathered from this requirement. Heritage was required to comply with the decommissioning activities described in their approved Decommissioning Plan, which met the license termination criteria in effect at that time. The staff has concluded that Heritage has completed these activities. Additionally, the NRC dose assessment of this area indicates that the public dose limit of 100 mrem/yr, specified in 10 CFR 20.1301, will not be exceeded.

COORDINATION:

The Office of the General Counsel has reviewed this paper and has / has no legal objections.

RECOMMENDATION:

That the Commission approve the proposed termination of the NRC license for Heritage Minerals, Inc. (Note: That the termination will be published in the Federal Register, allowing 60 days for public comment.)

Luis A. Reyes
Executive Director
for Operations

Attachments:
1. Heritage Minerals, Inc. Site History and Decommissioning
2. NRC Dose Assessment of Heritage Minerals, Inc.
3. Heritage Minerals Draft Environmental Assessment
4. Heritage Minerals Comments on NRC Dose Assessment
5. NJDEP Comments on Environmental Assessment and NRC Dose Assessment

ATTACHMENTS:

Attachment 1 Heritage Minerals, Inc. Site History and Decommissioning

Introduction

Heritage Minerals Inc. is a former minerals processing facility in Manchester Township, New Jersey, approximately 75 miles south of New York City in the New Jersey Coastal Plain. The licensee was authorized by the NRC from January 1991 for the possession of radioactive materials resulting from past operations at the site, and for decommissioning of the affected portions of the site. The facility had been used from 1972 to 1990 for the mechanical processing of dredged, native sands to extract various heavy minerals (zirconium and titanium). The native sand also contained natural uranium and monazite (an ore containing natural thorium), which were incidentally concentrated due to the processing operations. A process change in 1989, led to reprocessing of previously-stockpiled tailings (unwanted sands from earlier processing). The resultant waste stream from this process contained sufficient concentration of natural radioactive material to require an NRC license. Although the site occupies an area of almost 7000 acres, dredging and processing activities comprised approximately 287 acres. Within this smaller area, the NRC-licensed areas (plant and production areas involving licensed material), consisted of portions of two mill buildings and a stockpile of approximately 1400 tons of licensed material. Together, the NRC-licensed portions of the site comprised less than one acre.

Site Description

The Heritage Minerals site is located on Route 70 in Lakehurst, Manchester Township (Ocean County), New Jersey in the New Jersey Coastal Plain. It encompasses an area of approximately 7000 acres, of which 1000-1200 acres were dredged for the purpose of minerals processing. Plant and tailings (waste sands) storage areas were situated in the center of this mined area, and encompassed approximately 287 acres. The plant consisted of two mill buildings (Wet Mill and Dry Mill), a warehouse, and various service buildings. The Wet Mill was a three-story steel structure on a 229' X 99' concrete slab. The Dry Mill was also a three-story steel structure, and was situated on a 120' X 95' concrete slab. Both mill buildings have been demolished and only the concrete pads remain.

The site is predominantly flat, but has been recontoured by surface mining activities. The area is characterized by thick sandy deposits, resulting from surface erosion, water transport, and wind deposition. The deposits reach a depth of 1500 feet, with underlying deposits of stratified clay, silt, sand, and gravel over bedrock that is not encountered until 3000 feet. Wetlands form the drainage of Wrangel Brook, which has an easterly streamflow. Two lakes were formed along the Green Branch of the Wrangel Brook as a result of the mine dredging operations.

Groundwater flow occurs from areas located north and west of the site to east and northeast towards the tributaries of the Toms River. The Toms River and its tributaries form the major groundwater discharge zones for the region. Site groundwater is recharged by precipitation and flows unconfined through the permeable underlying sands.

The plant and tailings area is relatively free of vegetation, but the remainder of the site is covered by shrubs and trees. Areas adjacent to the site are predominantly rural and residential.

Site Operating History

The Heritage Minerals, Inc. (Heritage) site was originally owned and operated by ASARCO, Inc. (ASARCO). In the late 1950s, ASARCO investigated the area around the site for deposits of titanium-bearing minerals. Following several years of exploration, in 1960 ASARCO purchased 9000 acres for the purpose of titanium mineral recovery. From 1960 until 1968, the location was maintained in standby status. In 1968, design and construction of the mineral recovery plant began, and was completed in 1973. Between 1973 and 1982, ASARCO mined sands (by dredging) and processed the sands to extract a titanium mineral called ilmenite. The mined sand contained mostly (approximately 95%) light silica sands, clays, and gravels. The remaining 5% consisted of the titanium minerals ilmenite, leucoxene, and rutile, as well as other heavy minerals, including zircon, monazite, and uranium.

The ASARCO mining and processing operation was completely mechanical (i.e. no chemical processing was performed), and consisted of first dredging sands from a maximum depth of 65 feet, and conveying the sand in slurry form through pipes to a screening and dewatering barge. Oversize material was returned to the dredging pond, and the remainder was pumped to the Wet Mill. The slurry was again screened for size, and the screened material was sent through a spiral track, which accomplished gravity separation of the lighter silica sands from the heavy minerals (concentrate). The silica sands were returned to the dredging pond as backfill, and the heavy concentrate was stored on the ground east of the Wet Mill to allow for water to drain out. As this dewatering took place, the concentrate was fed into the Dry Mill process using front-end loaders. The concentrate pile was continually being added to, graded, blended, and picked up throughout this process. Once in the Dry Mill, the material was conveyed through dryers and then through electrostatic and electromagnetic mineral separators. The separators were calibrated to specifically remove either ilmenite, leucoxene, or rutile using their individual physical properties (conductivity and magnetism). The non-conductor materials (including zircon, monazite, and uranium) that were separated out in the Dry Mill were stored on site in a location designated the Gray Area. The other titanium minerals (leucoxene, and rutile) were continually fed back into the Dry Mill for further processing along with the fresh concentrate from the Wet Mill (to ensure all ilmenite was removed). The ilmenite product was stored until shipment.

This original process created a saleable product (ilmenite), feeder material containing other titanium minerals, and a waste stream that was stored in the Gray Area. The Gray Area material, which was the dredged sand with the light silicates and the heavy titanium now removed, consisted of concentrated amounts of the remaining materials, including the natural uranium and natural thorium.

ASARCO ceased operations at the site in March 1982 due to poor market conditions. At that time, ASARCO leased the site to another company, Humphrey's Gold, Inc. (Humphrey's Gold), that wished to re-process the Gray Area material to extract commercial grade zircon. Humphrey's Gold leased the site for six months, but only conducted pilot tests of the process for one month. The Gray Area material was processed in the same manner as the original material had been under ASARCO. The pilot tests were unsuccessful, and all of the processed and waste material was returned to the Gray Area.

From the end of the Humphrey's Gold lease until 1986, ASARCO maintained the site in standby status. In 1986, Heritage Minerals Inc. purchased the site and leased the plant to Mineral Recovery, Inc. (MRI). MRI also used the site to process the Gray Area material, and they modified the Dry Mill process to successfully recover zircon, leucoxene, and rutile. The Gray Area material was mixed with water and pumped to the wet mill as a slurry. This slurry was then sent through a series of spirals, using gravity separation to remove the unwanted, lighter fraction. This light fraction consisted primarily of titanium and ilmenite. The light waste material was collected in a sump and then was pumped to an area north of the Wet Mill building, referred to as the Blue Area. The remaining, heavy material was stockpiled on the ground east of the dry mill for de-watering, and then was fed into the dry mill where it was sent through a smaller dryer than the one that had been used by ASARCO. The material was then screened, and the unwanted, oversized portion was sent to the Blue Area. The small-particle material was sent through a series of electrostatic and electromagnetic separators, which sorted the material into three components: 1) leucoxene, 2) rutile, and 3) a blend of materials with low conductivity (zircon, monazite, alumina, and some silica). The leucoxene and rutile product were packaged and stored until shipment. The blend of materials with low conductivity was mixed with water and returned to the wet mill as a slurry. It was again sent through a series of spirals and a shaker table to remove any remaining alumina and silica. The remaining material was composed of zircon, monazite, and uranium. This material was sent through a separate circuit of electrostatic and electromagnetic separators, which sorted the material into its two components. The zircon was packaged and stored for shipment. The left-over material, containing natural thorium, natural uranium, and small amounts of unrecovered leucoxene, rutile, and zircon, was returned to the Blue Area.

In August, 1986, representatives from MRI contacted NRC Region I and asked whether an NRC license was required, because they recognized that the plant process concentrated the natural radioactivity in the sands (by separating the monazite). At that time, the NRC determined that a license was not required, because processing activities performed to-date did not result in concentrations that met the definition of source material in 10 CFR 40. The regulation defines source material as, ores which contain by weight, one-twentieth of one percent (0.05%) or more of uranium or thorium, or any combination thereof. Additionally, the sand was not being processed to obtain its radioactive component, and so the waste stream also was not considered byproduct material, as defined by 10 CFR 40. The regulation defines byproduct material as the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content.

MRI operated the site from October 1986 until August 1987, at which time HMI assumed control over site operations. Initially, HMI utilized the same process as MRI had, which was to process the Gray Area material to recover zircon, leucoxene, and rutile. After a time, HMI processed all of the Gray Area Material. Tests were then conducted to determine if sufficient amounts of zircon and leucoxene remained in the Blue Area material to warrant reprocessing of this matter. The tests indicated that the Blue Area material did contain sufficient amounts of the desired minerals, and HMI began processing it. This processing was performed in a manner similar to the Gray Area material process.

This reprocessing of the Blue Area material resulted in concentrating the uranium and monazite to the point where source material concentrations exceeded 0.05%. An NRC Inspection performed on January 12, 1989, identified that after a certain point in the process, HMI was concentrating source material, and that an NRC license was required. Specifically, after the material had passed through the Wet Mill spirals and the light fraction had been removed, uranium and thorium concentration exceeded 0.05% by weight. Following the inspection, HMI separated the source material from all other waste material, and stored this sand in a controlled stockpiled area. In addition, on March 10, 1989, HMI submitted an application for an NRC license.

Before the NRC license was issued, reduced demand for the zircon and leucoxene minerals caused HMI to suspend all processing operations. In a letter dated August 23, 1990, Heritage informed the NRC that the plant would be placed in standby status until market conditions improved. In the meantime, Heritage stated that they would initiate decontamination of the plants and equipment. Between 1989 and the cessation of plant operation, HMI had processed 200,000 tons of Blue Area material. As a result of this processing, an estimated 1000 tons of source material had been segregated and was now stockpiled for disposal. Heritage never restarted processing operations.

Site Licensing

The original Heritage license application requested approval to possess source material that was incidentally created through the processing of site native soil. Before the license was issued, Heritage ceased all processing activities. No additional source material was being concentrated and the only such material on site was the stockpiled waste and any residual source material within the plant equipment and structures. The original processing operations performed at the site from 1973-1989 had also resulted in elevated concentrations of natural thorium and natural uranium. This material had been stored in the gray Area and in the Blue Area, and had been periodically staged and re-graded around the mill buildings, resulting in layers of higher activity material. Because these concentrations had not exceeded 0.05%, however, they were not subject to NRC requirements. Only the material that had been concentrated to 0.05% source material content or greater and the plant areas affected by such material could be part of the NRC license.

In January 1991, the NRC issued License No. SMB-1541 authorizing Heritage Minerals, Inc. to possess the stockpiled source material and to perform decommissioning of the impacted areas of the site. The license specified that decontamination was required in all areas within the buildings where source material was generated, the source material pile, and any other areas where source material was used or stored, prior to release for unrestricted use. The clean up criteria for Heritage was specified in the license conditions. Plant buildings and equipment were specified to be decontaminated to meet NRC guidelines for release for unrestricted use:

Natural Uranium
5000 dpm $\alpha/100cm^2$, averaged over a 1 m^2 area
15000 dpm $\alpha/100\ cm^2$, maximum in a 100 cm^2 area
1000 dpm $\alpha/100\ cm^2$, maximum removable contamination in a 100 cm^2 area

Natural Thorium
1000 dpm/100 cm^2, averaged over a 1 m^2 area
3000 dpm/100 cm^2, maximum in a 100 cm^2 area
200 dpm/100 cm^2, maximum removable contamination in a 100 cm^2 area

In addition, the source material pile was required to be remediated to the cleanup criteria of 10 pCi/g above background for total thorium and uranium. The cleanup criteria were derived from the concentration-based decommissioning guidelines in place at the time: the Branch Technical Position "Disposal or Onsite Storage of Thorium or Uranium Wastes from Past Operations" and FC 83-23, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material".

NRC licensing and oversight of the Heritage site acknowledges that the site is impacted by the elevated concentrations of natural thorium and uranium surrounding the plant area from the previous processing operations. Remediation of the NRC-licensed material does not require remediation of this other concentrated material, because it remains exempt from NRC licensing requirements as specified in 10 CFR Part 40.13. State regulations may require additional remediation at the site to remove this other concentrated material, because the state defines source material at a lower concentration than NRC regulations. The complexity of this site, where NRC-regulated material and potentially state-regulated material are in such close proximity (and indeed are layered over each other in some locations), prompted NRC to add Heritage to its Site Decommissioning Management Plan (SDMP) in April 1992. The SDMP was created in 1990 to effect the decommissioning of sites with unique concerns warranting special attention.

A primary feature of the SDMP was that such sites, with License Termination Plans submitted prior to August 20, 1998 and approved prior to August 20, 1999 were exempt from the provisions in 10 CFR 20 Subpart E ("The License Termination Rule"). This regulation bases the termination of NRC licenses and the release of facilities for unrestricted use on meeting a specified dose criteria. The rule was a change from past practice, which based release of a site for unrestricted use on meeting specific contamination cleanup levels. The new regulation states that residual radioactivity that is distinguishable from background must not result in Total Effective Dose Equivalent to an average member of the critical group above 25 mrem per year. SDMP sites were grand-fathered under the License Termination Rule (LTR), and decommissioned under the criteria in their approved Decommissioning Plans, using the old contamination cleanup levels.

In 2004, the SDMP was eliminated, and all sites are now managed under a Comprehensive Decommissioning Management Plan. However, as a former SDMP site, Heritage is still exempt from the License Termination Rule. Under the Comprehensive Decommissioning Management Plan, Complex Sites such as Heritage are evaluated against the criteria in the License Termination Rule. If a Complex Site is being considered for release for unrestricted use, a dose analysis must be performed to determine if the site falls below the 25 mrem/year dose criteria in the LTR. If such a site does not meet this dose criteria, specific Commission approval must be obtained prior to termination of the license and release of the site for unrestricted use. The results of the dose analysis for Heritage is described in Attachment 2 of this report.

Site Decommissioning

Heritage Minerals has undergone various stages of decontamination and decommissioning (D&D). The first such activities took place between September 1990 and January 1991, and are described in the letters dated August 23, 1990 and November 30, 1998, and in the Inspection Report dated May 22 1991. This initial round of decontamination consisted of dismantling the Wet Mill equipment, and washing down the mill structure and equipment until surface readings were decreased to 20 mrem/hr. At this point, high pressure water and steam were used and any residual sand was physically removed from the equipment. The Dry Mill structure and equipment was also dismantled, but was cleaned using blown air, dusting, and sweeping. Sands recovered from these operations were added to the stored source material pile to await disposal.

The May 1991 NRC Inspection Report documented that NRC performed confirmatory contamination surveys that identified no loose contamination on equipment within the mill buildings. However, the report stated that high background dose rates from the stored source material pile would impact surveys for fixed contamination. The inspector stated that final surveys would have to wait until after this waste had been removed from the site. Dose rate and contamination survey results representative of this round of decontamination were submitted to the NRC as part of a letter dated November 30, 1998. In this letter, Heritage noted that not all equipment was reassembled after this decontamination, and that some of the equipment that was later determined to be un-impacted by source material was sold.

In February, 1991, following this initial round of D&D activities, Heritage proposed disposal of the stockpiled source material, to be followed by the performance of radiological surveys and request for license termination. The proposed method for disposal was to mix the material with unprocessed native soil from the property, essentially returning the material to its origin location (i.e. dilution). At the time, NRC regulations precluded the intentional mixing of contaminated soil to meet release criteria. Although the agency considered Heritage's request, the licensee was encouraged to pursue other disposal options. In October 1994, Heritage requested that NRC suspend its consideration of onsite disposal of this waste. At that time, Heritage had decided to pursue transfer of the material to another processing facility that could use it as feed stock. A facility in Malaysia had been identified that showed interest in receiving the material.

Between 1994 and 1997, very little D&D activity was accomplished at the site. Heritage had obtained an NRC license to export the source material waste to the facility in Malaysia, but the recipient company had not committed to receiving the material. In April 1997, NRC held a meeting with Heritage at which time the licensee was requested to provide NRC with a formal Decommissioning Plan and a schedule for completion of D&D activities.

When the License Termination Rule (LTR) (10 CFR 20 Subpart E) was published, a provision was included to exempt certain "grand-fathered" sites from the rule. Sites with License Termination Plans (LTPs) or Decommissioning Plans (DPs) submitted to the NRC before August 20, 1998 and approved by the NRC by August 20, 1999 were not required to comply with the LTR. In November 1997, Heritage submitted a Decommissioning Plan (DP) describing final cleanup and disposal of the stored source material and remediation of mill buildings and equipment. The DP specified the activities and methods for protecting workers and the public during removal of the waste and survey and decontamination of the mill buildings and equipment. SECY-99-195 extended the LTP/DP approval date for LTR-exemption to August 20, 2000 for 12 sites, including Heritage Minerals. NRC assessment of the DP was published in the Federal Register on September 1, 1999, and the plan was formally approved by the NRC in October 1999.

Plans to transfer the waste to Malaysia fell through in 2000, and an alternate recipient for the material was identified. International Uranium Corporation's (IUC) White Mesa uranium mill in Blanding, Utah another minerals processing facility, expressed interest in accepting the source material from Heritage. In December 2000, IUC's NRC license was amended to allow the company to accept the Heritage waste for use as feed material. In March 2001, Heritage contracted with Radiation Science, Inc. (RSI) to perform the D&D of the site, and that June, notification was made to the NRC that decommissioning activities were commencing. By October 2001, the waste had been loaded and shipped to IUC. In addition to the1400 tons of stockpiled material, RSI excavated additional soil from underneath the pile to ensure the cleanup criteria was met. During this campaign, RSI shipped approximately 3,385 tons of soil from the Heritage site. RSI also surveyed and decontaminated both the wet mill and the dry mill buildings and equipment. Surveys and soil samples performed by RSI indicated that the remaining soil in the source material storage area met the criteria for unrestricted release of 10 pCi/g total thorium and

uranium. Surveys of the mill buildings and equipment showed that residual contamination levels also fell below the NRC release criteria. A description of decommissioning activities and the results of these surveys were submitted as the Final Status Survey for Heritage in November 2001.

The NRC contracted with the Oak Ridge Institute for Science and Education (ORISE) to have confirmatory surveys performed of the site in December 2001. Preliminary results of this survey were provided to Heritage in February 2002, and the formal survey report was received by the NRC in April 2002. The confirmatory surveys showed residual contamination exceeding the unrestricted release criteria remained in the mill buildings and on equipment. In addition, soil samples taken from the source material storage area and around the mill buildings identified locations with source material concentrations greater than the 10 pCi/g release criteria.

In April 2002, NRC and Heritage met to discuss the results of the confirmatory survey and the actions that would be required to complete site remediation. Heritage explained that the identification of thorium and uranium in concentrations exceeding 10 pCi/g was understandable given the pre-licensing operations at the site. During that time period, the thorium and uranium in the sand had been inadvertently concentrated, but to levels below the 0.05% concentration requiring an NRC license. Heritage committed to compile a description of past plant practices explaining how such material had been placed on the ground around and between the mills during that time. Heritage also committed to preparing a mass balance report showing the amount of source material that had been concentrated at the site and comparing that to the amount of material that had been shipped to IUC. These items were submitted in November 2002. Heritage also committed to performing a new characterization survey of the areas around the mills and source material storage area to identify any remaining source material. The survey was submitted in December 2002, and identified several "pockets" of soil with concentrations greater than 0.05% source material.

Regardless of the time period during which the material had been placed around the site, NRC determined that Heritage was responsible, under the NRC license, to remove all soil pockets where uranium and thorium concentration exceeded the exempt amount in 10 CFR Part 40. These pockets would be required to be remediated to the cleanup criteria of 10 pCi/g total thorium and uranium. At the April meeting, and in letters submitted in June 2002, November 2002, and March 2003, Heritage committed to removing such material from the site.

Heritage hired SENES Consultants Limited (SENES) to provide advice on remaining decommissioning activities. In May 2003, Heritage provided final remediation plans, which included total demolition of the mill buildings and remediation of the pockets of source material. Heritage then hired ENERCON Services, Inc. to complete these final D&D activities. In April 2003, ENERCON personnel conducted another survey of the area around the mill buildings and the source material storage area. They identified seventeen pockets of soil containing source material. The contaminated soil pockets were subsequently excavated, sampled, and backfilled with clean sand. A report chronicling these activities was submitted to the NRC in June 2003. The excavated soil (313.35 tons) was packaged and shipped to IUC.

In May 2003, ENERCON began D&D of the mill buildings. Both structures were demolished using a shear, and all materials and the pads were decontaminated using power washers to meet the release criteria. After removing all large pieces of steel, a magnet was used to retrieve and remove small pieces, which were then also decontaminated and released. Only the concrete slabs remain of the mill buildings. Residual sand from the steel cleaning processes which had collected on the slabs was removed and stockpiled. Uncontaminated support buildings, used for equipment storage and office space, were left intact.

In September 2003, after these activities were completed, NRC contracted ORISE to perform a second confirmatory survey of the site. This second survey identified some elevated contamination on the mill pads. These elevated areas were decontaminated by ENERCON and were remediated during the survey. These activities completed remediation of the mill pads. ORISE also performed a surface scan of the soil around the mill pads and the source material storage area. Soil samples were obtained where the scans identified elevated levels of contaminants, and the sample results identified additional pockets of source material in previously un-excavated areas. The results of the ORISE surveys were provided to the NRC in December 2003 and to Heritage in January 2004.

In June 2004, Heritage proposed a new plan to complete remediation activities. The proposal included defining the site boundary within which NRC-licensed operations took place. The boundary encompassed the contaminated soil pockets identified by the ORISE survey. This area was determined based on historical site surveys, physical boundaries, and the performance of a walkover gamma survey. The walkover survey was performed with a Ludlum Model 2221 ratemeter and collimated sodium iodide probe linked to a portable GPS unit. Heritage committed to remediating all "licensable" soil pockets within this area. The pockets were identified using a cutoff value of 300,000 counts beta as identified with the ratemeter. The proposal also requested disposition of the approximately 400 tons of stockpiled soil which had been recovered from demolition of the mill buildings. In November, 2004, the NRC responded to the Heritage proposal. The NRC accepted the defined boundary and the proposed remediation activities within that bounded area. The NRC also required that the 400 tons of stockpiled soil be disposed of as licensed material.

In December 2004 and January 2005, ENERCON completed remediation activities. The soil pockets were excavated and the stockpiled and excavated soils were shipped to IUC. In January 2005, NRC and ENERCON obtained split soil samples from the excavated pockets. After the samples were obtained, the pockets were backfilled with clean soil. NRC inspectors then performed a gamma walkover survey of the area encompassed by the boundary identified in the June 2004 letter. This survey was performed to verify that no source material remained within this area. No readings were obtained that were greater than twice the background radiation level. Based on this walkover survey, NRC inspectors determined that all source material within this bounded area had been removed.

The samples obtained by Heritage were analyzed using gamma spectroscopy and compared against the release criteria. The results of the analysis of the ENERCON samples was provided to the NRC in the termination request dated March 4, 2005. The NRC-obtained samples were independently analyzed using the same methods, but by a different lab. Lab analysis of the ENERCON samples showed that all samples met the release criteria of 10 pCi/g total thorium and uranium. Analysis of the corresponding NRC samples largely agreed with the ENERCON results, except that one location exceeded the release criteria (16 pCi/g total thorium and uranium). The results of the analysis of the NRC samples is included in a report from ORISE dated February 14, 2005. Based on the agreement between the remaining samples, and the results of the analysis of the ENERCON samples, NRC did not require ENERCON to perform additional remediation of this location.

In March 2005, Heritage Minerals requested termination of its NRC license and release of the facility for unrestricted use. The termination request includes survey data of all materials and equipment from the Wet and Dry Mills and the remaining mill pads, as well as the results of the soil samples from the excavated pockets.

Termination of the NRC license for the Heritage Minerals site has been contingent upon the removal of all NRC-licensed material (i.e. source material), and the decontamination of all equipment and structures impacted by this material (i.e. the Mill Buildings). The surveys provided by the licensee and the confirmatory surveys performed for the NRC show that all licensed material has been removed from the site. The results of these surveys were used to perform a dose analysis of the NRC-licensed portions of the site.

From all D&D activities performed at the Heritage site since 1991, approximately 1800 tons of steel and 4246 tons of soil have been disposed.

Attachment 2 Heritage Minerals, Inc. Dose Assessment

Attach Final Dose Assessment Report