Fang, Samuel

From: Kevin H Dr Reinert [KReinert@rohmhaas.com]
Sent: Tuesday, May 25, 2004 3:17 PM
To: sfang@state.pa.us
Subject: Fw: Resorcinol Cleanup Standard
Follow Up Flag: Follow up
Flag Status: Completed

Sam,

this is what was accepted and used in 2 recent risk assessments in the SE region under Act 2.

Kevin

Kevin H. Reinert, Ph.D.
Sr. Research Section Manager
Toxicology Environmental Sciences
Toxicology Department
Rohm and Haas Company
PO BOX 0904
Spring House, PA 19477-0904
215 641 7479
215 619 1621 - fax
215 872 6801 - cell (emergencies)
kreinert@rohmhaas.com

Assistant :: Roberta Rieber 215 619 5501 :: rrieber@rohmhaas.com

Opinions are mine and not those of the Rohm and Haas Company

----- Forwarded by Kevin H Dr Reinert/NAR/RohmHaas on 05/25/2004 03:15 PM -----

RESORCINOL

	Residential	Nonresidential	Maine Standard(1)
Soil - Direct Contact (Ingestion), mg/kg	110,000	190,000(2)	
Groundwater – (Ingestion) mg/l	18	51	0.140
Soil to Groundwater – mg/kg (TDS < 2500)	250	700	1.9

(1) Maine Bureau of Health set a Maximum Exposure guideline (MEG) for drinking water at 140 ppb.
(2) 190,000 mg/kg is the cap or maximum allowable concentration.

For comparison, the table below lists the soil direct contact values and soil to groundwater values needed to meet Pennsylvania's cleanup standards for Phenol. Phenol and Resorcinol are structurally similar (see attached structures). It is important to note that Phenol is generally about 3 to 4 times more toxic than Resorcinol based on mammalian toxicity studies and reflected in published workplace exposure limits.

PHENOL

	Residential	Nonresidential
Soil - Direct Contact (Ingestion), mg/kg	130,000	190,000(1)
Soil to Groundwater – mg/kg (TDS < 2500)	66	66

(1) 190,000 mg/kg is the cap or maximum allowable concentration.

The following paragraphs document the equations and data used to calculate the soil direct contact values, groundwater, and soil to groundwater values for Resorcinol. In addition, we also calculated a reference dose for Resorcinol based on a 28-day rat repeat oral study. We have also asked the Pennsylvania DEP about the implications of taste and odor issues for Resorcinol and what, if any, data is being generated.

Resorcinol is not a carcinogen, therefore, Equation 1 (Pennsylvania Code, Title 25. 250.306) was used to calculate the residential and nonresidential cleanup standard for direct contact (MSCs) with soil based on ingestion.

Equation 1:

$$MSCs = \frac{(THQ \times RfDo \times BW \times ATDC \times 365\ d/yr)}{(Abs \times EF \times ED \times IngR \times CF)}$$

Where:

Term	Residential	Nonresidential
THQ (Target Hazard Quotient)	1	1
RfDo (Oral Reference Dose – mg/kg-day) (1)	0.5	0.5
BW (Body Weight (kg)	15	70
ATDC (Averaging Time for systemic toxicants – yr)	6	25
Abs (Absorption)	1	1
EF (Exposure Frequency – d/yr)	250	180
ED (Exposure Duration – yr)	6	25
IngR (Ingestion Rate)	100	50
CF (Conversion Factor – soil: kg/mg)	1 x 10-6	1 x 10-6

(1) The Reference Dose was calculated based on a 28-day repeat oral dose study in rats. The Lowest Observable Effect Level (LOEL) in this study was 504 mg/kg. Safety factors of 10 for intraspecies variation, 10 for interspecies variation and 10 for a LOEL from a 28-day study were applied to the LOEL.

The calculated value for the direct contact cleanup standard for Resorcinol in a residential scenario is 1.1 E05 mg/kg.

The calculated value for the direct contact cleanup standard for resorcinol in a nonresidential scenario is 1.4 E06 mg/kg. Because this concentration is larger than the highest allowable default concentration of 1.9 E05 mg/kg, the cleanup standard for nonresidential is set at 1.9 E05 mg/kg

USEPA has not established either a Minimum Contamination Level (MCL) or a Health Advisory Level (HAL) for Resorcinol, nor is there an established Medium Specific Concentration for Resorcinol in groundwater (MSCGW). However, The Maine Bureau of Health has set a Maximum Exposure guideline (MEG) for

drinking water of 140 ppb.

In order to calculate a soil to groundwater value, a MSCGW was calculated using Equation 2, where:

$$MSCGW = \frac{(THQ \times RfDo \times BW \times ATDC \times 365\ d/yr)}{(Abs \times EF \times ED \times IngR \times CF)}$$

Term	Residential	Nonresidential
THQ (Target Hazard Quotient)	1	1
RfDo (Oral Reference Dose – mg/kg-day)(1)	0.5	0.5
BW (Body Weight (kg)	70	70
ATDC (Averaging Time for systemic toxicants – yr)	30	25
Abs (Absorption)	1	1
EF (Exposure Frequency – d/yr)	350	250
ED (Exposure Duration – yr)	30	25
IngR (Ingestion Rate)	2	1
CF (Conversion Factor – soil: kg/mg)	1	1

(1) The Reference Dose was calculated based on a 28-day repeat oral dose study in rats. The Lowest Observable Effect Level (LOEL) in this study was 504 mg/kg. Safety factors of 10 for intraspecies variation, 10 for interspecies variation and 10 for a LOEL from a 28-day study were applied to the LOEL.

The calculated MSCGW values for the residential and nonresidential are 18.3 and 51.1 mg/l, respectively.

Equation 3 (Pennsylvania Code, Title 25. 250.308) was then used to calculate the residential and nonresidential cleanup standard for soil to groundwater.

Equation 3:

$$MSCS = MSCGW ((Koc*foc) + \grave{e}w/\tilde{n}b) * DF$$

Where:

Term	Maine Standard	Residential	Nonresidential
MSCGw (mg/l)	0.140	18.3	51.1
Koc (Organic carbon partition coefficient - l/kg)	10.36(1)	10.36(1)	10.36(1)
foc (Fraction organic carbon	0.0025	0.0025	0.0025
èw (Water-filled porosity of soil	0.2	0.2	0.2
ñb (Dry bulk density of soil (kg/l)	1.8	1.8	1.8
DF (Dilution factor)	100	100	100

(1) Boyd S.A. 1982. Soil Sciences 134: 337-43

The soil to groundwater pathway numeric value (MSCs) using the Maine standard is 1.9 mg/kg. The residential MSCs is 250 mg/kg and the nonresidential MSCs is 700 mg/kg.