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LETTER REPORT REGARDING STATUS OF DEVELOPMENT OF PRELIMINARY REMEDIATION GOALS FOR LEAD AND POLYCYCLIC AROMATIC HYDROCARBONS IN SOIL AT SITE 15 BASED ON ECOLOGICAL RISK CONCERNS NAS CECIL FIELD FL

6/10/2002

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Ligia Mora-Applegate
Bureau of Waste Cleanup
Florida Department of Environmental Protection
Room 471A, Twin Towers Office Building
2600 Blair Stone Rd.
Tallahassee, FL 32399

Dear Ms. Mora-Applegate:

This letter is intended to summarize the status to date of discussions regarding inputs for development of preliminary remediation goals (PRGs) for lead and PAHs in soils at Site 15, Cecil Field, based on ecological risk concerns. As you know, there have been extensive discussions regarding the technical merits of proposals set forth by TetraTech NUS (TTN) on behalf of the Navy, and proposals made by us. We have reached agreement on several of the exposure assumptions needed to calculate soil concentrations protective of mammalian and avian insectivores. The following table presents such consensus values, and identifies inputs for which agreement has not been reached.

Assumption	Mammal	Bird
Toxicity value (LOAEL, in mg/kg-day) for lead	80	11.3
Body weight (g)	5.5	49
Food ingestion (g, fresh weight)	3.3	23.2
Soil ingestion (mg)	50	450
Diet invertebrate fraction (%)	100	no agreement
Bioaccumulation factor (BAF, soil to invertebrate, fresh weight)	no agreement	0.014
Relative lead bioavailability (%)	no agreement	no agreement

The following summarizes discussion on the outstanding issues:

1. Diet invertebrate fraction: TTN has proposed that a mockingbird's diet should be assumed to be composed of 50% insects. We originally proposed that a diet with 100% insects should be assumed, since mockingbirds tend to consume more invertebrates during the breeding season. The breeding season is potentially the critical window of time for the lead effect of interest in the risk assessment (namely, reproductive effects). In support of this, we noted that the critical study upon which the lead toxicity value is based involved birds dosed for four months, demonstrating that partial year exposure to lead leading up to and during breeding is sufficient to impair reproduction. During discussion of this issue, we acknowledged that 100% is an upper end value for this assumption, and expressed willingness to agree to a compromise assumption of 75% insects in the diet. We were [and are] unwilling to recommend a lower value because: 1) we think that it likely represents an underestimate of actual insect composition of the diet at the site during the breeding season; and 2) intake of lead from the other, plant portion of the diet, isn't included in the exposure calculations.

2. Bioaccumulation factor: The modeling of risks to mammal and avian insectivores requires the calculation of a soil to invertebrate BAF. For the bird, which involves site-wide exposure, we originally recommended the slope-derived BAF (0.04) developed from the site study, consistent with the study work

plan. During discussion with TTN, we agree to the use of a lower, median value of 0.014 as proposed by TTN. The exposure area for the shrew is much smaller, and BAF values appear to vary substantially across the site. Under these circumstances, we consider the use of a site-wide average BAF to be undesirable. In order to produce a PRG protective of shrews for each potential exposure area at the site, we proposed using the maximum lead BAF observed, 0.07. After discussion, we agree to a compromise value of 0.04, which is the slope-derived average for the site. Although this is a site-wide average value, it is within a factor of 2 of the maximum, and therefore will likely produce a value protective for shrews for the vast majority of the site. Also, it is consistent with what was proposed, and agreed upon, in the site plan. We disagree with the use of the 0.014 site median value, as it can potentially result in an underestimation of dietary exposure for shrews of up to 5-fold.

3. Relative lead Bioavailability: TTN contends that a bioavailability adjustment for lead in the invertebrate diet is justified because lead acetate, the lead form used in the principal toxicity study, is 100% bioavailable. They base this assertion on information in a 1993 book published by the Society for Environmental Geochemistry and Health (Wixson and Davies, 1993). They also stated that an adjustment of 70% relative bioavailability is needed based on a study showing that quail's bioavailability of lead incorporated into oysters was about 70% of the availability of lead spiked into an oyster diet (Stone et al. 1981).

With respect to the statement that lead acetate is 100% bioavailable, we believe that this represents a misinterpretation of information in the literature. Wixson and Davies (1993) state "Because food constituents modify lead absorption, the bioavailability of lead in test materials such as soil is compared with that of the water soluble salt, lead-acetate, which is considered 100% bioavailable." The context of this statement is the need for establishing the bioavailability of lead ingested with food or soil *relative* to the bioavailability of lead acetate. Since lead acetate is the standard, it is considered to have a *relative* bioavailability of 100%. The absorption of lead acetate, as indicated by its absolute bioavailability, is far from complete. Since the critical studies for both avian and mammalian lead toxicity selected for this risk assessment involve dietary exposure, the absorption of lead acetate from food is the relevant comparison point. The absolute bioavailability of lead acetate-spiked food as been found to vary from 14 to 17% in the rat (Freeman et al. 1996).

The issue here is whether lead from insects is absorbed differently from lead added to a standard laboratory diet, as in the critical studies used to generate the toxicity values used in the risk assessment. In order to depart from the default assumption of 100% *relative* bioavailability, FDEP requires information from one or more sound, directly-relevant bioavailability studies. In our opinion, the study by Stone et al. (1981) offers no information that is useful in assessing the comparative absorption of lead from insects versus lead in standard laboratory diet. It compares two methods of incorporating lead into oysters, which are then added to the diet. It is unclear why lead in oysters should be considered representative of lead in insects. Stone et al. (1981) suggest that the reduced bioavailability (69-75%) of lead bound to oysters may be due to their high copper and zinc contents. When quail were fed a normal diet spiked with lead acetate but enriched with copper and zinc at levels similar to those of oyster meat, they found a very similar (74%) reduction in lead bioavailability. We have no information on the copper and zinc content of insects at the site, and no way to determine whether a similar phenomenon occurs. Consequently, we recommend that the default assumption of 100% relative bioavailability of lead be used.

As noted above, we have already made several compromises on exposure assumptions for the ecological risk assessment. While compromises such as these are a normal part of developing risk-based PRGs, we do not recommend further downward adjustment of exposure assumptions for the factors discussed above. We believe that our recommendations are scientifically defensible and in the best interest of developing a reasonable and protective risk assessment for this site.

Sincerely,

Hugo C. Ochoa, D.V.M., Ph.D.

Stephen M. Roberts, Ph.D.

References

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