Memorandum

Date: February 16, 2007
To: Tim Drexler and Ed Karecki/USEPA
From: Dave Mitchell, Ph.D., and Christine Archer
Subject: Pines Area of Investigation
        Uranium Screening Levels

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This memo is a follow-up to the discussion held on December 6, 2006 between USEPA Region 5 (T. Drexler, E. Karecki) and ENSR risk assessors (L. Bradley, D. Mitchell, C. Archer) regarding appropriate ecological screening levels for uranium in sediment and soil within the Pines (IN) Area of Investigation. As part of that discussion, ENSR agreed to prepare a technical memorandum recommending uranium screening values for USEPA review. This memorandum would potentially be incorporated as an addendum to the Pines RI/FS workplan - Vol. 6 Ecological Risk Work Plan [Pines AOC II for RI/FS Docket No. V-W-‘04-C-784].

This issue was first raised in USEPA comments on the ENSR April 2006 draft report entitled Evaluation of Polycyclic Aromatic Hydrocarbon, Polychlorinated Dibenzodioxin/Polychlorinated Dibenzofuran, and Radionuclide Data from Yard 520 (“Yard 520 Evaluation draft report”). The radionuclide concentrations in samples of coal combustion byproducts (CCBs) taken from Yard 520 were compared to ecological risk-based soil screening levels, including both radiation and chemical-based values.

No radiation-based levels (i.e., biota concentration guides (BCGs)) were exceeded for any radionuclide in any of the samples. The comparison of samples from Yard 520 with ecological screening values indicated that the concentrations of naturally occurring uranium and its U-238 component were greater than the soil screening value of 5 mg/kg (based on chemical effects). This is a phytotoxicity value which was derived from an Oak Ridge National Lab (ORNL) document (Efroymson, et al., 1997a). It was selected based on the literature hierarchy presented in the Ecological Risk Work Plan.

ENSR reported in the Yard 520 Evaluation draft report and in the subsequent response to USEPA comments on the draft report (dated 9/8/06), that a review of the technical basis for this phytotoxicity-based soil level revealed that the value is based on a single study conducted in 1983 which observed a reduction in root weight at 5 to 10 mg/kg uranium. The ORNL document (Efroymson, et al., 1997a) indicates that there is low confidence in the 5 mg/kg value because it is based solely on one study. Due to the low confidence associated with the value it reports, further investigation for applicable screening levels for uranium was conducted.
A recent review of the available uranium ecotoxicity literature indicates that additional data is now available for many types of media (Sheppard, et al., 2005). The authors reviewed a variety of toxicity studies and determined Predicted No-Effect Concentrations (PNECs) based on the chemical toxicity of uranium to plants and earthworms exposed to impacted soils. This document recommends a PNEC of 250 mg/kg for terrestrial plants and 100 mg/kg for earthworms. All of the detected levels of uranium in the Yard 520 samples are below both of these PNECs, indicating that impacts to plants and earthworms are unlikely.

Also, a review of wildlife-based screening values addressing the chemical toxicity of uranium was conducted. This review identified the preliminary remediation goal (PRG) of 92 mg/kg uranium in soil which was derived to be protective of the insectivorous short-tailed shrew (Efroymson, et al., 1997b). A PRG for birds could not be developed because effects data were not available. All Yard 520 uranium concentrations are well below this PRG, indicating that impacts to mammalian communities are unlikely.

In response to USEPA comments on the Yard 520 Evaluation draft report, sampling and analysis was conducted for radionuclides in selected sediment locations of Brown Ditch. A sediment screening value for uranium is not available from USEPA Region 5 ESLs or other sources listed in the literature hierarchy presented in the Ecological Work Plan, and so further investigation was undertaken. That investigation identified the Sheppard et al. (2005) presentation which recommends a sediment PNEC value for protection of freshwater benthic invertebrates of 100 mg/kg uranium in sediment.

Conclusions
Based on the information and analyses presented in this memo, ENSR recommends:

- A soil screening value of 92 mg /kg (dry weight) be adopted for ecological risk-based soil screening for uranium at the Pines Area of Investigation;
- A screening value of 100 mg /kg (dry weight) be adopted for ecological risk-based sediment screening for uranium at the Pines Area of Investigation; and
- Based on these new screening levels, no soil or sediment uranium concentrations exceed these values, therefore no further sampling or investigation is warranted.

References
