SUMMARY REPORT AND COMMENTS

on the review of

**The ATSDR Health Consultation dated April 12, 1993,
Palmerton Zinc Superfund Site,
Palmerton, Pennsylvania.**

and

SUMMARY REPORT AND COMMENTS

on the review of

**The Proposed U.S. EPA Interim Action Plan
as outlined by
EPA Environmental News Release of March 11, 1993**,

and

**Related U.S. EPA Interdepartmental Correspondence Requesting
Funds for a Removal Action, dated March 2, 1993**

Prepared by: **McTish, Kunkel & Associates**
Robert H. Hosking Jr., Project Manager

As Reviewed by:

Dr. Dale Bruns, Ph.D., Environmental Toxicologist

Dr. Brian Redmond, Ph.D., Geologist/Sedimentologist

Dr. Bruce Rowell, Ph.D., Hydrogeologist

for:

The Palmerton Citizens For A Clean Environment

OVERVIEW

The following report has been prepared in response to your request for a review of the above-referenced documents, in accordance with Task Schedule #7, issued January 4, 1994. The observations and conclusions contained herein are those of the MKA Project Team.

Task Schedule #7 requests that the MKA Project Team perform the following three tasks:

1. Review and comment on the ATSDR Health Consultation for the Palmerton Zinc Superfund Site dated April 12, 1993.

2. Based on the information contained in the ATSDR Health Consultation referenced above, and all other documents related to Operable Unit #3 that have been reviewed by the MKA Project Team to date, determine if the scope of the Interim Action Plan (proposed by U.S. EPA as outlined in the March 11, 1993 EPA Environmental News Release titled: EPA TO TAKE INTERIM ACTION IN MOST CONTAMINATED AREAS OF PALMERTON) will provide adequate protection to human health and the environment.

3. Determine if the potential for health risks due to arsenic contamination are sufficiently significant to justify development of a cleanup standard for arsenic, to be addressed in the Record of Decision (ROD) for OU #3.

REVIEW OF THE ATSDR HEALTH CONSULTATION

The ATSDR Health Consultation for the Palmerton Zinc Superfund Site (3026), Palmerton, Pennsylvania, dated April 12, 1993 was prepared by the U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry (ATSDR), as technical assistance to U.S. EPA, Region III. It is significant that the ATSDR has maintained an active interest in Operable Unit #3 of the Palmerton Zinc Superfund Site since at least 1987, and has provided various services and conducted previous studies including but not limited to: Publication of a Preliminary Health Assessment for the Palmerton Zinc Site on February 4, 1987; Sampling of blood and urine specimens for lead and cadmium analysis in the neighboring communities of Jim Thorpe and Palmerton, Pennsylvania during the fall of 1991, as part of a comparative health study of the two communities; ATSDR held a community meeting at the Palmerton High School cafeteria on September 29, 1992, to publicly address the preliminary results of the ATSDR health study mentioned above; and the publication of a draft report in April of 1993 titled: Biological Indicators of Exposure to Cadmium and Lead, Part I, Palmerton, Pennsylvania, which was prepared as assistance to the Pennsylvania Department of Health, and serves as a section of the final report on the results of the comparative health study referenced above. Consequently, it can be established that the ATSDR has sufficient knowledge and experience with OU #3 of the Palmerton Zinc Superfund Site, to be regarded as the definitive authority on issues related to the potential for risks to human health, due to environmental contamination of the Palmerton area.

The ATSDR Health Consultation is organized into five primary sections: 1. Background and Statement of Issues; 2. Discussion; 3. Conclusions; 4. Recommendations; and 5. References.

The following is an outline of important statements presented in the first section, **Background and Statement of Issues**:

1. The ATSDR Health Consultation of April 12, 1993 was requested by U.S. EPA, Region III to evaluate public health threats posed by exposure to metals detected in areas surrounding the Palmerton Zinc Superfund Site (PZSS) in Palmerton, Pennsylvania; and to provide comment on EPA's proposed removal response action levels in residential surface soil and dust within homes where children 6 years old and younger and/or pregnant women reside.

2. The removal response action levels proposed by EPA are 1500 mg lead/kg soil or dust and 100 mg cadmium/kg soil or dust, as referenced in the March 3, 1993 correspondence titled: Request for Funds for a Removal Action, from A.F. Koller, EPA Region III Remedial Project Manager to S.L. Laskowski, EPA Acting Regional Administrator.

3. The ATSDR Health Consultation report states that the proposed removal action is an interim measure and that future removal or remedial actions, targeted at lower lead and cadmium levels, may be necessary, as referenced by personal communication from A.F. Koller, EPA Region III Remedial Project Manager to Jack Kelley, ATSDR Region III representative, dated March 23, 1993.

4. The study states that lead, cadmium, arsenic and zinc were detected in area soils and dusts in living spaces inside residences. Concentrations of the four previously listed contaminants in various environmental media are presented in 4 separate tables of the report. Copies of the 4 tables are included as Appendix A of this summary report.

The following is an outline of important statements presented in the **Discussion** section:

1. The primary routes of human exposure to the contaminants detected in off-site areas are ingestion and inhalation. Ingestion of contaminated soil via hand-to-mouth activities may be an important route of exposure, particularly among children.

2. In addition to contaminant concentrations detected in environmental media, ATSDR also considered other site-specific factors such as vegetative cover, frequency and duration of exposure, and sensitive populations during evaluation of the potential for health risks resulting from exposure to metals in the Palmerton area.

3. Opportunities for exposure are greater where there are no protective barriers (e.g. vegetation, pavement, or concrete cover) between people and contaminated media such as soil. Many yards in the Palmerton area do not have the vegetative cover necessary to provide adequate protection from contaminated soils. Even though access to the cinder bank is restricted, wind and precipitation may transport contaminated materials from the cinder bank off-site.

4. Variables used to determine the potential for human health risks such as the frequency and duration of exposure to lead, cadmium, zinc and arsenic are difficult to determine, because the sensitivity of the population is variable, contaminant concentrations are not homogeneous, and the potential for human contact is dependent upon the use and location of the media. For example, the ATSDR Health Consultation states that the frequency and duration of exposure to sensitive populations is greater for sand box/play areas, bare and garden soil, and interior and porch dusts than for street dusts, the cinder bank, and soil on the surrounding mountains. However, the potential exists for contaminants to migrate from areas of low exposure potential to areas of high exposure potential, if the contaminated media is not adequately stabilized or contained.

5. Education of the general public and health care providers can be effectively used to minimize exposure to hazardous substances.

6. The most sensitive subgroups of the population to lead exposure includes: preschool age children (less than 6 years old), pregnant women, fetuses, the elderly, smokers, alcoholics, and people with genetic diseases affecting heme synthesis, nutritional deficiencies, and neurological or kidney disfunction.

7. The Health Consultation states that specific subgroups that are susceptible to the effects of cadmium, arsenic and zinc have not been unequivocally identified, but predicts that the elderly, and young children are likely to be more sensitive than healthy adults.

8. Several paragraphs of the Health Consultation are devoted to addressing factors affecting sensitivity to lead, and potential physiological responses to lead exposure. Physiological responses to lead in the form of inhibited enzymes activity involved in heme biosynthesis have been demonstrated at an oral dose of 0.02 mg/kg/day for 3 days, and at air concentrations of as little as 3.2 micrograms lead per cubic meter of air for 3 or 4 months. Blood lead levels in young children are raised, on average, about 5 ug/dL (5 micrograms per deciliter) for every 1000 mg/kg of lead in soil or dust, and may increase 3 to 5 times higher than the mean response depending on play habits and mouthing behavior.

9. Inorganic arsenic is a human carcinogen via the inhalation pathway. The risk of cancer from inhalation of inorganic arsenic increases with increasing concentration. Epidemiological studies have shown an increased incidence of cancer from airborne concentrations ranging from 10 to 300 micrograms of arsenic per cubic meter of air (ug/m^3). In addition, the ATSDR Health Consultation states that there is convincing evidence from a large number of epidemiological studies and case reports that ingestion of inorganic arsenic increases the risk of developing skin cancer, and there is also evidence that ingestion of arsenic increases the risk of cancer in other organs and tissues. An increased incidence of cancer has been associated with arsenic exposure levels ranging from 0.009 to 0.04 mg/kg/day over a period of several years.

10. Chronic exposure to arsenic can also result in noncarcinogenic adverse health effects including gastrointestinal disturbances, pigmentation of the skin, peripheral neuropathy, and adverse cardiovascular effects.

11. The EPA oral Reference Dose (RfD) for arsenic is 0.0003 mg/kg/day. An RfD is an estimate (with uncertainty possibly spanning an order of magnitude) of the daily exposure of the human population to a chemical that is likely to be without risk of deleterious, noncancerous effects during a lifetime. An RfD of 0.0003 mg/kg/day would result if a 10 kg (approximately 22 pound) child ingested 200 mg soil per day containing 15 mg arsenic/kg soil. The maximum concentration of arsenic detected in sandbox & play areas in the Palmerton area is 140 mg arsenic/kg soil (see Table 4 in Appendix A).

12. The most sensitive organ for chronic exposure to cadmium is the kidney. The EPA RfD for cadmium is 0.001 mg/kg/day. An RfD of 0.001 mg/kg/day would result if a 10 kg child ingested 200 mg soil per day containing 50 mg cadmium/kg soil. The maximum concentration of cadmium detected in sandbox & play areas in the Palmerton area is 680 mg cadmium/kg soil (see Table 2 in Appendix A).

13. Zinc is an essential element required for normal growth, bone formation, brain development, behavior, reproduction, fetal development, sensory function, immune function, membrane development, and wound healing; however, excessive zinc intake can cause adverse health effects. Ingestion of 2 to 4 mg zinc/kg/day (140 to 280 mg/day for a 70 kg person) for several weeks has been shown to cause a reduction in high density lipoproteins, an increase in low density lipoproteins, and produced adverse gastrointestinal effects. The EPA RfD for zinc is 0.3 mg/kg/day. An RfD of 0.3 mg/kg/day would result if a 10 kg child ingested 200 mg soil per day containing 15,000 mg zinc/kg soil. The maximum zinc concentration detected in sandbox & play areas in the Palmerton area is 13,500 mg zinc/ kg soil (see Table 3 in Appendix A).

The following **Conclusions** were presented in the ATSDR health Consultation memorandum:

1. The levels of lead, cadmium, zinc and arsenic detected in the Palmerton areas sampled may pose a health threat, particularly to young children.

2. EPA's removal action levels of both 1,500 mg lead/kg and 100 mg cadmium/kg residential soil or interior dust may not be protective of the health of children and pregnant women.

3. EPA has not developed removal action levels for arsenic and zinc.

4. Migration of contaminants has occurred in the past and may currently be occurring.

5. EPA is attempting to control erosion of the bare, contaminated surfaces of Blue Mountain; and

6. ATSDR has provided educational materials to health care providers and the public.

The following **Recommendations** were presented in the ATSDR health Consultation memorandum:

1. Consider lowering the removal action levels for lead and cadmium in areas such as sandboxes, day care centers, interior dusts, and park areas where there are no protective barriers between the contamination medium and people and where frequency and duration of exposure are likely to be high for sensitive populations.

2. Consider having independent removal action levels for lead and cadmium rather than requiring both to be elevated before removal action will be taken.

3. Develop removal action levels for arsenic and zinc.

4. Continue to implement measures to prevent migration of contaminants; and

5. Continue to provide educational materials to the public and health care providers as appropriate.

References

The information presented in the ATSDR Health Consultation memorandum is carefully cited and referenced. The source materials cited as references are primarily government documents and significant primary research reports, providing an additional measure of credibility to the document. A copy of the references section of the ATSDR Health Consultation memorandum is provided in Appendix B.

COMMENTS ON THE ATSDR HEALTH CONSULTATION MEMORANDUM

1. The ATSDR Health Consultation memorandum is an important document towards the development of a remedial action plan for OU #3 of the Palmerton Zinc Superfund Site (PZSS). The report is well written, provides ample background information, focuses on the most important issues, appears to be well researched, and clearly identifies what data were used and what assumptions were made during the evaluation of the potential for public health risks due to contamination of the Palmerton area. Although several pathways of human exposure are addressed (e.g., ingestion, inhalation, food, water, etc.), the report uses known environmental contaminant levels and established EPA oral Reference Doses (RfD) to develop risk scenarios based on ingestion of contaminated soil, an important exposure pathway, especially for children.

2. The Health Consultation memorandum does not appear to be intended as a full risk assessment study (multiple pathways of exposure, multiple contaminant assessment, etc.), as specified in the EPA (1989) document: Risk Assessment Guidance for Superfund (RAGS), Volume I, Human Health Evaluation Manual (Part A). However, given the focus on soil ingestion, the methods, data (e.g., use of an EPA oral Reference Dose [RfD]), and assumptions (e.g., a childs soil ingestion rate of 200 mg/day) used in the Health Consultation memorandum seem compatible with the RAGS manual based on a brief comparison of these two documents. Also, the Health Consultation (HC) generally cites standard EPA toxicological data bases, EPA reports, and the peer-reviewed literature to validate its data, assumptions, and methods.

The use of EPA RfD values is an important aspect to the HC analyses for arsenic, cadmium, and zinc (there is no RfD for lead; see below). According to the RAGS manual (EPA 1989) an RfD is an estimate of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime (i.e., long-term exposure to a contaminant); due to uncertainties in estimation, an RfD often reflects an order of magnitude (X10) "safety factor" in its value used for risk assessments.

It should be noted that the HC report uses a value of 10 kg for a child's body weight in its calculations of a dose equal to an element's RfD; the RAGS manual cites 16 kg as the 50th percentile for children ages 1 through 6. Thus, the HC estimates of soil lead concentrations equal to an RfD are more conservative, i.e., they provide a greater margin of safety for protecting health vs. calculations based on a body weight of 16 kg.

4. The following are comments about each element considered in the HC report. It should be noted that the analyses for cadmium, arsenic, and zinc are much more straightforward than that for lead. Lead exposure is a more complicated issue and EPA does not report a RfD for lead as it does for the other elements in the HC report:

> **Lead**: The HC report covers most of the relevant issues and data for consideration of health risks from lead, especially as it relates to children - a high-risk group. Health effects, blood lead levels, prenatal exposure, ingestion rates (at various soil concentrations), and blood level/soil concentration relationships are all considered; added risk from pica behavior is also identified.
>
> However, a clear picture does not emerge for lead in regard to a specific risk estimate relevant to potential cleanup levels. For example, risk is indicated from a calculated dose based on lead concentrations in soil at 1780 mg lead/kg soil (the maximum amount of lead found in a sandbox/play area); however, the report also cites evidence that lower soil concentrations of lead (150 to 250 mg/kg) might contribute to excessive blood lead levels in some children.

The HC report does not explicitly support either the low or the high lead concentrations as more indicative of health risks to children. However, in its conclusion section, it does state that: 1) levels of lead in Palmerton areas may pose a health threat, particularly to young children, and 2) EPA's removal action levels of lead (1500 mg/kg) may not be protective of the health of children and pregnant women.

Both conclusions appear to be valid. However, support for the second conclusion is based more on a recent paper published in the journal, Environmental Science and Technology, by Wixson and Davies (1994). This crucial paper on guidelines for lead in soil was not available at the time that the HC report was written. As Wixson and Davies (1994) indicate, the issue of lead in soils is complex and a single guideline value for lead is not appropriate for regulatory compliance and cleanup. The relevance of this paper to the situation in Palmerton is considered later in this review.

Arsenic: The most compelling evidence for cleanup of arsenic at Palmerton is the calculation that shows that ingestion of soil (by children) with arsenic in excess of 15 mg/kg would result in a does that exceeds the RfD. Table 4 in the HC report indicates that at least 25% of the samples across all categories of media in Palmerton were in excess of 15 mg arsenic/kg soil. Presumably, this is the basis for the HC report's recommendation for development of removal action levels for arsenic.

Once again, this recommendation appears to be on target. It should be noted that both PA (Interim Soil Standards) and NJ departments of environment have recommended arsenic cleanup standards of 20 mg arsenic/kg soil. The PA arsenic in soil standard is based on risk assessment methods (see Killian 1993) as outlined in the RAGS manual (EPA 1989).

Cadmium: The discussion of potential health effects from cadmium exposure in the Health Consultation memorandum identifies the kidney as the most sensitive target organ for chronic oral exposure. This statement is supported by several other sources including the June 1990 ATSDR publication titled "Case Studies in Environmental Medicine, Cadmium Toxicity", and the health effects overview provided in the September 14, 1992, Federal Register, (Part II, Department of Labor, Occupational Safety and Health Administration, 29 CFR Part 1910, et al.), titled "Occupational Exposure to Cadmium, Final Rules. However, the overview provided in the Federal Register, and the June 1990 ATSDR publication referenced above, also indicate that inhalation of cadmium has been associated with respiratory effects such as reduced ventilatory capacity, and may possibly cause lung cancer. This is significant, since airborne cadmium levels in Palmerton have not been adequately investigated .

The HC analysis indicates that ingestion of soils (by children) with greater than 50 mg cadmium/kg soil would result in a dose greater than the RfD for food. Table 4 in the HC report shows that at least 25% of the samples in 6 of 7 categories of media in Palmerton exceeded this reference value of 50 mg cadmium/kg soil. This would seem to be the basis for the HC report's conclusion that cadmium levels in soils at Palmerton pose a health threat and that the EPA removal action level of 100 mg cadmium/kg soil may not be protective of health for children and pregnant women.

Both of these conclusions appear to be valid. It should be noted that the NJ Department of Environmental Protection lists a recommended cleanup value of 3 mg cadmium/kg soil. PADER has an interim standard of 20 mg cadmium/kg soil for cleanup based on RAGS type risk assessment (EPA 1989, Killian 1993).

Zinc: The analysis in the HC report suggests that ingested soils (by children) with a concentration of greater than 15,000 mg zinc/kg soil would result in a dose greater than the RfD. Soil concentrations reported in Table 5 of the HC report that some samples at sites in Palmerton exceed this value. One would assume that this is the basis for the report's recommendation that zinc removal action levels be developed.

The finding of the HC report are well supported. However, It should be noted that the extent of a health risk, on a spatial basis, is much more limited than for the other metals evaluated above. The recommended and interim cleanup standards for zinc in NJ and PA is 350 and 1000 mg zinc/kg soil, respectively.

5. The HC report also makes several other recommendations; comment on some of these (highlighted) is provided briefly below:

A. Lowering removal action levels for lead and cadmium in key areas like sandboxes and day care centers where frequency and duration of exposure might be high for sensitive populations, (HC report) (especially children);

This seems reasonable because even though risk assessment methods and values (i.g., RfDs) have some built-in "safety factors," often it is assumed that average or median conditions prevail. Thus, special areas of high exposure or sensitive individuals may not be fully considered. At a minimum, the removal action levels for EPA's interim cleanup action plan at Palmerton should not be considered sufficient for protection of health. This is discussed more fully below relative to EPA's press release.

B. Independent removal action levels for lead and cadmium rather than requiring both to be elevated before removal action is taken (HC report);

This is an important recommendation. It is not clear at all why both lead and cadmium need to be above actions levels. There is no basis for this from a risk assessment point of view unless it is known that these metals are antagonistic in their toxic interaction. Certainly, this is not supported, cited, nor acknowledged in EPA's interim cleanup action plan. However, as discuss below, the EPA interim cleanup action plan does not seem to be based on any risk assessment and is presumably intended strictly as an initial, first step to a more comprehensive cleanup to be conducted later based on risk assessment information and analyses; thus, it (the interim plan) is focused on only the known worst case situations for immediate cleanup.

C. Continue measures to prevent migration of contaminants (HC report);

This is important so that source terms are controlled. Cleanup efforts will be diminished in the long run if migration of source contaminants is not prevented.

D. Continue educational program that aid the public and health care providers (HC report);

Life style habits (diet, smoking, etc.) and other sources (e.g., house paint for lead) of contaminants need to be managed in an overall program. Cleanup is just one crucial component of this program and can be effective only to the degree that these other factors are known and dealt with in an informed and consistent manner.

E. The HC report considers lead, cadmium, arsenic, and zinc but not on a multiple pollutant exposure basis; each element is considered independently. In contrast, the RAGS manual provides a hazard index based on the sum of the ratios of subthreshold exposures to acceptable exposures; this assumes that toxic effects from several different pollutants are additive (vs. another possibility like antagonism when toxic effects are reduced where several contaminants occur together at a site). Thus, individual contaminant concentrations in soil could result in an individual ingestion rate lower than its respective RfD (an exposure likely to be without risk) while the hazard index, in contrast, may indicate potential health effects (from additive toxicity of several contaminants) when its value exceeds unity.

A simple example illustrates this index and its assumption of additive toxic effects:

1. given RfDs for arsenic and cadmium at 0.0003 and 0.001 mg/kg/day, respectively;

2. assume that site-specific ingestion rates (doses) for these two metals (based on measured levels in soils at a hypothetical site and using risk assessment methods, e.g., RAGS (EPA 1989)) are 0.0002 and 0.0008 mg/kg/day, respectively;

3. when these two site-specific ingestion rates (doses) for metals are considered on an individual basis they are each below their RfD values and each would therefore be considered to be without significant risk;

4. in contrast, using the RAGS hazard index, each site specific dose is expressed as a ratio (relative to their respective RfD) and these are added to reflect assumed additive toxic effects:

hazard index = 0.0002/0.0003 + 0.0008/0.0010
= 0.67 (arsenic) + 0.80 (cadmium)
= 1.47 (exceeds 1.00, therefore combined toxicity exceeds "safe" dose).

6. As a final comment that may be more a curiosity than a significant observation, it is interesting to note that the contaminant levels used to provide the basis for the ATSDR health consultation memorandum are referenced to the U.S. EPA, Palmerton zinc pile superfund site amended quality assurance project plan, dated October 8, 1991 (item #5 of the references provided in Appendix B of this summary report). Having reviewed the documents on file in the PCCE library at MKA, it does not appears as though MKA ever obtained this report, and therefore has not reviewed it. The title of the report suggests that the tables provided in the ATSDR health consultation memorandum (see Appendix A of this Summary Report) are referenced to a document where they were published as secondary source materials. Considering the various studies conducted to measure environmental contamination in the Palmerton area, it is difficult to understand why the ATSDR did not reference a report on basic research such as the "Palmerton Zinc Site Second Draft Field Trip Report", published by the EPA on October 28, 1992; or information on environmental contamination published in the "Biological Indicators of Exposure to Cadmium and Lead, Part I, Palmerton, Pennsylvania, published by ATSDR in April of 1993. The contaminant levels reported in the tables provided with the health consultation appear to be consistent with results reported by other studies, so there is no reason to question their validity; however, it is curious that secondary source material was used when original research data was readily available. One possible explanation is that the U.S. EPA, "Palmerton zinc pile superfund site amended quality assurance project plan", dated October 8, 1991, may have simply presented the data in a more clear and concise manner.

EPA DOCUMENTS

1. The EPA press release outlining the interim action plan makes several important statements. First, the action plan includes warnings to the community about potential exposure from food, paint, dust, and soil. Effective mitigation has to include awareness and management of multiple sources of contaminants.

   Second, the action plan provides for education, monitoring of blood lead levels, and control of lead paint in selected areas. Again, these are important aspects to a comprehensive program in managing health risks from pollutants.

   And third, and perhaps most importantly, the press release states that "Action levels for a final cleanup decision could change from the interim action levels". This statement seems to imply that the EPA interim cleanup action plan is presumably intended strictly as an initial, first step to a more comprehensive cleanup to be conducted later based on risk assessment information and analyses; thus, it (the interim plan) is focused on only the known worst-case situations for immediate cleanup. This would seem to explain why the specific and concurrent interim action levels of all three metals, lead, cadmium, and zinc do not appear to reflect values and procedures of a risk assessment approach.

2. The longer EPA memo on "Request for Funds" (Koller to Laskowski, 3/2/93) does not specify explicitly whether the funds requested are for interim cleanup only or are applicable also for final cleanup. Mention of an interim cleanup was not noted, but only the interim action levels for lead (at 1500 ppm) and cadmium (at 100 ppm) are indicated in the memo. It is crucial to get a clear reading of this situation because PCCE might decide to agree to these action levels based on the assumption that these are only for the initial, interim action. However, EPA at a later time could claim that the memo was referring to final action levels (since interim was not explicitly stated). PCCE would have no recourse at that time. Therefore, PCCE should be cognizant of this ambivalence when it communicates with EPA, DER or other parties.

   The EPA request for funding memo also indicates that EPA's recommended cleanup levels of lead are between 500 and 1000 ppm and that cadmium > 100 ppm exceeds cleanup levels used at other sites by EPA. Given this statement (p. 5, second paragraph), it is difficult to justify the earlier action levels (i.e., 1500 ppm lead and 100 ppm cadmium) except on an initial, worst-cases first, interim plan. It appears that this is what EPA means but this is not clear in the memo. Also, these comments should not be construed to imply that the EPA memo was intentionally vague to facilitate the use of 1500 and 100 ppm action levels for a final action plan. However, some clarification is in order and it is recommended that PCCE request this in writing from the appropriate EPA people with the authority to make these statements.

PCCE TASK SCHEDULE #7

1. PCCE's request for comment and review on the ATSDR Health Consultation is provided above. This section is intended to address two other questions on PCCE's Task Schedule #7 that need explicit answers on a) the EPA interim action plan and b) arsenic as a contaminant. These are addressed below in this section.

2. Does the EPA interim action plan (March 1993 announcement) sufficiently address environmental and health risks resulting from Operable Unit 3 (i.e., off-site soils)? The action plan is based on action levels for lead and cadmium at 1500 and 100 ppm in soil, respectively. As stated in the action plan, these would help to identify initial sites for cleanup where risks would be the greatest. As such, these levels should only be considered relevant to an interim plan. It appears that this is the intent of EPA's documents on this issue and that other data will be considered in the final action plan.

   Specifically, there is no convincing evidence to conclude that 1500 ppm lead and 100 ppm cadmium in soils as final action levels will provide sufficient health protection to sensitive individuals like children and pregnant mothers. This is based on several factors. First, the 1500 and 100 ppm levels identified in the interim plan are never justified explicitly on any type of standard risk assessment procedure or study; It is assumed that this is the case because these numbers are only intended for interim purposes.

   Second, as indicated earlier in this review and in agreement with the ATSDR HC report above, risk assessment procedures indicate that action levels for lead or cadmium need to be below their respective values of 1500 and 100 ppm. For cadmium, this is fairly straightforward since an EPA RfD value is available for risk assessment; 50 ppm is the soil concentration (see attached summary table) that would be equivalent to the EPA RfD value based on risk assessment procedures and methods documented in the HC report. Lead in soils is a more complex issue and only a qualitative lowering of the action level (down from 1500 ppm) is indicated in the HC report based on sensitive children; below an example for lead is provided based on a very recent article in Environmental Science and Technology.

   Third, in addition to the HC report, PADER has interim soil standards for cleanup activities for arsenic, cadmium, and zinc. These are all based on a risk assessment method recommended by EPA for Superfund sites (RAGS, see EPA 1989). These values are reported in the summary table. Thus, cadmium at 20 ppm is significantly lower than the EPA interim action level of 100 ppm. Also, arsenic is not even mentioned in the interim plan yet soil values at Palmerton cited in the HC report and the PADER standard (20 ppm arsenic in soil, see attached summary table) would indicate that arsenic should be explicitly addressed in a final cleanup action plan. The PADER standard for lead (see summary table) is based on situations where gasoline (leaded) has contaminated soils; again, this value, 200 ppm lead, is considerably below that for the interim plan (1500 ppm).

   Fourth, the environmental protection agency for the state of New Jersey sets cleanup levels for all of these metals (see attached summary table) at levels far below those shown for the EPA interim action plan at Palmerton. Given the proximity of NJ, it might be expected that some consistency would be encouraged to provide more uniform protection and to eliminate any perception of marketplace disincentives for industrial cleanup or relocation.

And fifth, the EPA memo on "Request for Funds" (Koller to Laskowski, 3/2/93) states that EPA's recommended level for lead cleanup in soils is in the range of 500 to 1000 ppm. Also, cadmium in soils greater than 100 ppm exceeds cleanup levels used at other sites by EPA. Therefore, it seems that EPA's previous guidelines at other sites would mandate that the interim action plan for Palmerton would not be adequate for final cleanup efforts.

Both the interim and final action plans would have some benefit to the environment. However, there is not sufficient data nor information for me to evaluate what specific action levels would provide sufficient protection of critical ecological resources (e.g., fisheries, aquatic habitat, aquatic food base for fish). It appears that neither the interim action plan nor the ATSDR HC report were intended to support protection of ecological resources. It is recommend that ecological endpoints be addressed for protection in the final action plan for Palmerton. This deficiency has been identified in some of MKA's earlier reviews on PZSS.

2. Should arsenic be addressed (explicitly) in the final action plan (and ROD - Record of Decision??)? Yes. The rationale is indicated in the review of the HC report and in the discussion of issues relevant to the attached summary table. Inhalation is an additional contaminant pathway that is not considered in an oral RfD, and it is interesting that in the Health Consultation memo's discussion of arsenic, cadmium, lead and zinc, inhalation is discussed only for arsenic and lead.

It is possible to determine, within an order of magnitude, what a reasonable action level for arsenic might be by calculating the ratio of the contaminant action level to the RfD. In the case of lead, the memo mentioned observable effects on the production of certain adult enzymes at a lead dose of 0.02mg/kg/day for three days. This value can be used as a substitute for a lead RfD for purposes of comparison. Having calculated the contaminant action level to RfD ratios for cadmium, lead and zinc, a reasonable ratio can be estimated for arsenic and used to back-calculate a reasonable action level. Please refer to the calculation table on the following page:

Contaminant	**Cadmium**	**Zinc**	**Lead**	**Arsenic**
Oral RfD mg/kg/day[1]	0.001	0.3	0.02[3]	0.0003
EPA Action Level ppm[2]	100	10,000	1500	15[5]
RfD/Action Level Ratio	100,000	33,333	75,000	50,000[4]

1 source: ATSDR Health Consultation memo to Charles Walters, April 12, 1993
2 source: EPA Environmental News, March 11, 1993
3 source: ATSDR Health Consultation memo of 4/12/1993, used in place of RfD
4 chosen as a reasonable ratio based on the ratios for other contaminants
5 back-calculated from the ratio and the oral RfD

As can be seen, the ratios vary from about 33,000 to 100,000. A reasonable and conservative ratio for arsenic may be 50,000 which would correspond with an action level of 15 ppm arsenic in the soil. With the highest and lowest ratios, the corresponding arsenic action levels would be 30 ppm and 10 ppm respectively.

This calculation suggests that arsenic could be an important health risk comparable to the other three contaminants in Palmerton Soils. The EPA should establish an action level for arsenic in a manner similar to what has been done for the other three contaminants to see if arsenic is indeed significant as it may very well be.

Summary Table of Relevant Cleanup Standards for Metals in Soils

Metal	HC Report: soil [] equal to RfD (ppm)	PADER Interim Standard (ppm)	NJDEP Recommended Cleanup Level (ppm)
Lead	none available	200*	100
Arsenic	15	20	20
Cadmium	50	20	3
Zinc	15,000	1000	350

*Based on lead levels in gasoline contaminated soils in residential areas.

RECENT GUIDANCE ON LEAD IN SOILS

1. A recent paper published in the journal, Environmental Science and Technology (ES&T), by Wixson and Davies (19940 is very important for the risk assessment issues on lead at PZSS. This crucial paper on guidelines for lead in soil was not available at the time when the HC report was written. As Wixson and Davies (1994) indicate, the issue of lead in soils is complex and a single guideline value for lead is not appropriate for regulatory compliance and cleanup. The article is a summary of an expert committee's report that was established and sponsored by the Society for Environmental Geochemistry and Health.

2. As the article indicates, there are several factors that affect a soil lead guideline value: a target blood lead, degree of protection (i.e., percent of population to be protected at a given blood lead level), response (slope) of blood lead-soil lead relationships, background levels of blood lead, and geometric standard deviation (GSD) of the blood lead distribution.

3. Based on assumed values used in the article calculation (i.e., slope = 2, background blood lead = 4 ug/dL, GSD = 1.4, and target blood lead = 10 ug/dL), 98% of the population would be protected at 500 ppm soil lead and 99% would be protected at 300 ppm lead in soil. Using the same assumptions for 99% protection, a slope of 2 would require a soil lead standard of 300 ppm while a slope of 1 would give a standard of 600 ppm lead in soil. Similar analyses can produce a wide range of soil lead standards depending on what values are assumed or measured (site-specific) for the given parameters. Thus, a single, uniform standard for cleanup of lead in soil cannot be readily recommended.

4. In the interest of time (and scope of work), there was no attempt made to try to use site-specific data to estimate a potential standard for Palmerton. Such an endeavor would be difficult for several reasons. First, variability in data might make it problematic to select a truly representative value (e.g., the slope). Second, selection of site-specific data could represent best professional judgement in some cases (e.g., on background blood levels) and experts from different parties of interest might have different perspectives (e.g., contractors vs. EPA vs. PADER vs. citizen groups, etc.). Therefore, some consensus gathering might be needed among the experts with similar and sufficient data and information available to all parties. And third, given the complexity of interactions amount the various parameters, there could be a temptation to work backwards toward a specific soil lead standard.

5. Given comments in the previous point, it is still crucial to note that a target blood lead level of 10 ug/dL is a very reasonable endpoint to protect the health of sensitive individuals like children and pregnant mothers (see citations in the HC report and the ES&T article). Also, given the widespread distribution of lead in the environment (especially soils), it is reasonable to expect that background blood lead values would be greater than 2 ug/dL (probably much higher at Palmerton and places like Jim Thorpe - as demonstrated in the report we reviewed last summer). If we use these two numbers for target and background blood levels, it is interesting to note that 10 of 11 soil lead standards (Table 4 at 2 ug/dL background blood lead is the exception with a soil lead standard of 1300 ppm) calculated in the ES&T article are less than 1000 ppm. This also provides some caution to the interim action plan level of 1500 ppm lead in soil.

6. It is recommended that the issues identified in this article be used in our future assessments and evaluation for the PZSS. This might be a useful point of focus in negotiations between PCCE and EPA (and other involved parties) for a final action plan at Palmerton. Based on our information and evaluations to date, we believe that a soil lead standard for Palmerton is probably below 1000 ppm in order to protect sensitive individuals (e.g., pre-school children). We would need more time (and more information) to estimate how far below 1000 ppm this standard might be but hopefully this will give PCCE some point of reference from which to proceed to the next step.

CONCLUDING COMMENTS

1. Based on the PCCE meeting in Palmerton in December 1993 and our evaluations to date, we think it is in PCCE's interest to see cleanup proceed in a productive fashion. If PCCE can get a clarification from EPA (in writing from authorized personnel) that the action levels of 1500 ppm lead and 100 ppm cadmium are intended truly and only as a first step in an interim plan (and therefore, new values and other risk assessment data will be used for the final action plan), then it might be in their interest to agree to the interim plan to expedite progress and begin protection for high-risk individuals.

2. It may also be in PCCE's interest to view final cleanup efforts at Palmerton (especially if action levels cover lead, cadmium, and arsenic at concentrations justified by risk assessment) as part of PADER's evolving greenfields program. One goal of this project is to encourage voluntary cleanup; also, risk assessment is intended to be a crucial part of this process. This approach might provide the responsible parties with some positive incentive for cleanup without giving them a "negative-image." It may also present PCCE with a more cooperative image since the emphasis of negotiations will be on productive cleanup and not on who might or might not be the guilty parties involved with environmental contamination.

APPENDIX A

APPENDIX B