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## **ENVIRONMENTAL ASSESSMENT OF SITE DECOMMISSIONING PLAN FOR THE CABOT READING SLAG PILE SITE IN READING, PENNSYLVANIA**

### **1.0 Introduction**

#### **1.1 Background**

The possession of slag at the Reading, Pennsylvania location is licensed by the US Nuclear Regulatory Commission (NRC) License No. SMC-1562 held by Cabot Corporation (Cabot). Slag materials from metal processing activities performed in the late 1960's were deposited on a preexisting slag pile. The process utilized tantalum in low grade ores by heating a mixture of iron ore, tantalum ore, and coke in an electric arc furnace. The ores contained naturally-occurring uranium and thorium in concentrations defined as "source material" by the NRC. The possession and handling of these materials were regulated under an NRC license. The tantalum alloyed with the iron, leaving a glass-like silica gangue in which the naturally-occurring thorium and uranium remained. The glass-like slag residues from processing operations were placed on a preexisting slag disposal area on an embankment at the southern end of the property. Additional material including sand mixed with tin slag from a location in Baltimore was placed there in 1977 and 1978 as a result of building decontamination activities. The total estimated volume is approximately 5007 m<sup>3</sup> (180,000 ft<sup>3</sup>).

In late 1995, Cabot initiated a comprehensive site characterization at the Reading slag pile site. The radiological survey included a site characterization, determination of slag leach rates, surface gamma measurements, radiological analysis of surface and subsurface samples, determination of the weathering rate of the slag, and analysis of the slag pile stability. Radiological slag was identified at two topographically distinct areas: on an embankment (Slag Pile Area) and within the River Road Right-of-Way (ROW).

In August 1998, Cabot submitted a decommissioning plan (DP) for the Reading Slag Pile Site using the decommissioning criteria in 10 CFR Part 20, Subpart E. NRC contracted with Sandia National Laboratories (SNL) to review the dose assessment in the DP. In response to a December 1999 request for additional information, Cabot submitted a revised DP and Radiological Assessment (RA) in March 2000.

This environmental assessment was prepared in evaluation of Cabot's March 2000 DP and RA submission. Approval of this plan and supporting documents would result in removal of the Reading slag pile site from license SMC-1562 and release of the site for unrestricted use.

#### **1.2 The Proposed Action**

Cabot requests approval of their DP and therefore license termination of their source materials license for the Reading Slag Pile site in Reading, Pennsylvania. In their DP, they propose to release the site for unrestricted use with no further onsite decommissioning or surveys.

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### 1.3 Purpose and Need for the Proposed Action

The purpose of this action is to terminate the source material license on that part of site, where source material is no longer used. Furthermore, the intent of this is to allow unrestricted release of the site, thereby removing limitations on the future use of the property. This action is required by 10 CFR 40.42, "Expiration and termination of licensees and decommissioning of sites and separate buildings or outdoor areas".

## 2.0 Facility Description/Operating History

### 2.1 Site Locale and Physical Description

The Cabot site is located in Reading, Bucks County, Pennsylvania east of the Schuylkill River. Between the slag pile area and the Schuylkill River, there are an underdeveloped extension of the River Road Right-of-Way (ROW), a Norfolk Southern (Norfolk) railroad ROW, and remnants of the former Schuylkill Canal. Another Norfolk Southern ROW is located approximately 150 feet northwest of the slag pile. Buttonwood Street is located approximately 600 feet to the southeast of the pile. Slag materials from metal processing activities performed in the late 1960's were deposited on the preexisting slag pile. Topographical survey information was used to estimate the dimension of the radiological slag at the site. The cross-sectional area is approximately 103 m<sup>2</sup> (1125 ft<sup>2</sup>). The estimated volume of the slag pile and the slag in the River Road ROW is approximately 5007 m<sup>3</sup> (180,000 ft<sup>3</sup>). The top of the slag pile is a level area that is approximately 160 feet long and extends back a maximum of 15 feet from the top edge of the slag pile. The slag pile stability was evaluated using standard geotechnical engineering practice. Based on the model results and observations that the slope has been stable for approximately 30 years since the material was placed, it has been concluded that the slope is stable. Its elevation is approximately that of a much larger contiguous level area upon which industrial facilities are located.

### 2.2 Facility Operating History

In October 1967, Kawecki Chemical Company, a predecessor to Cabot, obtained Source Material License SMC-1562 from the U.S. Atomic Energy Commission (predecessor of NRC) which allowed the company to process tin slag containing trace amounts of natural uranium and thorium, at their Reading location. The process was designed to increase the percentage of tantalum in low grade ores by heating a mixture of iron ore, tantalum ore, and coke in an electric arc furnace. The tantalum alloyed with the iron, leaving a glass-like silica gangue in which the naturally-occurring thorium and uranium remained. The glass-like slag residues from processing operations were placed on a preexisting slag disposal area on an embankment at the southern end of the property.

Currently there are no licensed materials used at the industrial property, which constitutes the site. Other than the slag pile area and the River Road ROW area, all areas where licensed material was handled have been decontaminated and released under the SDMP cleanup criteria for unrestricted use. Because the property is not owned by the licensee, the area

Draft

encompassing the radiological slag has been defined as the "Site" for purposes of discussion in this EA.

Currently, Cabot holds license SMC-1562 allowing the company to possess the slag material produced by Kawecki Chemical Company in the early 1960s.

### **3.0 Radiological Status of the Facility**

#### **3.1 Radiological Status of Uranium/Thorium Contaminated Slag**

The radionuclides of interest for the dose assessment were determined using operational history and the site characterization data. The radionuclides considered are naturally occurring uranium (U-238, U-234 and U-235), naturally occurring thorium (Th-232 and Th-228) and their radioactive progeny. The radioactive materials at concentrations distinguishable from background concentrations are primarily confined to slag from processing of ores with small concentrations of naturally-occurring uranium, thorium, and progeny nuclides. The slag, which retained the radioactive constituents, was deposited on the slag pile.

The DP includes six dose modeling scenarios. These scenarios are summarized as: 1) Worker - Current Condition, 2) Worker - Eroded Slope, 3) Trespasser -Current Condition, 4) Trespasser - Eroded Slope, 5) Recreation Walker - ROW, 6) Excavation Worker - ROW. For the base scenarios, Cabot reports the total effective dose equivalent for worker under current conditions is 1.2 mrem/y, for worker with an eroded slope 2.0 mrem/y, trespasser for current condition 1.5 mrem/y, trespasser with an eroded slope 4.4 mrem/y, recreation walker ROW 0.32 mrem/y, and Excavation Worker ROW 1.7 mrem/y. However, NRC considers Cabot's Resident Gardener sensitivity analysis to be a more appropriate dose calculation model. This analysis differs from the base-case scenario in that it assumes no soil cover over the slag and includes the ingestion of vegetables in the analysis, resulting in a total effective dose equivalent for a Resident Gardener of 0.15 mSv/y (15 mrem/y). NRC staff independently calculated the total effective dose equivalent, using the same scenario with different parameters, to be no greater than 20 mrem/yr. The derived average radionuclide concentration for natural uranium and thorium in equilibrium, used in both Cabot's and NRC's assessment, is: U-238 5pCi/g for intact and 15 pCi/g for eroded, Th-232 7.5 pCi/g for intact and 22.5 pCi/g for eroded. The NRC Radiological Criteria for License Termination: Final Rule (10 CFR Part 20 Subpart E) limit for unrestricted release is 0.25 mSv/y (25 mrem/yr) from all pathways plus ALARA.

#### **3.2 Radiological Status of Soils**

Cabot reports that based on the Site characterization data and visual observations, the surface soils consist of mixed fill materials; (i.e., primarily non-radiological slag mixed with construction debris, a small volume of radiological slag, and soil). The average net activity concentration in the slag/soil/debris mix is approximately 75 pCi/g of combined thorium (Th-232 and Th-228) and uranium (U-238 and U-234). This estimate is based on the average measured concentration from the surface to a depth of 16 feet. Average net uranium and thorium concentrations in soil near the surface (to a depth of 2 feet or less) are somewhat lower. The

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average net activity concentration in surface soil samples in the slope face is approximately 25 pCi/g total combined thorium and uranium, of which approximately 5 pCi/g is U-238 and 7.5 pCi/g is Th-232. These estimates are based on the results of surface soil measurements.

### 3.3 Radiological Status of Surface Water and Groundwater

Monitoring of groundwater and surface water is not required by license SMC-1562. Therefore, the only information regarding the status of water on the Reading Slag Pile Site is contained in the aquifer characterization presented in the DP, which indicates the aquifer is not a practical source for drinking or irrigation of a fish pond. Analysis of groundwater directly below the radiological material meets drinking water standards for radiological parameters and is similar to Schuylkill River water.

## 4.0 Alternatives to the Proposed Action

### 4.1 Alternative 1: No Action

The no action alternative would leave NRC license SMC-1562 unmodified, and allow the licensee to continue with the contaminated slag piles on Site. Cabot would remain on the SDMP list. Failure to pursue decommissioning of the site would not be consistent with 10 CFR 40.42, "Expiration and termination of licensees and decommissioning of sites and separate buildings or outdoor areas". The purpose of the Decommissioning Timeliness Rule is to reduce the potential risk to the public and environment that may result from delayed decommissioning of inactive facilities and sites. Specific concerns addressed by the Timeliness Rule include the potential risk of safety practices becoming lax because of attrition of key personnel, and lack of management interest at facilities after operations cease, as well as the potential for bankruptcy, corporate takeover, or other unforeseen changes in a company's financial status that may complicate or delay decommissioning.

The No Action Alternative would also be counter to established NRC environmental regulations, policy, and practice. Therefore, this alternative is not reasonable and, therefore, is not further addressed in this EA.

### 4.2 Alternative 2: Further remediation of the Site

The licensee examined the possibility of conducting further remediation of the Site. However, after conducting a cost benefit analysis, the licensee concludes that the cost of the proposed remediation exceeds the value of the dose expected to be saved, that the ALARA condition has been met, and that no further dose reduction is necessary. Therefore, based on our review this action is not further addressed in this EA.

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## 5.0 Radiation Protection Program

As the licensee proposes to release the site for unrestricted use, no radiation protection program is delineated in the Site decommissioning plan. The licensee reports no known radiological operating occurrences that would affect the safety of their personnel during decommissioning.

## 6.0 Environmental Impacts

### 6.1 Licensee's Proposed Action

#### 6.1.1 Radiological impacts to workers and the public

Cabot's radiological assessments contain two base-case scenarios for possible future use at the site and possible exposure to radiological slag remaining on the site. These scenarios are a trespasser and worker scenario. Because radioactivity within the slag pile is not uniform (with the deeper slag being more radioactive than that at the surface), the assessment also considers these hypothetical individuals being exposed to the slag in an eroded state. The radiological assessment also considers a recreational walker and an excavation scenario for possible future exposure to radioactive slag remaining in the River Road ROW, located at the base of the slag pile. Cabot believes these scenarios appropriately bound likely exposure to residual radioactivity at the site. However at the request of the NRC, Cabot's radiological assessment also includes a resident gardener scenario as part of their sensitivity analysis. For the resident gardener scenario, a hypothetical homeowner is assumed to reside on the property immediately adjacent to the slag pile. The hypothetical resident is assumed to maintain a vegetable garden for a family of two. In addition to spending time on the slag pile for gardening activities, the resident is assumed to spend some fraction of time spent outdoors on the pile for other activities. The slag pile is assumed to stay intact. A dose of 15 mRem/year is calculated for the resident gardener scenario.

NRC considered the resident gardener scenario to be a credible scenario, although it is considered to have a small likelihood of occurrence. The Resident trailer scenario was not considered, because the top of the slag pile is a land area that extends back a maximum of only 4.5 meters (15 ft) from the edge; therefore, any structure placed on the top of the pile would pose a serious hazard. The slag pile also has an estimated area overall slope of 30<sup>0</sup>, but is as great as 45<sup>0</sup> in some places; therefore, very limited activity is expected to occur on the side slope of the pile. Therefore, NRC concentrated its effort on evaluating Cabot's assessment of the resident gardener scenario because it is expected to provide the largest dose and, therefore, is expected to bound the dose from exposure to the slag for future use of the site. The trespasser scenario was also considered credible by NRC staff. The staff's results indicated the dose to be 20 mrem/year for the resident gardener scenario. The expected dose from the trespasser scenario is highly dependent on the time that the trespasser is assumed to spend on the site. Developing an appropriate time to assume for this scenario is highly speculative, because of the wide range of activities that can be postulated. In the Cabot radiological assessment, the trespasser is assumed to spend five hours per week, nine months

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of the year (180 hours/year) as a bounding analysis. The trespasser is assumed to spend all of this time on the side slope of the pile to maximize exposure. The calculated dose in the Cabot radiological assessment for this scenario is 11 mRem/year. The NRC staff analysis shows that the hypothetical trespasser would need to spend slightly more than 400 hours/year to exceed the 25 mRem/year dose limit. The NRC staff finds it difficult to pose a situation where a trespasser will spend that many hours on the site, especially on the side slope of the pile.

Because the radioactivity of the slag located in the River Road ROW is lower than that within the pile (i.e., the side slope of the pile), exposure to the slag in the right-of-way will be generally bounded by the analysis of radioactivity in the pile. Although the contaminated area in the right-of-way is level, it is not considered large enough to support a residence. The contaminated area is estimated to be 139 m<sup>2</sup> (1500 ft<sup>2</sup>). Only 18 percent of new houses constructed in the northeast are less than or equal to 186 m<sup>2</sup> (2000 ft<sup>2</sup>) according to 2000-Census data.

In evaluating the various scenarios, NRC staff believes that the light industrial scenario is the more credible scenario for evaluating potential doses because the area has historically been used for industrial activities. In addition, St. Joseph Medical Center has shown an interest in building a new hospital in the vicinity of the site. If St. Joseph Medical Center constructs a hospital and its associated infrastructure (e.g. roads, parking lots and doctors offices), such land use would preclude the resident gardener scenario well into the foreseeable future. However, the staff based its decision on the more conservative resident gardener scenario.

#### 6.2.2 Non-Radiological Environmental Impacts

No water courses other than the Schuylkill River were identified in the immediate vicinity of the site. As would be expected for granular fill material, the surface of the site and adjacent areas appear well drained. The Norfolk ROW and the River Road ROW are within the flood plain of the Schuylkill River. The majority of the slag pile, which ranges in elevation from approximately elevation 210 feet mean sea level (MSL) to 260 feet MSL, is above the 100-year and the maximum reported flood level.

Bucks County has a temperate, humid, maritime climate. The average annual precipitation is approximately 40 inches. Bedrock beneath the site is mapped as Richland Formation which is from the Cambrian Period age. Between the base of the embankment, and the Schuylkill River the geology is mapped as Quaternary age alluvium. The groundwater down gradient from the slag is restricted to a shallow, thin (no more than several feet thick), and short (80 feet to 200 feet long) flow zone between the slag and the river. The zone has insufficient yields to support even a marginal domestic or industrial supply well.

The groundwater is not expected to be contaminated because the leach rate of the slag is so low. To confirm this conclusion, groundwater samples were collected on two occasions from a well installed in the River Road ROW directly down gradient from the slope and within the ROW area. The results of that sampling and analysis indicate that the groundwater quality meets the National Primary Drinking Water Standards for radionuclides.

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The NRC staff has determined that the proposed action will result in minimal environmental impacts.

## **7.0 Agencies and Individuals Consulted**

NRC contacted the U.S. Fish and Wildlife Service to determine the potential impacts of the proposed action on threatened and endangered species near the Site. By letter dated June 6, 2002 the U. S. Fish and Wildlife Service informed NRC that the proposed action would have no impact on threatened and endangered species.

NRC did not contact the State Historical Preservation Officer due to the fact the proposed action is no further decommissioning, therefore, it was determined that there will be no impact.

## **8. CONCLUSION**

Radiological exposure to workers and the public will be in accordance with 10 CFR Part 20 subpart E limit of 0.25mSv/y (25 mrem/y).

NRC also believes that the potential dose to workers, members of the public, and the environment is minimal and the potential environmental impacts from the proposed action are not significant.

## **9.0 REFERENCE**

NRC, "*Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for License Termination of NRC-Licensed Nuclear Facilities*", U.S. Nuclear Regulatory Commission, Washington, DC, NUREG-1496, July 1997.

NRC, "*Probabilistic Modules for the RESRAD and RESRAD-BUILD Computer Codes-User Guide*", U.S. Nuclear Regulatory Commission, Washington, DC, NUREG/CR-6692, November, 2000.

NRC, "*Probabilistic Dose Analysis Using Parameter Distributions Developed for RESRAD and RESRAD-BUILD Codes*", U.S. Nuclear Regulatory Commission, Washington, DC, NUREG/CR-6676, July, 2000.

NRC, "*Disposal or On-site Storage of Residual Thorium or Uranium from Past Operations*"; U.S. Nuclear Regulatory Commission, Washington, DC, SECY-81-576, October 1981.

NRC, "*Radiological Criteria for License Termination; Final Rule*", U.S. Nuclear Regulatory Commission, Washington, DC, July 1997.

STEP, "*Radiological Assessment for Reading, Pennsylvania Site - Revision 1*", Cabot Corporation, Boyertown PA, March, 2001.

Draft

STEP, *"Decommissioning Plan for Reading, Pennsylvania Site - Revision 1"*, Cabot Corporation, Boyertown PA, March, 2001.

NES, *"Characterization Report for the Reading Slag Pile"*, Cabot Corporation, Boyertown, PA, April 1996.