Cabot Corporation Comment Report on the Johns Hopkins Draft Progress Report and Related Issues
November 21, 2002

1.0 INTRODUCTION

Several documents have been prepared by various federal and state agencies and their contractors that discuss the characterization and radiological dose assessment for the Reading Slag Pile site (Site). The documents include:

- A draft progress report prepared by Johns Hopkins University (JHU report)
- Two assessments prepared by Sandia National laboratories (Sandia) for the NRC
- A Health Consultation prepared by the Agency for Toxic Substance and Disease Registry (ATSDR) in response to a request by a member of the public
- Letters from the Pennsylvania Department of Environmental Protection (PADEP) to the Nuclear Regulatory Commission (NRC), dated May 2, 2002 and July 10, 2002

Review of these documents leads to some general conclusions:

- JHU reviewed only a small fraction of the available information and omitted nearly all of the most recent comprehensive reports prepared and submitted by Cabot. The JHU report contains numerous factual errors that result in a gross overestimate of the amount of source material at the Site and unjustified criticisms of the site characterization.
- The Sandia evaluations include assumptions that do not reflect reasonable potential future exposure scenarios. These unrealistic assumptions result in overestimating the potential dose and are not representative of potential exposure to an average member of the critical group.
- ATSDR considered only a minor fraction of the available documents and did not adequately take into account the physical setting and site characteristics. The ATSDR report also contains inconsistencies and numerical errors.
- The PADEP comments appear to be based primarily on the JHU report and the Sandia assessments, with particular emphasis on the erroneous JHU assertion that the radiological inventory at the site is nearly 75 times greater than indicated by the characterization and site historical data.

The comments and documents prepared by JHU, Sandia, PADEP, and ATSDR are interrelated. Each successive document continues the mistakes of the previous documents and adds new ones. In total, they give the false impression that site characterization is insufficient and that there is a problem with the prudently conservative radiological assessment. This response is intended to correct this false impression by pointing out the mistakes in the JHU and PADER documents. A response to the ATSDR reports is being provided to the NRC under separate cover. Taken together, these responses confirm the previous site characterization and dose assessment work and that the Site is suitable for unrestricted release under NRC decommissioning and license termination rules.

2.0 Johns Hopkins University Draft Progress Report

The JHU report makes several statements and recommendations about the Site that are incorrect and inconsistent with its own reported analyses, the large body of available physical measurements, records that were generated during the slag processing and placement (period documents), and the detailed studies prepared in support of license termination. There are two principal issues with the JHU report:

1. it grossly overestimates the source material inventory; and,
2. it incorrectly assumes that site characterization is inadequate because JHU believes that split-spoon sampling could not obtain representative samples.

This response discusses the errors in the JHU report and supplements the public record with additional period information from Cabot's internal files that is useful in characterizing and quantifying radioactive material inventory and concentrations in the Reading slag pile.

2.1 BACKGROUND ON THE JHU REPORT

The objective of the JHU study is clearly stated in the draft report. "The purpose of this study is to identify the phases within slags that contain U, Th and to determine the long-term stability of those phases." The draft JHU report, however, contains statements questioning the characterization program, incorrectly suggesting that there is much more source material than indicated by the site characterization, and recommending additional characterization effort and techniques. Doubts about the reliability of such statements that reach outside the bounds of the intended scope and presumed qualifications of the author are confirmed by a careful comparison of these statements to the record.

The JHU draft report indicates that work related to the stated objectives has not been completed. This response focuses on issues relating to characterization of the Site. Cabot may have comments on other aspects of the JHU study, such as leaching and stability of the slag, when a final draft is released for comment.

2.2 JHU INCORRECTLY CALCULATED THE SOURCE MATERIAL INVENTORY

The two most serious errors in the JHU report are the assertion that all slag and slag mixtures contain 2 wt% Th and U and that an additional 6,000 tons of tin slag (at 2 wt%) was deposited on the slag pile. These two errors led JHU to conclude that there is approximately 75 times more Th and U present in the slag pile than indicated by the period documents and site characterization data. The errors in the JHU report are demonstrated by numerous inconsistencies between statements in the body of the JHU report and the source documents and JHU's own data. Because these two issues (concentration and amount of slag) are combined by JHU to develop the incorrect source material inventory, they are treated together here.

2.2.1 JHU Citations

<u>Assertion That The Tin Slag Contains 2 Wt% Thorium And Uranium</u>

The JHU report states in various places that the tin slag contained 2% by weight thorium and uranium, for example:

1. Section 1.4.1.2 (third paragraph, item number 1.) states:

> "The tin slags contained up to a total of 2 weight percent (wt %) U and Th (Kawecki, 1967)"

2. Section 1.4.1.2 (seventh paragraph item number 5.)states:

> "Bulk chemical analyses (X-ray fluorescence) Table 2 indicate that a total of 2 wt% of U and Th are present in the Reading Sn and Nb-Ta slags."

<u>Assertion That There Are 6,000 More Tons Of Sn Slag In The Pile Than Indicated In The NES Report</u>

The JHU report states several times that there is an additional 6000 tons of tin slag, and uses this assertion to calculate a total source material inventory for the pile.

1. Section 1.4.1.2 (fourth paragraph; item number 2.) states:

> "A letter from the Maryland Department of the Environment to Applied Health Physics, Inc., dated July 25, 1977, indicates that, at about that time, 286 20-ton-dump truck loads of Sn slag and contaminated sand left the Canton Railroad Yard in Baltimore for the Reading site. This amounts to approximately 6000 tons of Sn slag and sand, or ~ 152 tons of U and Th,

which is approximately six times the 1040 tons indicated in the Characterization Report for the reading Slag Pile (NES, Inc. 1996)."

2. Section 1.4.1.2 (seventh paragraph; item number 6.) of the JHU report states:

"An estimate of the original total U/Th content for the pile can be calculated from (a) the amount of Sn slag on-site (1040 tons + 6000 tons = 7040 tons) and its initial U/Th content (~2 wt%) and (b) the amount of Nb-Ta slag (600 tons) and its initial U/Th content (~2 wt%). This amounts to approximately 153 tons of uranium and thorium, which is 120 tons more U/Th than was estimated in the NES Site Characterization Report for the Reading Slag Pile (1996)."

2.2.2 Response

The JHU report grossly overstates the concentration for Th/U in the slag and compounds that error by grossly overstating the amount of slag in the slag pile. When these errors are corrected, the characterization data is shown to bound the amount and concentration of source material that could be contained in the pile. The inventory of source material in the pile is on the order of 2 to 2.5 tons Th/U, not 153 tons as reported by JHU.

The JHU reports cites "Kawecki, 1967" as the basis for the estimate of 2 wt % Th/U concentration in slag, but does not provide enough detail for this citation for Cabot to be able to identify the referenced document. Regardless of the nature of this document, there is ample evidence that the actual concentrations of Th and U in the tin and waste slags was much lower than 2 wt %. The JHU report also incorrectly implies that the NES report estimates the total quantity of Th and U present in the slag pile at 33 tons, when it states "153 tons of uranium and thorium, which is 120 tons more U/Th than was estimated in the NES Site Characterization Report". The NES report does not explicitly estimate the total amount of uranium and thorium, and a reasonable estimate of the total based on available data would be more than an order of magnitude less than 33 tons.

Cabot's review of the Kawecki Chemical records that contain analytical results, including Atomic Energy Commission license applications, memorandums, reports and other documents, did not identify any reference indicating that any of the materials used, produced or disposed at the Site contained concentrations of Th and U as high as 2 wt %. The documents reviewed consistently indicated that the concentration of Th was in the range of **0.1 to 0.3 wt % in the tin slag** and in the range of **0.2 to 0.4 wt% in the waste slag.** The concentration of U was so much lower that it was not reported in the period documents. JHU and NES data show the concentration of U in the waste slag to be in the range between 0.0003 and 0.2 wt%, with an average of 0.05 wt%.

Table 1 is a summary of the analytical results for tin slag and waste slag. The table includes analyses performed by Applied Health Physics, Inc (AHP), consultant to

Kawecki Chemical Company, during the slag processing and placement activities, analyses of waste slag samples collected by NES as part of the characterization effort, and analytical results contained in the JHU report. As shown in Table 1, the average detected Th concentration was **0.22 wt% in tin slag and 0.31 wt% in waste slag, and the average detected U concentration in waste slag was 0.05 wt%.** The highest tin slag result was 0.25 wt % Th and all waste slag results were below 0.5 wt %. The tabulated analytical results are consistent with the ranges reported in the numerous documents prepared before, during, and after the processing activities at the site.

Table 2 of the JHU report presents analyses for 12 samples (including slag samples) collected from the Reading slag pile (RSP and CB series identification numbers). The maximum concentration reported is 4,400 ppm Th. The average of the Th concentrations reported is 2,358 ppm. These concentrations are equal to 0.44 wt% and 0.23 wt%, respectively. Thus, the analytical data provided by the JHU report are inconsistent with the statement made in the body of the JHU report. The analytical results reported in the JHU report are consistent with concentration ranges and analytical results reported in the other documents, as discussed above.

Period documents and recollections by employees provided a good estimate of the inventory of materials on the Reading pile and in Baltimore. Review of the available documents indicates that there was a conscientious effort to record the quantity and concentration of radiological material handled.

The inventory of tin slag on hand in Baltimore in 1974 (28,276 tons) (Kawecki, 1974) was nearly equivalent to the amount of material shipped from Baltimore to W. Germany on September 14, 1976 (28,087 tons) (AHP, 1976). Reports on the shipping effort indicate an effort to avoid including excessive dirt (soil) in the shipment. Thus, some tin slag close to the ground surface was left behind.

A substantial effort was undertaken to decontaminate the Baltimore shipyard after the unused tin slag was shipped to Europe. The tin slag was relatively fine grain material on the order of 6 mesh down with less than 2% below 100 mesh. (Kawecki, 1967). A significant volume of soil/sand/slag material was removed from the Baltimore site in order to meet the decontamination criteria of 0.05% Th applied to the site.

In addition, some tin slag from Baltimore and material from the later Reading building decommissioning were shipped to Boyertown for recovery. Therefore, the maximum amount of slag that could have been shipped to Reading since September 15, 1976 is limited to a few hundred tons, not 6,000 tons as stated by JHU.

The total inventory of Th and U in the material placed in the pile from all sources, including the material shipped from Baltimore after September 15, 1976, is on the order of 2 to 3 tons total Th and U and is summarized below.

a) 600 tons of waste slag was generated by the process at Reading and placed in the pile. At 0.3% Th, this equates to 1.8 tons of Th. This information is based on recollections by employees at the time. (AHP, 1979; Cabot, 1991b)

b) 580 tons of decontamination debris and soil were placed in the pile and that 293 samples of this material were analyzed and had an average of 0.51 pCi/g Th and 0.35 pCi/g U. (AHP May 3, 1979 and NRC, 1980) These concentrations are less than background and equate to 0.0016 tons Th and 0.00016 tons U.

c) During final decommissioning in Baltimore, remaining tin slag was sent to Boyertown for processing and sand/soil containing residual tin slag was sent to Reading for placement on the pile.

d) The recollections indicated that material shipped to Reading consisted of approximately 20 parts sand/soil and one part tin slag (Cabot, 1991a). That mixture would have a Th concentration of approximately 0.01% Th and 0.0025% U. This equates to approximately 0.6 tons Th/U based on 286 truckloads containing approximately 20 tons each. Testing of sand samples collected during the NES characterization effort indicated less than 1.6 pCi/g total Th activity (approximately 0.0007 wt %) which was at or below background levels (NES, 1996).

All available information pertaining to placement of source material on the pile is summarized and totaled in Table 2. The tabulation includes the 5,700 tons of material shipped from Baltimore. As shown, the inventory records indicate that the pile contains approximately 2.0 to 2.5 tons of total Th which represents an average activity of **47 pCi/g** in the pile. The average activity of Th in the pile, based on the characterization data was **45 pCi/g**. The close agreement of these values, which are based on different sources of information, provides a high degree of confidence in both.

The combination of the JHU report's overestimation of the concentration of Th/U in the slag and its incorrect conclusion that the Site contains 6000 tons of additional tin slag result in the JHU report overestimating the inventory of source material in the pile by a factor of 75.

2.3 CRITICISMS OF THE USE OF SPLIT-SPOON SAMPLING IN THE JHU REPORT ARE WRONG

The JHU report criticizes the site characterization for using a split-spoon sampler, arguing that this sampling method cannot sample the large blocks of waste slag. This criticism is not valid. The split-spoon sampling did obtain information that is representative of the entire slag pile, including the buried waste slag.

2.3.1 JHU Citations

Assertion That Split-Spoon Sampling Was Not Appropriate

Section 4.1, first paragraph, p. 21, of the JHU report states:

> "Photographs from May 1967 of the Nb and Ta slag, along with our collection of large blocks slag bearing U and Th, indicate that majority of the Nb-Ta slag is like the CB5.5 series or RSP5.5 series that we sampled. This is similar to the hottest material sampled and reported as slag in the NES Site Characterization Report. It appears that the method used for sampling the slag pile does not provide a representative sample of these slags. A split-spoon sampler cannot sample the large blocks that are buried in the pile. It appears that most of the material sampled."

In section 5.2, p.25, first bullet, the JHU report further states:

> "Care must be taken during site characterization. Split spoon sampling will not provide a representative sample of slag, if the slag is present in large blocks or cobbles."

There are several sources of information that contradict these JHU statements.

2.3.1 JHU Citations

Large blocks of waste slag do not constitute a significant part of the pile volume. Nevertheless, the borings did encounter and sample the zone containing the waste slag. The split-spoon sampling would have obtained samples of any waste slag encountered, including from large blocks. The samples obtained are representative of the pile.

Large Blocks Of Waste Slag Do Not Constitute A Significant Volume Of The Pile

The 600 tons of waste slag deposited on the slope had a bulk density of approximately 181 lb/ft3 (NES, 1996), and therefore would have a volume of approximately 6,600 ft3. This represents less than 4 % (by volume) of the measured pile volume (STEP, 2000). Based on the historical pictures (JHU, 2000, Figure 7) it appears that little if any of the waste slag was composed of blocks larger than 2 feet (the front-end loader provides a scale). JHU's caption for Figure 8 states "Note the large 0.6 to 1.0 m (2 ft to 3 ft) blocks of slag." However, no scale reference is visible in Figure 8, making determination of the size of blocks difficult. Even if as much as 20 % of the waste slag was composed of large blocks, it would comprise less than 1 % (by volume) of the slag pile.

The slope of the slag pile covered approximately 10,000 to 15,000 square feet. As shown in the photograph taken when the slag was deposited in 1967 (JHU, 2000, Figure 8), the slag appears to cover most of the slope. Therefore, the average thickness of the layer of waste slag would be relatively thin, on the order of one foot. Subsequent to the placement of the slag, other materials were placed on the slope, including clean cover, debris containing background levels of Th/U from the 1986 building decommissioning effort, sand/soil containing approximately 0.01 wt% Th, and other materials unrelated to Cabot's activities. Each of these materials was dumped from the top and would have filled-in the void spaces of underlying material. The zone containing the radiological slag would therefore be diluted.

The Borings did Encounter and Sample the Zone Containing Waste Slag

The slag and other materials placed on the pile were dumped from the top in batches over the period of operations and cleanup activities. As a result, the top edge and slope surface migrated horizontally outward over that period. The previous slope surfaces are approximately parallel to the original and current slope surfaces. Each of the previous slope surfaces underlies the current top edge of the pile and was penetrated by the six NES borings conducted along the top edge. Therefore, the former slopes containing the waste slag were sampled as part of the characterization program. The 1967 pictures (JHU, 2000) clearly show that the waste slag was distributed along the entire slope surface. The current top edge is approximately 15 feet further out and above the slope surface shown in the pictures. Because cover materials were placed on the pile the top edge extends over the previous radiological disposals.

Based on the law of superposition, the lower deposits were placed before the upper deposits. Figure 1 depicts a representative cross section through the slag pile showing the spatial relationship of the materials deposited on the pile based on the sequence of deposition. The cross section also depicts sampling and measurement locations. Each location shown represents a series of 4 or more locations extending along the embankment (in front of and behind the plane of the cross section). As shown in the cross section, the six NES borings along the edge of the embankment penetrated the entire sequence of the slag pile deposits. In addition, the slag pile was thoroughly characterized by surface soil samples on the face of the pile, direct measurements across the entire pile and surrounding area, borings and surface soil samples at the base of the pile, and wells along the base of the pile. The result was a thorough characterization of the slag pile and any potential migration of the constituents of concern.

In Figure 7 of the JHU report, it can be seen that the top edge of the slope in 1967 was approximately in line with the right pole of the double poles in the background and the left pole of the double poles in the foreground. The double poles are still present and are shown in Figure 9 of the JHU report. Their locations are depicted in plan view in the Topographical Plan (STEP, 1999). Extending the line between the two poles in the Topographic Plan clearly shows that the current top of the slope is more than 15 feet further southwest than it was in 1967.

The six NES borings located along the top edge of the slope provided representative samples of every layer of material placed on the pile. The samples from those borings showed radiological concentrations were generally highest from a depth of 4 feet to 20 feet. These data are consistent with the method of disposal, sequence of disposal, and the expected distribution of subsurface materials. The samples collected from strata where the split-spoon sampling encountered increased resistance also tended to correlate with higher radiological concentrations.

Boring B-5 encountered a sample with a total Th + U activity of over 400 pCi/g. JHU dug a 5-foot wide pit at the location of B-5 and located a large piece(s) of waste slag in the vicinity of B-5. The JHU work confirms that the borings did sample the waste slag zone.

The statement that spilt-spoon sampling cannot sample large blocks may be intended to suggest that the split spoon would not penetrate the blocks. If that is the intent of the JHU report, it does not provide any quantitative test results on the physical strength of the waste slag to support such a contention. There is good reason to believe the split-spoon would penetrate and sample any large blocks of waste slag that were encountered. The fact that the slag was reportedly broken up by dropping an iron ball onto it indicates that it is possible to drill and sample it. The split-spoon technique uses a 140 pound hammer dropped 30 inches to drive a 2-inch diameter hollow tube. The impact force per unit area is likely similar to the force per unit area as of the dropped ball used to break the slag. The statements in the JHU report appear to be based on an AHP letter (AHP, 1979) containing similar assertions. The drilling experience of a Health Physicist at the time was likely limited to hand auger borings (cores) collected from shallow soil or slag piles.

In addition, a further indication that the split-spoon obtained representative samples is that the boring logs do not identify any instance of refusal within the pile. If the waste slag was too hard to sample by split-spoon techniques, then the boring would have encountered refusal. The data leads to only two realistic conclusions; 1. The large blocks of slag do not comprise a significant portion of the pile or 2. The split-spoon technique was able to sample the large blocks of waste slag.

2.4 OTHER ERRORS

In addition to the principal issues discussed above, Cabot also has identified other errors and inconsistencies in the JHU report that tended to exaggerate the potential for there to be more source material on the pile than indicated in the site characterization report.

2.4.1 Assertion That the NRC License Gave Cabot Right to Hold 500 Tons of U/Th at Reading

In section 1.4.1.2, item 3.) the JHU report states:

> "Another Source Materials License obtained in 1983, gave the Cabot Corp. permission to hold 500 tons of natural U/Th at the Reading site."

The license limit is not relevant to the determination of inventory placed on the pile. The referenced license was issued fourteen years after the cessation of processing activities at Reading and five years after the last material was placed on the pile. The 500 ton limit applies to the total held at all three Kawecki sites at the time; Boyertown was active while Reading and Revere were not. Furthermore, the license states that no more source materials are to be deposited at Reading.

2.4.2 <u>Assertion That Leachate Waste Was Placed on the Slag Pile</u>

In section 1.4.1.1, the JHU report references a 1971 publication by Gustison and Cenerazzo as the basis for the discussion of the metallurgical process applied at the Reading Site including a discussion of two leachate waste products. The JHU report later states that:

> "according to Gustison and Cenerazzo (1971), the leachates were dumped on the waste pile"

The Gustison and Cenerazzo paper does not state this nor does it even imply that these leachate waste products went to the pile. The paper is silent on the disposition of these waste streams. During the September 23, 2002 meeting, the author of the JHU report stated that filtrates were identified visually, but they were not a radiological concern.

There are a number of documents that indicate that Kawecki Chemical was clearly aware of AEC and other regulatory requirements in effect at that time, was diligent in meeting and documenting the compliance effort and acted responsibly. Period documents indicate that placement of filter cake on the pile was being considered and would have been acceptable based on analytical results indicating less than 3 pCi/g Th (AHP, 1968b and 1968c). There are no documents that indicate whether or not this material was actually placed in the pile. Nevertheless, the results indicate activity in this material was at background levels and the concentrations below levels of regulatory concern. Even if fine grained material with elevated activity was placed on the pile and had washed down, it would have been detected in the numerous borings, surface samples, seep water samples, groundwater samples, and radiation surveys conducted along the bottom of the pile.

There are also records that the water going to the sanitary sewer was tested and met applicable standards (AHP, 1967).

2.4.3 <u>Assertion That The Pile Might Have Greater Dimensions</u>

In section 1.4.1.2, second paragraph under item 6, the JHU report states: "

> The NES report appears to have omitted the 6,000 tons of Sn slag that may have been shipped from Baltimore to the site in 1977 (July 25, 1977 letter from the Maryland Department of the Environment to Applied health Physics, Inc.).. This raises the question: is it possible for an additional 6,000 tons of Sn slag to fit within the confines of the Reading slag pile? Assuming that Sn slag has a density of 3.5 g/cm3 or 218 lb/ft3, an additional 5400 tons of slag would occupy a volume of 1558 m3 (55,045 ft3). This would increase the total volume of the slag pile to 3112 m3 (109,905 ft3). If the volume of the slag pile is calculated by assuming a total depth to native clay material beneath the slag pile of 11.6 m (38 ft), (see Figure 6) rather than 6.1 m (20 ft), used by in the Characterization Report for the Reading Slag Pile (pg 7, NES, Inc., 1996), the total volume available at the Reading site is 3249 m3 (114,747 ft3). It is therefore possible for the Reading slag pile to contain an additional 6,000 tons of Sn slag and this possibility should be investigated."

In section 4.1, p.21, third paragraph, JHU expands on the discussion:

> "NES determined the boundaries of the slag pile based on radiological assessments. These numbers are however inversely related to distance from the source, therefore contaminated soil at the bottom of the pile in the 20 – 38' depth range may not be detected at the lower edge of the pile due to build-up of uncontaminated cover material as the pile grows from burial with soil."

A total of approximately 60,000 ft3 of material was documented as being placed on the pile (NES, 1996). A detailed topographic survey performed in 1998 (STEP, 1999) indicated that the slope of the slag pile was approximately 30 degrees not 60 to 70 degrees as had been previously estimated by NES. Because the previous volume estimate by NES may have been impacted by the overestimate of the slope, the volume of the slag pile was recalculated. The recalculated estimate was 180,000 ft3, as discussed in the Decommissioning Plan (STEP, 2000b). That volume represents the locations where slag may be mixed with other materials. In any event, the change in the estimated volume did, not change the total amount of Th and U.

The volume of material on the pile obviously also includes non-radiological materials that are unrelated to Cabot's activities. Cabot never owned the site and did not have control over the activities of others. The JHU report mentions several types of material observed in and on the pile that clearly are not related to Cabot's activities, such as stuffed animals and plastic bags. Also present on the pile are concrete slabs, large rubber rectangular containers, wood and other building debris not related to the building decommissioning, and various types of residential and industrial trash. Recent observations indicate that additional construction debris has been deposited on the embankment since 1997.

The entire western portion of the American Chain and Cable property, from the buildings to the base of the embankment, is composed of approximately 3,000,000 ft3 of fill and debris (primarily non-radiological slag) that has been built up over a period of more than 100 years. There obviously is enough room in the pile for it to include the alleged 6000 ft3 of sand/slag from the Baltimore site without having to resort to the speculations in the quoted section of the JHU report. These comments in the JHU report do not raise any question about the adequacy of the site characterization.

2.4.4 Assertion That Debris From Final Clean-Up Was Placed On The Pile

In Section 1.4.1.2, second paragraph, the JHU report states:

> "It appears that during the final clean-up of the processing building, products from each step of the clean-up were added to the pile. This includes brick, cement block, and wood from the building floor."

Building decontamination material was placed on the pile only during efforts conducted up to 1983. During decontamination activities conducted in 1988-1989 and in 1994-1995 all materials were sent to Boyertown for storage and subsequent processing or disposal (NES, 1995). The materials encountered by JHU may be demolition debris from razing of former buildings unrelated to Cabot's activities. An example of continuing placement of non-radiological material on the pile is provided by JHU's descriptions of the types of material present on the surface that are obviously unrelated to the slag processing activities.

2.4.5 Assertion That Trenching Is Needed

In section 2.1.1, p. 8, in the sixth paragraph, the JHU report states:

> "During this visit, it became clear that more representative sampling methods for site characterization are needed. For example, trenching, although not done at this time, would allow investigators to collect more representative samples from a heterogeneous pile containing material ranging in size from sand-sized material to large blocks."

This statement highlights the difference between the objective of the site characterization efforts and the JHU study. The JHU effort was intended to study the stability and leaching characteristics of the slag only. Therefore, JHU was interested only in the "hottest" samples of pure tin slag and waste slag. For their purposes, trenching would assist in locating the few discrete large pieces of pure waste slag contained in the pile. The site characterization efforts were intended to, and did, provide an unbiased characterization of the total, average concentration, and distribution of radiological material in the pile. Trenching would not be useful for this purpose. As discussed above, the techniques used by NES and others, were more than adequate to characterize the pile as evidenced by the consistent agreement between the historical documents and characterization data.

3.0 PADEP ISSUES

Most of the PADEP comments are derived directly from the JHU and Sandia comments. Those issues have been addressed in the preceding sections and under separate cover. The remaining PADEP concern relates to recent direct dose measurements.

PADEP COMMENT 4.

> "Recent limited measurements of the gamma exposure levels by PA-DEP personnel significantly exceed the results reported by the licensee and its contractors."

RESPONSE

The PADEP measurements were the maximum readings they identified at a few discrete locations. The characterization measurements used in the dose assessment were the unbiased average, which is consistent with regulatory guidance. The PADEP readings are well within the range to be expected from the concentration of source material in the waste slag and are consistent with readings reported during the characterization effort. One location coincided with the location where JHU had dug to a depth of approximately 5 feet, collected pure waste slag samples, and left them exposed on the surface. There is nothing remarkable about these isolated readings and they do not impact the dose assessment conclusions. It should be noted that the dose assessment for the eroded scenario utilized the average concentration of slag within the pile for direct dose on the slope, not the current surface readings. The dose assessment for the intact pile did assume that the top of the pile remained at the measured levels because if someone was living there they would have to repair the erosion with fill or it would erode into a steep slope and not be habitable. If the PADEP were to perform a comprehensive survey (as was performed for the characterization program) the average measurements would be expected to be very close to the characterization values.

It also should be recognized that the results of the dose assessment for the postulated eroded condition were still well below the 25 mrem/yr limit.

4.0 SUMMARY

The JHU report overestimates of the total Th + U in the pile by a factor of approximately 75 times. When the errors in the JHU report are corrected, it is clear that there is not a large source term hiding in the pile. There is no information in the JHU report that raises any significant questions about the validity of the site characterization or the dose assessment.

5.0 REFERENCES

The following references are cited above or were evaluated in preparing this response document. References that may not be in the NRC document room or are not readily accessible are marked with and (*) and provided in attachment A.

AHP, 1967, Letter to John A. Cenerazzo (Kawecki), Applied Health Physics, Inc., November 10, 1967. *

AHP, 1968a, Health Physics Report #2 for the Kawecki Chemical Company, Applied Health Physics, Inc., February 6, 1968. *

AHP, 1968b, Laboratory Report, Waste Sludge from Reading, 2.p, Applied Health Physics, Inc., April 29, 1968. *

AHP, 1968c, Letter to Frank Coyle (Kawecki), Applied Health Physics, Inc., May 3, 1968. *

AHP, 1976, Health Physics Report of the Radiological Safety Aspects Associated with KBI Tin Slags Stored at the Canton Railroad Yards, Applied Health Physics, Inc., December 3, 1976. *

AHP, 1979, Letter from Robert G. Gallaghar to Nathan Bassin (NRC), Applied Health Physics, Inc., May 3, 1979

Cabot, 1991a, Hand written notes on bottom of copy of an 1980 inspection report, stamped January 23, 1991. *

Cabot, 1991b, Hand written note in file, to Tony, from W. Gannon, January 23, 1991. *

Gustison, R. A. and Cenerazzo, J. A., 1971, Exothermic Fusion of Eastern Tin Slag Carbides to a Tantalum-Columbium Concentrate, Journal of Metals, August 1971.

JHU, 2000, Characterization of Radioactive Slags, Draft Progress Report, Johns Hopkins University, Violin, Linda A., et. al., March 2000.

Kawecki, 1967, Application Renewal for Source Material License #SMB-920, with attachments including Health Physics Report #1, Kawecki Chemical Company, October 4, 1967. *

Kawecki, 1974, Amine Extraction – Eastern Tin Slag, Summary, Kawecki Chemical Company, March 15, 1974. *

Kawecki, 1976a, Radioactive Materials Transfer Records, Kawecki Berylco Industries, Inc., May – June 1976, Untitled, 2 p. *

Kawecki, 1976b, Eastern T. S. Removal from reading to Baltimore, May and June 1976, Inter-Office Correspondence from W. C. Gannon to A. Zabrowski, 3 p., Kawecki Berylco Industries, Inc., June 17, 1976 *

MDE, 1976, Radioactive Material License number MD 07-073-01, Amendment 01, Maryland Department of Health and Mental Hygiene, April 27, 1976.

MDE, 1977, Radioactive Material License number MD 07-073-01, Amendment 02, Termination, Maryland Department of Health and Mental Hygiene, September 20, 1977.

NES, Inc., 1995, Final Decommissioning Project Report for the Main Processing Building and Surrounding Area Reading, Pennsylvania, May 1996.

NES, Inc., 1996, Characterization Report for the Reading Slag Pile, Revision 1, April 22, 1996.

NRC, 1976, Export License number SME-8331, U. S. Nuclear regulatory Commission, June 4, 1976

NRC, 1980, Inspection Report 40-6940/80-02, December 11, 1980.

NRC, 1983, Materials License SMB-920, U. S. Nuclear Regulatory Commission, December 20, 1983.

NRC, 1983, Materials License number SMB-920, U. S. Nuclear Regulatory Commission, December 20, 1983.

NRC, 2002, Letter from Larry Camper (NRC) to David Allard (PADEP), U. S. Nuclear Regulatory Commission, June 20, 2002.

PADEP, 2002a, Letter form David Allard (PADEP) to Larry Camper (NRC), Pennsylvania Department of Environmental Protection, May 2, 2002.

PADEP, 2002b, Letter form David Allard (PADEP) to Larry Camper (NRC), Pennsylvania Department of Environmental Protection, July 10, 2002.

Sandia, 1999, Preliminary Assessment of the Cabot Corporation Reading Slag Pile Site, Reading, Pennsylvania, Sandia National Laboratories, Undated.

Sandia, 2000, Review of the Revised Decommissioning Plan for the Cabot Corporation Reading Slag Pile Site, Reading, Pennsylvania, Sandia National Laboratories, June, 2000.

STEP, 1997, Hydrologic and Geologic Assessment for Reading, Pennsylvania Slag Pile Site, Revision 0, ST Environmental Professionals, Inc., November 12, 1997.

STEP, 1999, Report on Topographic and Radiological Surveys, Reading Slag Pile Site, ST Environmental Professionals, Inc., January 25, 1999.

STEP, 2000a, Radiological Assessment for Reading, Slag Pile Site, Revision 0, ST Environmental Professionals, Inc., Revision 1, March 2000.

STEP, 2000a, Decommissioning Plan for Reading, Slag Pile Site, Revision 0, ST Environmental Professionals, Inc., Revision 1, March 2000.