

Memorandum

Date: March 29, 2012

From: Chau Vu, Human Health Risk Assessor, Technical & Enforcement Support Section

To: Centredale Site File

Subj: Updated calculation of site-specific non-cancer dioxin soil PRGs for recreational scenario and re-evaluation of dioxin soil data for Merino Park

On February 17, 2012, EPA finalized its non-cancer science assessment for dioxins. EPA now requires evaluations of the dioxin non-cancer health effects in a range of agency activities, including establishing cleanup levels at Superfund sites. With science available from the non-cancer dioxin assessment, the purpose of this memorandum is to revise site-specific non-cancer dioxin soil PRGs for recreational scenario and re-evaluate currently available dioxin soil data for Merino Park.

This memorandum should be reviewed along with the November 23, 2010 memorandum from Chau Vu to Ted Bazenas and the December 2010 EPA Site-Specific Recreational Dioxin Action Level information sheet for Merino Park for additional background information on the site.

Since there is no change to dioxin cancer toxicity values, there is no change to the cancer risk-based dioxin PRGs and cancer dioxin action levels calculated in the 2010 memorandum and information sheet.

From the 2012 final dioxin non-cancer assessment, the new non-cancer toxicity value is a reference dose value of 0.7 pg/kg-day. Applying this value to equation 2 for non-cancer PRGs from the 2010 memorandum and using the same standard default and site-specific exposure parameters, the non-cancer soil PRGs for 2,3,7,8-TCDD are presented in the table below:

Recreational User	Non-cancer PRG (ppt TEQ) at target HQ of 1	Non-cancer PRG (ppt TEQ) at target HQ of 2	Non-cancer PRG (ppt TEQ) at target HQ of 3
Adult	1,664	3,328	4,992
Older Child	930	1,860	2,790
Child	184	368	552

Using the same rationale presented in the 2010 information sheet, the revised site-specific recreational use dioxin action level for dioxin would be 368 ppt or 0.368 ppb dioxin TEQ for Merino Park. This number is based on non-cancer adverse health effects from dioxin TEQ for a young child recreational user since this is the most vulnerable age group. This action level of 0.368 ppb would equate to a non-cancer target hazard quotient of 2 and a cancer risk of 1.8×10^{-5} , which is within the acceptable cancer risk range for EPA's



Removal Program. RIDEM's long-term cleanup goal remains at 200 ppt (0.2 ppb), which equates to a 1×10^{-5} excess lifetime cancer risk.

Available dioxin soil data for Merino Park are then re-evaluated by screening against the revised action level of 368 ppt. Soil dioxin TEQ concentrations at all 18 locations along the river bank and at Merino Park are below 368 ppt. Three locations (SS-04, SS-05, and SS-13) along the river bank have detections above RIDEM's long-term cleanup goal of 200 ppt, which would require long-term monitoring.

Memorandum

Date: November 23, 2010
From: Chau Vu, Human Health Risk Assessor, Technical & Enforcement Support Section
To: Ted Bzenas, OSC, Emergency Response and Removal Section
Subj: Revised calculation of site-specific soil dioxin PRGs for recreational scenario for Merino Park

Upon request, I have calculated the site-specific cancer and non-cancer recreational preliminary remediation goals (PRGs) for 2,3,7,8-TCDD for Merino Park. The equations and most default values are from EPA's guidance (2002 Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, 2004 Risk Assessment Guidance for Superfund Part E on Dermal Risk Assessment, and 1997 Exposure Factors Handbook). The oral cancer slope factor value is from EPA's 1997 Health Effects Assessment Summary Table (HEAST). This value is consistent with the cancer slope factor value used in the 2005 Centredale Human Health Risk Assessment. It is very similar to the slope factor value used to develop the cancer draft interim PRGs by OSWER [1.56E-04 (pg/kg-day)⁻¹ from EPA's 1985 Office of Health and Environmental Assessment]. The non-cancer reference dose is based on the ATSDR's 1998 chronic oral Minimal Risk Level and is the value used to develop the OSWER's non-cancer draft interim PRGs.

This calculation also includes the assumption that a recreational visitor would use the Park 4 times a week for 6 months a year from May to October, resulting in 96 days/year. The Centredale HHRA made the assumption that recreational visitors to the oxbow area at the site are exposed to the area 78 days/year (twice a week in May, September, October and 4 times a week in June, July, and August). All receptors are assumed to come to the Park for the same days/year with the children being accompanied by adults at all time during the visits. Consistent with risk assessment practice, a child is assumed to be 1-6 years old, older child is 7-18 years old, and adult is 19 and above. It is also assumed that a person is exposed to a site for a total of 30 years as under Superfund guidance.

The PRGs are developed for both incidental ingestion of and dermal contact with soil at the Park during the visits. The equations, assumptions and default values used are as follows:

Equation 1 for cancer PRGs

$$\text{PRG (pg/g or ppt)} = \frac{\text{TR} \times \text{BW} \times \text{AT} \times 365 \text{ days/yr}}{(\text{EF} \times \text{ED}) [(\text{IR} \times \text{CSF}) + (\text{CSF}/\text{ABS}_{\text{GI}}) \times \text{AF} \times \text{ABS}_{\text{d}} \times \text{EV} \times \text{SA}] \times \text{RBA}}$$

RBA

Table 1 Values used for cancer PRGs calculation

Parameter	Unit	Default Value		
		Adult	Older Child	Child
TR (target cancer risk)	dimensionless	1E-06	1E-06	1E-06
BW (body weight)	kg	70	45	15
AT (averaging time)	years	70	70	70
EF (exposure frequency)	days/year	96	96	96
ED (exposure duration)	years	12	12	6
1997 CSF (oral cancer slope factor)	(pg/kg-day) ⁻¹	1.5E-04	1.5E-04	1.5E-04
1985 CSF (oral cancer slope factor)	(pg/kg-day) ⁻¹	1.56E-04	1.56E-04	1.56E-04
IR (soil ingestion rate)	g/day	0.1	0.1	0.2
ABS _{GI} (gastrointestinal absorption fraction)	pg absorbed/pg ingested	1.0	1.0	1.0
ABS _d (dermal absorption fraction)	pg absorbed/pg on skin	0.03	0.03	0.03
EV (dermal exposure frequency)	events/day	1	1	1
AF (dermal adherence factor)	g/cm ²	7E-05	2E-04	2E-04
SA (dermal surface area)	cm ²	5700	4800	2800
RBA (relative bioavailability)	dimensionless	1	1	1

Substituting the values from Table 1 into equation 1 and using the 1997 HEAST CSF= 1.5E-4 (pg/kg-day)⁻¹, the cancer soil PRGs for 2,3,7,8-TCDD are:

Recreational User	Cancer PRG (ppt TEQ) at 10E-6 target risk level	Cancer PRG (ppt TEQ) at 10E-5 target risk level	Cancer PRG (ppt TEQ) at 10E-4 target risk level
Adult	92	920	9,200
Older Child	52	520	5,200
Child	20.5	205	2,050

Substituting the values from Table 1 into equation 1 and using the 1985 CSF = 1.56E-4 (pg/kg-day)⁻¹, the cancer soil PRGs for 2,3,7,8-TCDD are:

Recreational User	Cancer PRG (ppt TEQ) at 10E-6 target risk level	Cancer PRG (ppt TEQ) at 10E-5 target risk level	Cancer PRG (ppt TEQ) at 10E-4 target risk level

Adult	89	890	8,900
Older Child	50	500	5,000
Child	20	200	2,000

Equation 2 for non-cancer PRGs

$$\text{PRG (ppt)} = \frac{\text{THQ} \times \text{BW} \times \text{AT} \times 365 \text{ days/year} \times \text{RSC}}{(\text{EF} \times \text{ED}) [(\text{IR}/\text{RfD}) + (\text{AF} \times \text{ABS}_d \times \text{EV} \times \text{SA})/(\text{RfD} \times \text{ABS}_{\text{GI}})] \times \text{RBA}}$$

Table 2 Values used for non-cancer PRG calculation

Parameter	Unit	Default Value		
		Adult	Older Child	Child
THQ (target hazard quotient)	dimensionless	1	1	1
BW (body weight)	kg	70	45	15
AT (averaging time)	years	12	12	6
EF (exposure frequency)	days/year	96	96	96
ED (exposure duration)	years	12	12	6
RfD (oral reference dose)	pg/kg-day	1	1	1
IR (soil ingestion rate)	g/day	0.1	0.1	0.2
ABS _{GI} (gastrointestinal absorption fraction)	pg absorbed/pg ingested	1.0	1.0	1.0
ABS _d (dermal absorption fraction)	pg absorbed/pg on skin	0.03	0.03	0.03
EV (dermal exposure frequency)	events/day	1	1	1
AF (dermal adherence factor)	g/cm ²	7E-05	2E-04	2E-04
SA (dermal surface area)	cm ²	5700	4800	2800
RBA (relative bioavailability)	dimensionless	1	1	1
RSC (relative source contribution)	dimensionless	1	1	1

Substituting all the values from Table 2 into equation 2, the non-cancer soil PRGs for 2,3,7,8-TCDD are:

Recreational User	Non-cancer PRG (ppt TEQ) at target HQ of 1	Non-cancer PRG (ppt TEQ) at target HQ of 2	Non-cancer PRG (ppt TEQ) at target HQ of 3
Adult	2,377	4,754	7,131

Older Child	1,328	2,656	3,984
Child	263	526	789

Note: At PRG=263 ppt, the non-cancer hazard quotient = 1 and the cancer risk level for the child recreational user would be $1.3E-5$.

At PRG=526 ppt, the non-cancer hazard quotient = 2 and the cancer risk level for the child recreational user would be $2.6E-5$.

At PRG=789 ppt, the non-cancer hazard quotient = 3 and the cancer risk level for the child recreational user would be $3.9E-5$.

EPA Site-Specific Recreational Dioxin Action Level
Merino Park, Providence, RI
December 2010

For evaluation of soil samples collected at Merino Park, EPA developed site-specific recreational dioxin action levels using standard equations, default exposure assumption values, as well as recreational use assumptions specific to the Park. The standard equations and default exposure assumption values follow nation-wide EPA risk methodologies, which include the:

- 2002 Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites;
- 2004 Risk Assessment Guidance for Superfund Part E on Dermal Risk Assessment; and
- 1997 Exposure Factors Handbook.

The site-specific cancer and non-cancer recreational action levels for dioxin were developed for both exposure pathways of incidental ingestion of and dermal contact with soil at the Park during recreational visits.

For dioxin toxicity, EPA used the oral cancer slope factor value of $1.56E-04$ (pg/kg-day)⁻¹ developed by EPA's 1985 Office of Health and Environmental Assessment. The non-cancer reference dose is based on the 1998 chronic oral Minimal Risk Level from the Agency for Toxic Substances and Disease Registry (ATSDR). Both of these values are publicly available and peer reviewed.

All exposure assumption values used to develop the recreational dioxin action levels, except the exposure frequency value, are default values from the EPA guidances listed above. Consistent with EPA risk assessment practice, a young child is assumed to be 1-6 years old, older child is 7-18 years old, and adult is 19 and above. It is also assumed that a person is exposed to a site for a total of 30 years in a lifetime.

For the exposure frequency value, since EPA does not have site-specific data for the use of the Park, an assumption was made that a recreational visitor would use the Park 4 times a week for 6 warm months a year from May to October, resulting in 96 days per year. All visitors are assumed to come to the Park for the same number of days per year with the children being accompanied by adults at all time during the visits. This assumption is considered reasonable for recreational use of a park in New England.

The equations, assumptions and default values used are as follows:

Equation 1 for Cancer Action Levels (from 2002 Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites)

$$\text{Action Level (pg/g or ppt)} = \frac{\text{TR} \times \text{BW} \times \text{AT} \times 365 \text{ days/yr}}{(\text{EF} \times \text{ED}) [(\text{IR} \times \text{CSF}) + (\text{CSF}/\text{ABS}_{\text{GI}}) \times \text{AF} \times \text{ABS}_{\text{d}} \times \text{EV} \times \text{SA}] \times \text{RBA}}$$

EPA Site-Specific Recreational Dioxin Action Level
Merino Park, Providence, RI
December 2010

Table 1 Values Used for Cancer Action Level Calculation

Calculations use EPA standard defaults and values from 2004 Risk Assessment Guidance for Superfund Part E on Dermal Risk Assessment and 1997 Exposure Factors Handbook, except EF (exposure frequency) values which are site-specific assumptions.

Parameter	Unit	Default Value		
		Adult	Older Child	Child
TR (target cancer risk)	Dimensionless	10 ⁻⁵	10 ⁻⁵	10 ⁻⁵
BW (body weight)	Kg	70	45	15
AT (averaging time)	Years	70	70	70
EF (exposure frequency)	days/year	96	96	96
ED (exposure duration)	Years	12	12	6
1985 CSF (oral cancer slope factor)	(pg/kg-day) ⁻¹	1.56E-04	1.56E-04	1.56E-04
IR (soil ingestion rate)	g/day	0.1	0.1	0.2
ABS _{GI} (gastrointestinal absorption fraction)	pg absorbed/pg ingested	1.0	1.0	1.0
ABS _d (dermal absorption fraction)	pg absorbed/pg on skin	0.03	0.03	0.03
EV (dermal exposure frequency)	events/day	1	1	1
AF (dermal adherence factor)	g/cm ²	7E-05	2E-04	2E-04
SA (dermal surface area)	cm ²	5700	4800	2800
RBA (relative bioavailability)	Dimensionless	1	1	1

Substituting all the values from Table 1 into equation 1, the cancer soil action levels for 2,3,7,8-TCDD are:

Recreational User	Cancer Action Levels (TEQ ¹) at 10 ⁻⁵ target risk level
Adult	890 ppt or 0.890 ppb
Older Child	500 ppt or 0.500 ppb
Young Child	200 ppt or 0.200 ppb

¹ TEQ, or Toxicity Equivalency Quotient, is a way of expressing the total toxicity of all of the types of dioxin found in a given sample as a single number.

EPA Site-Specific Recreational Dioxin Action Level
Merino Park, Providence, RI
December 2010

Equation 2 for Non-Cancer Action Levels (from the 2002 Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites)

$$\text{Action Level (ppt)} = \frac{\text{THQ} \times \text{BW} \times \text{AT} \times 365 \text{ days/year} \times \text{RSC}}{(\text{EF} \times \text{ED}) \left[\frac{\text{IR}}{\text{RfD}} + (\text{AF} \times \text{ABS}_d \times \text{EV} \times \text{SA}) / (\text{RfD} \times \text{ABS}_{\text{GI}}) \right] \times \text{RBA}}$$

Table 2 Values Used for Non-Cancer Action Level Calculation

Calculations use EPA standard defaults and values from 2004 Risk Assessment Guidance for Superfund Part E on Dermal Risk Assessment and 1997 Exposure Factors Handbook, except EF (exposure frequency) values which are site-specific assumptions.

Parameter	Unit	Default Value		
		Adult	Older Child	Child
THQ (target hazard quotient)	dimensionless	1	1	1
BW (body weight)	Kg	70	45	15
AT (averaging time)	Years	12	12	6
EF (exposure frequency)	days/year	96	96	96
ED (exposure duration)	Years	12	12	6
RfD (oral reference dose)	pg/kg-day	1	1	1
IR (soil ingestion rate)	g/day	0.1	0.1	0.2
ABS _{GI} (gastrointestinal absorption fraction)	pg absorbed/pg ingested	1.0	1.0	1.0
ABS _d (dermal absorption fraction)	pg absorbed/pg on skin	0.03	0.03	0.03
EV (dermal exposure frequency)	events/day	1	1	1
AF (dermal adherence factor)	g/cm ²	7E-05	2E-04	2E-04
SA (dermal surface area)	cm ²	5700	4800	2800
RBA (relative bioavailability)	dimensionless	1	1	1
RSC (relative source contribution)	dimensionless	1	1	1

EPA Site-Specific Recreational Dioxin Action Level
Merino Park, Providence, RI
December 2010

Substituting all the values from Table 2 into equation 2, the non-cancer soil action levels for 2,3,7,8-TCDD are:

Recreational User	Non-cancer Action Levels (TEQ) at target HQ of 2
Adult	5,754 ppt or 5.754 ppb
Older Child	2,656 ppt or 2.656 ppb
Young Child	526 ppt or 0.526 ppb

EPA Action Level

EPA selected the site-specific recreational use dioxin action level of 0.526 ppb TEQ for Merino Park. This number is based on non-cancer adverse health effects from dioxin TEQ for a young child recreational user since this is the most vulnerable age group. This action level is protective of a recreational young child as well as recreational visitors of other age groups. In addition, the non-cancer action level of 0.526 ppb equates to a cancer risk of 2.6×10^{-5} , which is also within the acceptable cancer risk range for EPA's Removal Program.

Relationship to RIDEM's Methodology --*The following is RIDEM-provided language:*

Long-Term Monitoring

RIDEM completely agrees with the methodology of this assessment, and the short-term protectiveness described by EPA. The EPA risk assessment coincides in methodology and guidance used with the RIDEM Method III Risk Assessment process, and therefore, RIDEM accepts this risk-assessment as a proper Method III assessment as described in Rule 8.04 of the Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases (Site Remediation Regulations).

The Site Remediation Regulations also describe the maximum risk acceptable when setting soil remediation goals or action levels. According to Rule 8.01A, the excess lifetime cancer risk for a site cannot exceed 1×10^{-5} (1 in 100,000). Furthermore, according to Rule 8.01B, the hazard index cannot exceed 1. Therefore, RIDEM is obligated to use 200ppt (0.200ppb) as the long-term cleanup goal, given the specified parameters, because it equates to a 1×10^{-5} excess lifetime cancer risk.

It is important to note that this is a **long-term** risk goal, and does not suggest that there is an *imminent threat to human health or the environment, which would require a removal action*. As a result, the EPA has agreed to monitor this area as part of the downstream considerations of the Centredale Manor Superfund Site. In the Feasibility Study for that site, EPA describes that the downgradient reaches of the Woonasquatucket River will be addressed with an adaptive management approach. The collection and evaluation of monitoring data following implementation of the selected upstream sediment remedy will help determine whether downgradient conditions are improving following control of upgradient sources.