

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY



REGION 4

61 Forsyth Street, S.W.  
Atlanta, Georgia 30303

MEMORANDUM

October 4, 2012

**SUBJECT:** Derivation of risk based levels for dioxin in dust  
Gainesville, FL residences

**FROM:** Kevin Koporec, Toxicologist  
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Superfund Support Branch

**THROUGH:** Glenn Adams, Chief  
Technical Support Section  
Superfund Support Branch

**TO:** Scott Miller, RPM  
Superfund Remedial Branch

Per your request, I have derived health risk based levels for dioxin in indoor dust for comparison with data from samples recently collected from residences in Gainesville, Florida. This investigation stems from previous and ongoing investigation of the Cabot-Koppers Superfund site.

A July 2011 document- *Indoor Dust Investigation/Interpretation Plan, Stephen Foster Neighborhood, Gainesville, Florida* (hereafter referred as "Plan")- includes exposure assumptions and one of the toxicity values that were agreed to by the Indoor Dust Dioxin Workgroup. Since EPA now has a verified reference dose (RfD) on IRIS (2012), and it is slightly more conservative (i.e., more protective) than the ATSDR MRL described in the Plan, I have used the EPA RfD in my assessment.

While EPA guidance has no separate equations for dust ingestion, the exposure pathway of incidental ingestion of dust is the same as for soil, with appropriate dust-specific input values.

Separate equations are used to derive risk based levels based on the cancer endpoint and noncarcinogenic toxic endpoint.

For the cancer endpoint, the soil PRG-soil equations (3) and (4) from the EPA RAGS-B guidance (1991) are used (agreed to in the Plan), adjusting the soil terms to dust terms.

$$C_{\text{dust}} (\text{ng/kg})_{\text{carc}} = \frac{\text{TR} \times \text{AT}_{\text{carc}} \times 365 \text{ d/yr} \times 10^6 \text{ ng/mg chemical}}{\text{CSF} \times 10^{-6} \text{ kg/mg} \times \text{EF} \times \text{IF}_{\text{dust/adjust}}}$$

For the noncarcinogenic endpoint, the equation for soil ingestion from the RSL table website is used, adjusting the soil terms to dust terms.

$$C_{\text{dust}} (\text{ng/kg})_{\text{nc}} = \frac{\text{THQ} \times \text{AT}_{\text{nc}} \times 365 \text{ d/yr} \times \text{BW}_c \times \text{RfD} \times 10^6 \text{ ng/mg chemical}}{\text{EF} \times 10^{-6} \text{ kg/mg soil} \times \text{ED}_c \times \text{IR}_{\text{dust/child}}}$$

Assumptions used in derivation of risk based levels:

Target risk (TR) = cancer risk range of  $10^{-6}$ ,  $10^{-5}$ ,  $10^{-4}$ .

Averaging Time, carcinogenic ( $\text{AT}_{\text{carc}}$ ) = 70 yrs

Averaging Time, noncarcinogenic ( $\text{AT}_{\text{nc}}$ ) = 6 yrs

Carcinogenic Slope Factor (CSF), TCDD =  $1.5\text{E}+05$  per mg/kg-d

Reference Dose (RfD), TCDD =  $7\text{E}-10$  mg/kg-d (IRIS 2012)

Exposure Frequency (EF) = 350 days/yr (EPA 1989, 2011)

Exposure Duration, child ( $\text{ED}_c$ ) = 6 yrs

Ingestion rate, dust-child ( $\text{IR}_{\text{dust/child}}$ ) = 60 mg/day

Ingestion rate, dust-adult ( $\text{IR}_{\text{dust/adult}}$ ) = 11 mg/day

Ingestion Factor, age-adjusted ( $\text{IF}_{\text{dust/adjust}}$ ) = 26 mg-yr/kg-day

(IF calculated with RAGS-B equation 3, using  $\text{IR}_{\text{dust/child}}$ ,  $\text{IR}_{\text{dust/adult}}$ )

Body Weight<sub>child</sub> = 16 kg

Body Weight<sub>adult</sub> = 80 kg (EPA 2011)

Based on these inputs, risk-based levels were calculated, and are shown here.

Excess Cancer Risk	TCDD-TEQ concentration in dust
$1 \times 10^{-6}$	19 pg/g
$1 \times 10^{-5}$	190 pg/g
$1 \times 10^{-4}$	1900 pg/g

Noncancer Hazard quotient = 1	190 pg/g
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NOTE: pg/g (units from the data report) is equivalent to ng/kg (derived in the above equation).

**Uncertainty:** Other potential exposure routes (e.g., dermal, inhalation) are not included in these calculated values. Running the RSL calculator (EPA 2012) as if this were soil, however, shows

that these other potential exposure routes do not contribute significantly to the risk. Thus the workgroup decision to focus on ingestion in assessing the dust TEQ data is supported.

**Conclusion:** Since 190 pg/g is calculated based on a hazard quotient of 1, and is in the middle of the cancer risk range, I recommend this level as health protective in evaluation of the data from the indoor dust sampling effort in Gainesville.

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References:

EPA 1989, 2011\*. *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part A*. Interim Final, EPA OERR, December 1989.

[\*updates have recently been added to the electronic version of RAGS-A:  
<http://www.epa.gov/oswer/riskassessment/ragsa/index.htm>]

EPA 1991. *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, (Part B, Development of Risk-based Preliminary Remediation Goals*. Interim. EPA Office of Research and development, EPA/540/R-92/003, Publication 9285.7-01B, December 1991.

EPA 2011. *Exposure Factors Handbook: 2011 Edition*, EPA 600/R-09/052F, EPA Office of Research & Development, September 2011. [<http://www.epa.gov/ncea/efh/pdfs/efh-complete.pdf>]

EPA 2012. Regional Screening Levels for Chemical Contaminants at Superfund Sites [[http://www.epa.gov/reg3hwmd/risk/human/rb-concentration\\_table/index.htm](http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm)], updated April 2012.

IRIS, 2012. Integrated Risk and Information System, National Center for Environmental Assessment, Office of Research & Development, USEPA (website [[www.epa.gov/iris](http://www.epa.gov/iris)]), reference dose for 2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD); CASRN 1746-01-6

EPA 2010. Recommended Toxic Equivalency Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachloridibenzo-*p*-dioxin and Dioxin-Like Compounds. Risk Assessment Forum, U.S. Environmental Protection Agency, Washington, DC. EPA/600/R-10/005.

Feel free to contact me if you need further assistance on risk assessment issues.

