SCIENTECH

October 13, 2003

Mr. Anthony Talak
Pennsylvania Department of Environmental Protection
230 Chestnut Street
Meadville, Pennsylvania 16335

Subject: Proposal for Beneficial Reuse of Slag

Dear Mr. Talak

As consultants to the Whittaker Corporation (Whittaker), SCIENTECH, Inc. has prepared the enclosed document, *Technical Proposal for the Beneficial Reuse of Waste Slag from the Mercer Alloys (Whittaker) Site, Transfer, PA.* The purpose of the document is to provide some site background and to set forth a case for a proposed beneficial reuse of Whittaker site slag materials. This technical proposal is not intended to take the place of a formal application for beneficial reuse. Whittaker simply hopes that the Pennsylvania Department of Environmental Protection (PADEP) will consider the reuse option as a viable option and recommend that Whittaker proceed with a formal beneficial reuse application.

In letter sent to me on January 16, 2003, you expressed that the current position of the department is that beneficial reuse of the slag would not be approved. However, Whittaker feels that this decision was made without full consideration of the regulations that would allow the reuse activity and without regard to the high financial cost of the negligible risk avoided by not allowing the reuse option.

Please review the enclosed technical proposal and distribute it within the PADEP to those who have a stake in this decision. I have copied the Mr. Bryan Werner of the PADEP's Bureau of Radiation Protection and Mr. Randy Randolph Ragland of the U.S. Nuclear Regulatory Commission (NRC). Mr. Ragland is the NRC project manager for the site decommissioning.

If you need any further information or have any questions regarding the proposed approach, please call me at (864) 235-3695.

Regards,

Kevin E. Taylor, PE
Whittaker Site Radiation Safety Officer
SCIENTECH, Inc.

Enclosure

cc: Eric Lardiere, Whittaker Corporation
Bryan Werner, PA DEP Bureau of Radiation Protection
Randolph Ragland, U.S. NRC

17 College Street, Suite D • Greenville, SC 29601 • Tele: (864) 235-3694 • Fax: (864) 235-8405

Technical Proposal for the Beneficial Reuse of Waste Slag from the Mercer Alloys (Whittaker) Site, Transfer, PA

Introduction

This technical proposal was prepared to present a case to the Pennsylvania Department of Environmental Protection (PADEP) for the acceptance of slag material containing "unimportant" concentrations of the naturally occurring radioactive elements uranium and thorium for beneficial reuse. The Whittaker Corporation (licensee) is aware that for official acceptance, a formal permit application must be submitted and approved. However, before committing the resources to preparing the application, the licensee wishes to enter a dialog with the PADEP regarding the likelihood of approval.

In a letter sent to the licensee's site radiation safety officer (RSO), Mr. Kevin Taylor of SCIENTECH, Inc., Mr. Tony Talak, PADEP Regional Engineer, expressed that the current position of the department is that beneficial reuse of the slag would not be approved. However, the licensee does not believe that the PADEP considered all technical and financial aspects of the reuse when making this judgment. The information presented here provides a technical basis for allowing a specific beneficial reuse of this material. The licensee hopes that the PADEP will consider this option as viable and, after any further necessary discussions and communications, will recommend that the licensee complete and submit the beneficial reuse permit applications as soon as possible.

Site History

The Mercer Alloys (Whittaker) site is located in the Reynolds Industrial Park in Transfer, Pennsylvania approximately 3.5 miles south of Greenville, Pennsylvania. Much of the area of the existing Reynolds Industrial Park was a World War II-era U.S. Army base called Camp Reynolds. After the base's closure, ownership of this property changed hands. Beginning in the 1960s, a portion of this area was used by Mercer Alloys, a predecessor of Whittaker Metals Corporation (Whittaker), to produce metal alloys.

In February of 1966, Mercer Alloys received U.S. Nuclear Regulatory Commission (NRC) License No. SUB-864, which allowed it to possess 250 pounds of uranium in the form of calcium uranate for a ferro-molybdenum production process. Natural uranium was to be received in impure calcium molybdate sludge with a weight distribution of 45% water, 41% calcium molybdate, and 14% impurities including the natural uranium. The impurities contained up to 1.5% natural uranium by weight. The sludge was to be blended with uranium-free molybdate to reduce the uranium content to less than 0.05% by dry weight, charged to a rotary drum drier, then charged to an arc furnace to produce ferro-molybdenum slabs. License SUB-864 was not renewed and was allowed to expire in February of 1969.

In December of 1969, Mercer Alloys received NRC License No. SMA-1018 in response to an application for a new license. License No. SMA-1018 authorized the possession of a maximum quantity of 16,000 pounds of uranium and thorium in any form. Ores containing 1 to 2% thorium by weight were to be charged to an alumino-thermic reactor to produce ferro-columbium alloys. Natural uranium, depleted uranium, or thorium were also present as unwanted contaminants in various chemical forms in monel, copper, stainless steel, and other scrap metals that were melted in an arc-furnace process for a ferro-nickel production process. Thorium and uranium bearing waste slags were to be disposed of on-site in accordance with Section 20.301 of 10 CFR 20.

Between October of 1971 and February of 1973, certain assets were leased to Noblemet International Corporation. In April 1973, the leases were terminated and the assets were transferred to a wholly owned subsidiary of the Whittaker Corporation, Whittaker Metals Alloy Division. The site NRC license was amended in 1973 to reflect these changes.

In early 1974, Whittaker decided to terminate all manufacturing operations involving source material at the Reynolds Industrial Park site. In November of 1974, a request for renewal of SMA-1018 was submitted for the storage (possession) of up to 1,000,000 pounds of natural and depleted uranium and thorium in any chemical form. The facility was sold to Exomet, Inc. in late 1974, with Whittaker retaining responsibility for source materials that remained on the premises.

Whittaker, with the assistance of several consultants, has been negotiating with the NRC on plans for terminating the license for this site. The site was placed on the NRC's Site Decommissioning Management Plan (SDMP) list for sites that exceed the criteria for release for unrestricted use, yet do not represent an immediate threat to the health and safety of the public. The SDMP program generally applies to more complex sites that may present unique or difficult decommissioning issues, such as extremely large volumes of contaminated materials.

In mid-1999, Meggitt, LLC acquired Whittaker. The Whittaker name and organization remained unchanged as the licensee for the site. Currently, License No. SMA-1018 allows for the possession of material contaminated with uranium and thorium that were present at the site as of June 1, 1985. The only activities authorized by the license relate to the storage of radioactive material and the decontamination and decommissioning of the site.

Waste Material Description

The vast majority of the waste material being generated during the remediation activities proposed for the Whittaker Site will be in the form of metal slag that resulted from the process described in previous paragraphs. It is estimated that approximately 136,300 cubic feet (8,000 dry weight tons) of waste will be required to be excavated to meet license termination requirements defined in the site Decommissioning Plan submitted to the NRC on August 7, 2003. Less than 10% of the estimated volume of LLRW is expected to have natural uranium and/or thorium concentrations that exceed the limits that would require the waste to be disposed of at an NRC-licensed disposal facility.

The licensee wishes to find an acceptable non-disposal (reuse) path for the approximately 7,400 tons of slag material that has thorium and uranium concentrations above the release criteria defined in the Decommissioning Plan yet at such low levels to be considered "unimportant quintiles of source material." Table 1 below provides the concentrations, in picocuires per gram (pCi/g), of the benchmarks described in this section. It should be noted that the release criteria in Table 1 are proposed and have not yet been approved by the NRC.

TABLE 1
WASTE MATERIAL CONCENTRATIONS AND PROPOSED PATH

Waste Designation		Source Material (pCi/g)	Unimportant Source Material (pCi/g)	Less Than Release Criteria (pCi/g)
Concentration	U-238+D	> 165	4.7 to 164	< 4.7
Range	Th-232+D	> 55	3.3 to 54	< 3.3
Path		LLRW Disposal*	Beneficial Reuse	Left on-site

* - Disposal at EnviroCare of Utah

Although the range of unimportant concentrations in Table 1 is quite large, actual site conditions suggest a much tighter range of contamination above the release criteria. The characterization data presented in Appendix A of the Decommissioning Plan provides only five locations where the measured uranium-238 or thorium-232 concentration was within the unimportant concentration range of Table 1 and greater than 20 pCi/g. Each of these concentrations was also less than 30 pCi/g. Therefore, it can be certain that the mean concentration of the slag that Whittaker wishes to apply to a beneficial use is less than 20 pCi/g thorium-232 and uranium-238 (in equilibrium with their decay daughters) and is likely even less than 10 pCi/g.

Proposed Beneficial Use

The licensee proposes to use the Whittaker site slag material as a road sub-base in strip mine reclamation project located in Smith Township, Washington County, PA. Penn-Balt, Inc. (P.O. Box 287, Joffre, PA 15053) formerly operated the strip mine as well as a nearby bituminous coal mine. Penn-Balt still holds the title to the strip mine site.

The licensee proposes to limit the use of the raw material as a road sub-base in the strip mine. The roads in the mine support the on-going reclamation project, which involves filling the mine with agricultural lime. Recmix of PA, Inc. (359 North Pike Rd., Sarver, PA 16055) currently operates the backfill operation and places about 100,000 tons of lime into the mine each year. The slag material will be transferred from the licensee to K&P Asphalt (79 Skyline Dr., Hickory, PA 15340) who will construct the mine roads under contract to Recmix. As the mine is filled back in, the roads will be covered with lime and soil. This essentially eliminates the possibility that the slag material will be excavated in the future and placed in a residual waste landfill.

Slag material will be transported by truck from the Whittaker site to Smith Township, PA. Smith Township is about 80 miles south of the Whittaker site. Because of the low uranium and thorium concentrations in the slag, the material is exempt from U.S. Department of Transportation hazardous material shipping regulations and no special labels or placards will be required on the trucks. At the strip mine, the material will be placed directly on the ground for use as road base inside the strip mine. The slag material will not be processed or size reduced in any manner. Later, the slag material will be covered with lime and soil.

An additional option for the use of some of the slag material would be to reprocess it to extract valuable metals. It is proposed that K&P Asphalt, along with its associates experienced in slag reprocessing, would make this decision following the transfer of the material to K&P.

Relevant Federal and State Regulations and Commentary

The following Federal and State regulations from the Code of Federal Regulation (CFR) and the Pennsylvania Code (PAC) are relevant in the decision to allow the proposed beneficial reuse of the slag material from the Whittaker site. The importance of each specific regulation is also discussed.

10 CFR 40.4 *Definitions*

> "Source material" means: (1) uranium and thorium, or any combination thereof, in any physical or chemical form or (2) ores which contain by weight one-twentieth of one percent (0.05%) or more of uranium, thorium or any combination thereof.

This provides the legal definition of "source material."

10 CFR 40.13 *Unimportant Quantities of Source Material*

> (a) Any person is exempt from the regulations in this part [10 CFR 40] and from the regulations for a license set forth in Section 62 of the Act to the extent that such person receives, possesses, uses, transfers, or delivers source material any chemical mixture, compound, solution, or alloy in which the source material is less than one-twentieth of one percent (0.05%) of the mixture, compound, solution, or alloy.

This states that an NRC license is not required for those receiving, possessing, or using "unimportant quantities of source material."

10 CFR 20.2002 *Method for Obtaining Approval of Proposed Disposal Procedures*

> A [NRC] licensee or applicant for a license may apply to the Commission for approval of proposed procedures, not otherwise authorized in the regulations in this chapter, to dispose of licensed material generated in the licensee's activities.

This regulation allows for alternative disposal methods of licensed material to be reviewed and approved by the NRC. Combined with 10 CFR 40.13, it includes the use an unlicensed facility where unimportant quantities of source material are concerned.

PAC Title 25 Chapter 288.201 *Basic Limitations* [for residual waste landfills]

> (g) The following radioactive material controlled under specific or general license or order authorized by any Federal, state, or other government agency may not be disposed at the facility, unless specifically exempted from disposal restrictions by an appropriate Pennsylvania of Federal statute or regulation:
>
> (1) Naturally occurring and accelerator produced radioactive material.
> (2) Byproduct material.
> (3) Source material.
> (4) Special nuclear material.
> (5) Transuranic radioactive material.
> (6) Low-level radioactive waste.

This regulation states that material controlled under an NRC license will not be allowed in Pennsylvania landfills unless specifically exempted. However, it does limit other uses of the material at other locations.

PAC Title 25 Chapter 288.222 *Radiation Monitoring and Response for Noncaptive Landfills*

> (c) Radiation detector elements shall be as close as practical to the waste load and in an appropriate geometry to monitor waste. The radiation monitoring system shall be set to alarm at a level no higher than 10 microroentgen per hour (uR/hr) above the average background at the facility when any of the radiation detector elements is exposed to a cesium-137 gamma radiation field.

The regulation implies that there is an acceptable level of gamma-emitting radioactive material that is allowable in noncaptive landfills. This limit is set at 10 uR/hr as detected by the waste monitoring system.

PAC Title 25 Chapter 287.611 *Authorization for General* [Beneficial Reuse] *Permit*

(d) The Department will not issue a general [beneficial reuse] permit for the following:
(1) Residual waste disposal impoundment.
(2) A residual waste landfill, a valley fill, or other fill.
(3) the use of residual waste to fill open pits from coal or other mining . . .
(4) The use of residual waste solely to level an area or bring the area to grade unless construction activity is completed on the areas promptly after placement of the waste. A general permit may be issued for the beneficial use of waste as a construction material.
(5) The placement of waste oil or asbestos-containing waste on roads in this Commonwealth.
(6) Surface land disposal activities.
(7) The use of residual waste for construction or operation at a disposal facility.

Based on these limitations, the proposed beneficial reuse of the slag material described in this technical proposal is not restricted by the regulation.

Gamma Exposure and Dose Assessments

The licensee conducted two rudimentary assessments to analyze the effects of this material on human populations. The first assessment estimates the gamma radiation exposure levels that would occur during transport of slag-containing waste material excavated FOLLOWING beneficial reuse. The second assessment estimates the radiation dose to a hypothetical human receptor from buried slag material.

The gamma exposure estimate was determined using the MicroShield Version 5.05 dose modeling code. The exposure scenario assumed a truck trailer measuring 15 feet by 8 feet by 4 feet filled with a slag and soil mixture as excavated from the strip mine road base. This scenario also assumes that the trailer is constructed of 0.75-inch steel. The slag-containing mixture is assumed to contain 10 pCi/g each of uranium-238 and thorium-232, each in secular equilibrium with their decay daughters (+D). This is likely greater than the true average concentration of the slag alone. The resulting gamma radiation exposure rate at 2 feet from the center point on the trailer sidewall is less than 5 microRoentgen per hour (uR/hr). As such, a shipment of this material as described would be less than the minimum alarm set point for landfill waste monitors (PAC 25 288.222) and would be allowed at a noncaptive landfill. This exposure assessment also suggests that the exposure rate to those driving on the road containing the slag material should also be less than 5 uR/hr.

The dose estimate to the hypothetical human receptor from buried slag material was determined using the RESRAD Version 6.21 dose modeling code. The dose estimate assumed the standard ultra-conservative residential farmer exposure scenario with the following conditions placed on the slag-containing waste deposition:

- Average uranium-238 (+D) and thorium-232 (+D) concentrations – 10 pCi/g
- Source area – 1,000 square meters
- Source thickness – 4.5 meters (4,500 cubic meters of material)
- Cover thickness – 2 meters
- Thickness of unsaturated zone (below source layer) – 8 meters

Furthermore, solubility limits and leach rates developed by the NRC and presented in the Decommissioning Plan that are specific to slag at the Whittaker site were used in place of the RESRAD default values.

Using the RESRAD default values for the remaining parameters in the external gamma; inhalation; and plant, meat, milk, aquatic food, drinking water, and soil ingestion exposure pathways, the resulting maximum dose within a 1,000-year time frame is 20 millirem per year at time=1,000 years. The primary contributors to the dose at this time are radium-226 and uranium-234 in groundwater.

Cost Analysis

The licensee has estimated that the cost for disposing of the "unimportant" source material as low-level radioactive waste (LLRW) will be about $1.6 million assuming 7,400 tons of waste. Specifically, the transportation costs are estimated at close to $1.1 million ($120/ton + $150,000 for rail siding improvements) and the disposal fees approach $500,000 ($61/ton). This option includes rail transportation to Waste Control Specialists, Inc. (WCS) in Andrews County, Texas.

The beneficial reuse option would cost the licensee less than $200,000. This includes a $10/ton fee from the K&P Asphalt Co. for managing the slag ($74,000) and about $15/ton for transportation ($111,000) to the Smith Township, PA by truck. Smith Township is about 80 miles south of the Whittaker site.

Furthermore, because of the reduced cost in removing the slag material from the site, there will likely be cost savings in on-site operations. At high disposal costs, the on-site contractors must implement a very precise excavation and sampling method as to not dispose of material below the release criteria that could stay on-site. If the costs to remove the material from the site are significantly lower, the removal of material less than the release criteria is not as financially significant. As a result, the excavation and sampling methods would not require the precision and effort that would be required if the material is going the high-cost route of LLRW disposal. This cost savings is difficult to predict, but it could be on the order of several hundred thousand dollars.

If the beneficial reuse option is allowed, the overall cost savings to the licensee could be between $1.5 and $2 million.

In addition to the substantial cost savings to the licensee, the expenditures associated with the reuse option will stay within the Commonwealth of Pennsylvania. The licensee will use a local trucking firm(s), material handling/processing fees will be paid to a local asphalt company, and the use of a low-cost road sub-base will benefit Recmix. If the material were disposed of as LLRW, it would require the use of an out-of-state transportation company and send all disposal fees to an out-of-state facility.

Justification for Allowance

The licensee requests that an allowance for the beneficial reuse of the Whittaker site slag with uranium and thorium concentrations within the "unimportant" source material concentrations presented in Table 1 based on the following conclusions supported by the information presented in this technical proposal.

1 – The material in question, although currently licensed by the NRC, contains "unimportant" concentrations of source material as defined in 10 CFR 40.13. In fact, the mean concentration of the material is likely less than 10 pCi/g.

2 – The material in question would not require an NRC license for possession, processing, or use if it were not currently managed under an existing license that was originally obtained to manage radioactive feed material (natural ores). Under 10 CFR 20.2002, the NRC can allow this material to be transfered to an unlicensed recipient.

3 – Use of the slag from the Whittaker site will be limited to the road sub-base material in the abandoned PennBalt strip mine located in Smith Township, PA. Use of the material in this way will essentially eliminate the possibility that the material will be excavated at some point in the future. Therefore, the landfill disposal restrictions in PAC Title 25 Chapter 288.201 would not be applicable. Furthermore, this proposed use is not restricted by PADEP regulations (PAC 25 287.611).

4 – Exposure modeling shows that if the slag-containing material were excavated and taken to a Pennsylvania landfill equipped with radiation detectors the exposure rates would be below the existing minimum alarm levels required by PAC Title 25 Chapter 288.222.

5 – Extremely conservative dose modeling shows that, if the processed slag-containing material were excavated and taken to a Pennsylvania landfill and a home and farm were eventually built on the landfill, the resident farmer would not receive an unacceptable dose within a 1,000 year time frame according to the dose limits established by the NRC's License Termination Rule (10 CFR 20, Subpart E).

6 – The economic burden placed on the licensee to transport over 7,000 tons of "unimportant" source material out of Pennsylvania and dispose of it as LLRW is not in balance with the level of risk to human health that is avoided. Disposal of the material as LLRW would require the use of an out-of-state transportation company and send all disposal fees to an out-of-state facility. The beneficial reuse option will result in significant cost savings to the licensee and will keep the expenditures inside the Commonwealth of Pennsylvania with no substantial increase in the human health risk to the citizens of the Commonwealth.

Conclusions

Based on the information provided in this technical proposal, the licensee hopes that the PADEP will consider the beneficial reuse of slag material containing "unimportant" concentrations of the naturally occurring uranium and thorium. This proposal has demonstrated, through rudimentary and conservative exposure and dose assessments, that acceptance of the proposed reuse option does not create any unacceptable risk to human health. Furthermore, acceptance of the reuse option lies within both the federal and state regulatory frameworks governing the action. If the PADEP determines that the reuse option is unacceptable, the licensee may be forced to dispose of the material as LLRW and incur the high costs associated with this type of disposal. These costs are not in balance with the minimal risk avoidance resulting from a rejection of this proposal.