

ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

8100 North Austin Avenue
Morton Grove, Illinois 60053-3203

17D0946
PM: Katherine Langfoss
TRC Environmental Corporation
St. Anne's Center

847-967-6666
FAX: 847-967-6735
www.emt.com

Quality Control

TURNAROUND TIME:
 RUSH
 ROUTINE
 ___ day turnaround

COC #: **22683**

Due Date: _____

Company: TRC
 Address: 150 Patrick Blvd. Suite 130
 Phone #: (262) 212-0153 Fax #: ()
 P.O. #: _____ Proj. #: _____
 Client Contact: Marcia Karcher
 Project ID / Location: St. Anne's Center Milwaukee Hill

- Sample Type:**
 1. Waste Water 4. Sludge 7. Groundwater (filtered)
 2. Drinking Water 5. Oil 8. Other
 3. Soil 6. Groundwater

- Container Type:**
 P - Plastic V - VOC Vial O - Other
 G - Glass B - Tedlar Bag

- Preservative:**
 1. None 4. NaOH 7. Zn Ace
 2. H2SO4 5. HCl 8. Other
 3. HNO3 6. MeOH

Sampling

Sample I.D.	Sample Type	Container			Preservation						
		Size	Type	No.	By	Date	Time	pH	Temp.	Field	Lab
MW-2 MW-2	G	1L	G	1	MK	4/25	1305	6.44	13.92	1	X
MW-1 MW-1							1330	6.59	11.58		X
MW-3							1355	6.82	11.48		X
MW-4							1425	6.95	11.56		X
DUP-1											X

Analyses

EMT USE ONLY

EMT

WORKORDER # 17D0946

PAHS

Relinquished By: MK
 Date: 4-25-17
 Time: 15:45

Relinquished By: DJK
 Date: 4-26-17
 Time: 12:00

Relinquished By: DJK
 Date: 4-26-17
 Time: 13:45

Relinquished By: DJK
 Date: 4-26-17
 Time: 13:45

Relinquished By: DJK
 Date: 4-26-17
 Time: 13:45

Relinquished By: DJK
 Date: 4-26-17
 Time: 13:45

EMT USE ONLY
 WORKORDER # 17D0946

EMT USE ONLY
 TRC Environmental
 Client Code: Cor pond
 EMT Project I.D. St Anne's
 Jar Lot No. _____

EMT USE ONLY
 Date: 4-26-17
 Time: 8:55

EMT USE ONLY
 Date: 4-26-17
 Time: 12:00

EMT USE ONLY
 Date: 4-26-17
 Time: 13:45

EMT USE ONLY
 Date: 4-26-17
 Time: 13:45

SAMPLE RECEIVED ON ICE
 SAMPLE RECEIVED ON ICE
 TEMPERATURE (Must be recorded if sampling was greater than 6 hrs, prior to sample receipt)
3.2
 EMT SAMPLE RETURN POLICY ON BACK

SPECIAL INSTRUCTIONS:

EMT FORM-GEN-028

Page 15 of 15

Page 15 of 15

Page 15 of 15

TRC Environmental Corporation
150 N. Patrick Blvd, Suite 180
Brookfield, WI 53045-5854
Main 262.879.1212 Fax 262.879.1220

Memorandum

Date: June 15, 2017
To: Marita Stollenwerk – TRC
From: Karen M. Vetrano, Ph.D. - TRC
Subject: RBCL Calculations for St. Ann Center Fruit and Nut Orchard, Milwaukee, WI
Project No.: 259002.0002

A risk evaluation and subsequent calculation of risk-based clean-up levels (RBCLs) was performed for the St. Ann Center Brownfield Site located in Milwaukee, WI. The site soils contain lead, with concentrations up to 220 mg/kg; and Polycyclic Aromatic Hydrocarbons (PAHs) with concentrations exceeding non-industrial direct contact standards (WI DNR NR 720) (http://docs.legis.wisconsin.gov/code/admin_code/nr/700/720.pdf). One area of the property will be utilized for an orchard, with a variety of trees such as apple, pear, cherry, plum and nut trees. Risk calculations were performed to determine a baseline risk level for the ingestion of fruit and nuts grown in the orchard area should no soil remediation occur in the planting area. The risk assessment was performed in accordance with USEPA 2005a: *Human Health Risk Assessment Protocol (HHRAP) for Hazardous Waste Combustion Facilities*, which provided the algorithms to calculate plant uptake of the constituents of potential concern (COPCs), USEPA 1989: *Risk Assessment Guidance for Superfund (RAGS), Volume 1: Human Health Evaluation Manual (Part A)* and USEPA 2014: *Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors* (OSWER Directive 9200.1-120). The maximum detected soil concentration was used for the risk evaluation. For those COPCs that exceeded the target risk level (1E-06 for carcinogens and Hazard Quotient of 1 for non-carcinogens), a risk-based clean-up level (RBCL) was calculated based upon USEPA 1991: *Risk Assessment Guidance for Superfund (RAGS), Volume 1: Human Health Evaluation Manual, Part B, Development of Risk-based Preliminary Remediation Goals*.

Risk Evaluation

The estimation of exposure concentration and dose potentially received by receptors eating fruit and nuts grown in the orchard area followed procedures outlined in USEPA's 2005 HHRAP Guidance (USEPA 2005a). The tables with the equations and parameters that were used to quantify exposure and risk are provided in Appendix A and are discussed below.

Aboveground produce is typically assumed to be contaminated by three possible mechanisms (USEPA 2005):

- Wet and dry deposition of particle phase COPCs in the air adhere to the leaves and fruits of plants;
- Uptake of vapor phase COPCs by plants through their foliage; and
- Root uptake of COPCs available from the soil and their transfer to the aboveground, edible portions of the plant.

For the St. Ann Center site, the concern is root uptake of the COPCs into the fruit and nuts of the trees proposed to be planted in the walking path orchard area. Potential concentrations in plant tissue due to root uptake in exposed and protected aboveground produce are estimated by:

$$PR = Cs \times Br$$

Where:

PR = concentration of constituent in aboveground produce due to root uptake
(mg COPC/kg DW fruit)

Cs = Soil Concentration (mg COPC/kg soil) (maximum detected concentration)

Br = plant-soil bioconcentration factor for aboveground produce due to root uptake (unitless,
mg COPC/kg DW fruit/mg COPC/kg soil)

The plant-soil bioconcentration factor (Br) for aboveground produce accounts for the uptake from soil and the subsequent transfer of contaminants through the roots to the aboveground plant parts. The Br value for organic compounds is a function of water solubility, which is inversely proportional to the octanol-water partition coefficient (Kow). Due to the lack of literature data for plant specific Br factors, the generic default factors provided by the HHRAP Companion Database (USEPA 2005b) was used for the COPCs. The Br factors ranged from 0.0057 for benzo(g,h,i)perylene (i.e. 0.57% of soil COPCs will be transferred to the aboveground plant) to 0.479 for naphthalene (i.e. 47.9% of COPC concentration will be transferred to the aboveground plant). As a conservative estimate of risk, the maximum detected concentrations in soil were evaluated.

Daily COPC intake was calculated by (USEPA 2005):

$$I_{ag} = Pr \times CR_{ag}$$

Where:

I_{ag} = Daily Intake of Contaminant from Fruits/Nuts grown at St. Ann Center Site (mg/kg-d)

PR = concentration of constituent in aboveground produce due to root uptake (mg/kg)

CR_{ag} = Consumption Rate of Fruit (kg/kg-d DW, 3.11E-04 adult; 6.65E-04 child)

A conservative assumption of fruit intake was used to calculate a site-specific fruit consumption rate. It was assumed that an adult would consume 5 oz. of fresh fruit grown from the St. Ann Center Orchard every day for 180 days. This is based on the average size of an apple and the availability of fresh fruit from the trees through the harvest seasons and extending approximately 3 months afterwards. A child (up to 6 years old) would consume 2.5 oz. of fruit every day for 180 days, and is based upon consumption of ½ of an apple.

The COPCs included in the baseline risk assessment exhibit a combination of potential carcinogenic and/or non-carcinogenic effects. In the case of human health effects associated with exposure to potential carcinogens, estimates of cancer risk are expressed as the lifetime probability of additional cancer risk associated with the given exposure. Potential cancer risks were evaluated using oral cancer slope factors (SFo) expressed in terms of risk per unit exposure dose for oral exposures (i.e., risk per mg/kg-d or (mg/kg-d)⁻¹). The oral cancer risks are calculated as:

$$CR_o = \frac{I_{ag} \times ED \times EF \times SF_o}{AT \times UC}$$

Where:

CR_o = Cancer Risk, oral route

I_{ag} = Daily Intake of COPC from Produce (mg/kg-d), calculated

ED = Exposure Duration (20 yr adult; 6 yr child) (USEPA 2014)

EF = Exposure Frequency (180 day/yr) (Best Professional Judgment)

SFo = Ingestion Cancer Slope Factor (mg/kg-d⁻¹) (USEPA 2017)

AT = Averaging Time (cancer, 70 yr) (USEPA 2014)

UC = Units Conversion (365 days/yr)

In numerical terms, the excess lifetime cancer risks are presented in scientific notation in this report. Thus, an estimated excess lifetime cancer risk of 1E-04 means an incremental lifetime cancer risk of one in ten thousand; an estimated cancer risk of 1E-06 means an incremental lifetime cancer risk of one in one million and so on.

For determining whether noncancer health effects may be a concern, the hazard quotient (HQ) is used. Non-carcinogenic effects from exposures were evaluated using oral reference doses (RfDs) expressed in units of mg/kg-d. Reference doses have been determined by USEPA and other State or Health Agencies to be a dose to which the most sensitive individual can be exposed without a risk for non-cancer health effects. The HQ for oral exposures is calculated as:

$$HQ_o = \frac{I_{ag} \times ED \times EF}{RfDo \times AT \times UC}$$

Where:

HQ_o = Hazard Quotient, oral route

I_{ag} = Daily Intake of COPC from Produce (mg/kg-d), calculated

ED = Exposure Duration (20 yr adult; 6 yr child) (USEPA 2014)

EF = Exposure Frequency (180 day/yr) (Best Professional Judgement)

RfDo = Ingestion Reference Dose (mg/kg-d) (USEPA 2016)

AT = Averaging Time (non-cancer, 20 yr adult, 6 year child) (USEPA 2014)

UC = Units Conversion (365 days/yr)

The HQs are summed across chemicals to calculate a hazard index (HI) per receptor in each scenario. The HQs (and HIs) represent a ratio, where an HQ of 0.25 means, for example, that the estimated exposure dose is one-quarter the RfD.

The SFO and RfD for the COPCs were obtained from USEPA's most current Regional Screening Level Tables (May 2016) found at: <https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2016>. The SFO and RfD for Benzo(a)pyrene was obtained from EPA's Integrated Risk Information System (IRIS) (https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?&substance_nmbr=136) as it was just updated in January 2017 and the RSL tables have not yet been updated at the time of this

evaluation. The S_{Fo} values for the rest of the carcinogenic PAHs were calculated using EPA's relative potency factors (USEPA 1993).

The estimated cancer risks are compared to a 1E-06 (one in one million) target risk level while a HI equal to or less than one is considered acceptable.

Since there are no toxicity criteria for environmental lead exposure, child lead exposures were evaluated by comparing soil concentrations against USEPA's residential soil lead target level of 400 mg/kg as recommended in the HHRAP (USEPA 2005).

Results of Baseline Risk Assessment

Consumers of fruit and nuts grown at the St. Ann Center Brownfield Site may potentially be exposed to site contaminants when eating the site-grown fruit and nuts. The risk tables are provided in Appendix A and show that the total cancer risk to the adult and child receptor are 1E-05 and 9E-07, respectively. The adult cancer risk exceeds the 1E-06 target cancer risk level. For the adult receptor, Benzo(a)pyrene was the only COPC that exceeded the 1E-06 target cancer risk level, however, Benzo(a)anthracene, Benzo(b)fluoranthene and Dibenz(a,h)anthracene all contributed to the total risk exceedance, although their individual risk levels did not exceed the 1E-06 target. The total HIs for non-cancer COPCs were well below the target of 1 for both the adult and child receptors.

In the case of lead, the maximum detected soil concentration is 220 mg/kg, which is less than the 400 mg/kg residential soil standard. Therefore, soil lead concentrations are below a level of concern.

Calculation of Risk-Based Clean-Up Levels

RBCLs were calculated for those carcinogenic PAHs which contributed to the exceedance of the 1E-06 target cancer risk level. The RBCLs were calculated in accordance with RAGS Part B (USEPA 1991):

$$RBCL = \frac{\left(\frac{TR \times AT \times UC}{Br \times CRag \times ED \times EF \times S_{Fo}} \right)}{N}$$

Where:

TR = Target Risk, 1E-06

AT = Averaging Time, 70 years (USEPA 2014)

UC = Units Conversion, 365 days/year

Br = plant-soil bioconcentration factor for aboveground produce due to root uptake, chemical specific

Crag = Consumption Rate of Fruit, 0.000285 kg/kg-d DW (based on assumption of 5 oz. eaten per day)

ED = Exposure Duration (Adult), 20 years (USEPA 2014)

EF = Exposure Frequency, 180 days (Best Professional Judgement)

SFo = Cancer Slope Factor, chemical specific

N = Number of COPCs contributing to the 1E-06 exceedance, 4

The calculation of the RBCLs based upon the adult consumption rate and exposure duration is protective of the child receptor. The calculated RBCLs were divided by a factor of 4 so that the total cancer risk would not exceed the target risk level of 1E-06. Appendix B provides the calculation of the RBCLs and the calculated risk levels using the RBCLs as the soil concentrations for the carcinogenic PAHs. The RBCLs are summarized in the table below.

Constituent	RBCL (ug/kg) ¹
Benzo(a)anthracene	3160
Benzo(a)pyrene	472
Benzo(b)fluoranthene	5500
Dibenz(a,h)anthracene	920

¹ RBCLs rounded up without exceeding total cancer risk of 1E-06

References:

U.S. Environmental Protection Agency (USEPA). 1989. Risk Assessment Guidance for Superfund. Volume 1. Human Health Evaluation Manual (Part A). Interim Final. EPA/540/1-89/002. December.

U.S. Environmental Protection Agency (USEPA). 1991. Risk Assessment Guidance for Superfund. Volume 1. Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals). Interim Final. Publication 9285.7-01B. December

U.S. Environmental Protection Agency (USEPA). 1993. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. EPA/600/R-93-089. July.

Technical Memorandum

June 15, 2017

Page 7 of 7

U.S. Environmental Protection Agency (USEPA). 2005a. Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Final. EPA530-D-05-006. September.

U.S. Environmental Protection Agency (USEPA). 2005b. Companion Database to the Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Final. EPA530-D-05-006. (<http://www.epa.gov/epaoswer/hazwaste/combust/riskvol.htm#volume2>).

U.S. Environmental Protection Agency (USEPA). Exposure Factors Handbook: 2011 Edition. EPA/600/R-09/052F. September.

U.S. Environmental Protection Agency (USEPA). 2014. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors. OSWER Directive 9200.0-120

U.S. Environmental Protection Agency (USEPA). 2016. Regional Screening Level (RSL) Table. Master. May. Downloadable at: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/whatsnew.htm

U.S. Environmental Protection Agency (USEPA). 2017. Screening Tools for Chemical Contaminants. RSL Calculator. January. Found on-line at: https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search

[Wisconsin Department of Natural Resources \(WDNR\). 2017. Chapter NR 720 – Soil Cleanup Standards. Register November 2013. Found on-line at: http://docs.legis.wisconsin.gov/code/admin_code/nr/700/720.pdf](http://docs.legis.wisconsin.gov/code/admin_code/nr/700/720.pdf)

APPENDIX A

BASELINE RISK ASSESSMENT

Appendix A-1a
 Calculation of Chemical Intakes - Adult and Child
 St. Ann Center for Intergenerational Care, Milwaukee, WI

Parameter	Contaminant	Cs mg/kg	Br (--)	Pr mg/kg	Iag Adult	Iag Child
PAHs						
Pr = Cs * Br	Acenaphthene	2.9E+00	2.16E-01	6.2E-01	1.8E-04	4.7E-05
Iag = Pr * CRag	Acenaphthylene	1.1E-01	1.72E-01	1.9E-02	5.4E-06	1.4E-06
Where: CS* = Values Specific to Contaminant: COPC = Constituent of Potential Concern Pr = Aboveground Produce Concentration Due to Root Uptake (mg COPC/kg DW) : CS* Cs = Soil Concentration (mg COPC/kg soil) : CS* Br = Plant Soil Bioconcentration Factor For Produce Due to Root Uptake (unitless, dry weight basis): CS* Iag = Daily Intake of Contaminant from Produce (mg/kg-d): CS* CRaga = Adult Consumption Rate of Fruit (kg/kg-d DW): 2.85E-04 CRagc = Child Consumption Rate of Fruit (kg/kg-d DW): 7.59E-05 CRag DW (dry weight) = CRag WW (wet weight) x ((100 - % moisture content)/100) CRaga = Adult Consumption Rate of Fruit ¹ (kg/kg-d WW): 0.001771 CRagc = Child Consumption Rate of Fruit ¹ (kg/kg-d WW): 0.0043 Moisture content ² : 83.93%	Anthracene	8.5E+00	9.71E-02	8.3E-01	2.3E-04	6.3E-05
	Benzo(a)anthracene	1.6E+01	1.97E-02	3.2E-01	9.2E-05	2.5E-05
	Benzo(a)pyrene	1.6E+01	1.32E-02	2.1E-01	5.9E-05	1.6E-05
	Benzo(b)fluoranthene	2.3E+01	1.12E-02	2.6E-01	7.3E-05	1.9E-05
	Benzo(k)fluoranthene	8.8E+00	1.15E-02	1.0E-01	2.9E-05	7.7E-06
	Benzo(ghi)perylene	1.0E+01	5.70E-03	5.7E-02	1.6E-05	4.3E-06
	Chrysene	1.4E+01	1.97E-02	2.7E-01	7.6E-05	2.0E-05
	Dibenzo(a,h)anthracene	2.3E+00	6.78E-03	1.6E-02	4.5E-06	1.2E-06
	Fluoranthene	3.2E+01	4.99E-02	1.6E+00	4.5E-04	1.2E-04
	Fluorene	3.8E+00	1.45E-01	5.5E-01	1.6E-04	4.2E-05
	Indeno(1,2,3-cd)pyrene	9.0E+00	5.93E-03	5.3E-02	1.5E-05	4.0E-06
	1-Methylnaphthalene	7.1E-01	2.24E-01	1.6E-01	4.5E-05	1.2E-05
	2-Methylnaphthalene	7.3E-02	2.27E-01	1.7E-02	4.7E-06	1.3E-06
	Naphthalene	9.5E-01	4.79E-01	4.6E-01	1.3E-04	3.5E-05
	Phenanthrene	2.9E+01	9.70E-02	2.8E+00	8.1E-04	2.1E-04
	Pyrene	2.8E+01	5.70E-02	1.6E+00	4.5E-04	1.2E-04

¹Based upon ingestion of 5 oz of fruit per day; 80 kg adult body weight and 15 kg child body weight

²USEPA 2011, Exposure Factors Handbook, Table 9-27

Appendix A-1b
 Summary of Cancer Risks and Hazard Indices - Maximum Soil Concentrations
 Adult and Child - Ingestion of Fruit/Nuts
 St. Ann Center for Intergenerational Care, Milwaukee, WI

Parameter	Contaminant	RfDo mg/kg-d	SFo (mg/kg-d) ⁻¹	HQo Adult	CRo Adult	HQo Child	CRo Child
PAHs							
CRo = Itot * ED * EF * SFo/AT * UC	Acenaphthene	6.0E-02	NA	1.5E-03	NA	3.9E-04	NA
HQo = Itot * ED * EF/ RfDo * AT * UC	Acenaphthylene	NA	NA	NA	NA	NA	NA
Where:	Anthracene	3.0E-01	NA	3.9E-04	NA	1.0E-04	NA
CS* = Values Specific to Contaminant:	Benzo(a)anthracene	NA	1.0E-01	NA	1E-06	NA	1E-07
CRo = Cancer Risk oral (--): CS*	Benzo(a)pyrene	3.0E-04	1.0E+00	9.6E-02	8E-06	2.6E-02	7E-07
HQo = Ingestion Hazard Index (--): CS*	Benzo(b)fluoranthene	NA	1.0E-01	NA	1E-06	NA	8E-08
Itot = Total Daily Intake of Contaminant (mg/d): CS*	Benzo(k)fluoranthene	NA	1.0E-02	NA	4E-08	NA	3E-09
SFo = Ingestion Slope Factor ((mg/kg-d)-1): CS*	Benzo(ghi)perylene	NA	NA	NA	NA	NA	NA
RfDo = Ingestion Reference Dose (mg/kg-d): CS*	Chrysene	NA	1.0E-03	NA	1E-08	NA	9E-10
ED = Exposure Duration (see below) (yr):	Dibenzo(a,h)anthracene	NA	1.0E+00	NA	6E-07	NA	5E-08
adult: 20	Fluoranthene	4.0E-02	NA	5.6E-03	NA	1.5E-03	NA
child: 6	Fluorene	4.0E-02	NA	1.9E-03	NA	5.2E-04	NA
EF = Exposure Frequency (day/yr): 180	Indeno(1,2,3-cd)pyrene	NA	1.0E-01	NA	2E-07	NA	2E-08
	1-Methylnaphthalene	7.0E-02	2.9E-02	3.2E-04	2E-07	8.5E-05	1E-08
AT = Averaging Time (yr): See Below	2-Methylnaphthalene	4.0E-03	NA	5.8E-04	NA	1.6E-04	NA
Cancer: 70	Naphthalene	2.0E-02	NA	3.2E-03	NA	8.5E-04	NA
Noncancer: See Below	Phenanthrene	NA	NA	NA	NA	NA	NA
adult: 20	Pyrene	3.0E-02	NA	7.4E-03	NA	2.0E-03	NA
child: 6							
UC = Units Conversion (day/yr): 365							

Bold = Exceeds Cancer Target Risk of 1E-06

	Adult	Adult	Child	Child
	HQ	Cancer Risk	HQ	Cancer Risk
Totals	1E-01	1E-05	3E-02	9E-07

APPENDIX B

CALCULATION OF RBCLS

AND RISK EVALUATION

Appendix B-1
 Calculation of Risk-Based Cleanup Levels
 St. Ann Center for Intergenerational Care, Milwaukee, WI

	Brag	SFo	RBCL mg/kg	RBCL ug/kg
Benzo(a)anthracene	1.97E-02	1.0E-01	3.16E+00	3.16E+03
Benzo(a)pyrene	1.32E-02	1.0E+00	4.72E-01	4.72E+02
Benzo(b)fluoranthene	1.12E-02	1.0E-01	5.50E+00	5.50E+03
Dibenzo(a,h)anthracene	6.78E-03	1.00E+00	9.20E-01	9.20E+02

Where:

$$RBC = \frac{TR \times AT \times UC}{Brag \times CRag \times ED \times EF \times SFo} / N$$

And:

RBC = Risk Based Clean-Up Value: Calculated
 CS = Chemical Specific: CS*
 TR = Target Risk (unitless): 1.00E-06
 AT = Averaging Time (yr): 70
 UC = Units Conversion (d/yr): 365
 Brag = Plant Soil Bioconcentration Factor for Produce due to Root Uptake (--): CS*
 CRag = Adult Consumption Rate of Apples (kg/kg-d DW)¹: 2.85E-04
 ED = Exposure Duration (Adult) (yr): 20
 EF = Exposure Frequency (day/yr): 180
 N: 4

¹Based on assumption of 5 oz of fruit eaten per day, 83.93% moisture content of apples

Brag values from USEPA 2005

SFo from USEPA on-line RSL Calculator (June 2017)

Appendix B-2a
 Calculation of Chemical Intakes - Adult and Child
 St. Ann Center for Intergenerational Care, Milwaukee, WI

Parameter	Contaminant	Cs mg/kg	Br (--)	Pr mg/kg	I _{ag} Adult	I _{ag} Child
PAHs						
Pr = Cs * Br	Acenaphthene	2.9E+00	2.16E-01	6.2E-01	1.8E-04	4.7E-05
I _{ag} = Pr * Crag	Acenaphthylene	1.1E-01	1.72E-01	1.9E-02	5.4E-06	1.4E-06
Where: CS* = Values Specific to Contaminant: COPC = Constituent of Potential Concern Pr = Aboveground Produce Concentration Due to Root Uptake (mg COPC/kg DW) : Cs = Soil Concentration (mg COPC/kg soil) : Br = Plant Soil Bioconcentration Factor For Produce Due to Root Uptake (unitless, dry weight basis): I _{ag} = Daily Intake of Contaminant from Produce (mg/kg-d): CR _{aga} = Adult Consumption Rate of Apples (kg/kg-d DW): CR _{agc} = Child Consumption Rate of Apples (kg/kg-d DW): CR _{ag} DW (dry weight) = CR _{ag} WW (wet weight) x ((100 - % moisture content)/100) CR _{aga} = Adult Consumption Rate of Fruit ¹ (kg/kg-d WW): CR _{agc} = Child Consumption Rate of Fruit ¹ (kg/kg-d WW): Moisture content ² :	Anthracene	8.5E+00	9.71E-02	8.3E-01	2.3E-04	6.3E-05
	Benzo(a)anthracene	3.2E+00	1.97E-02	6.2E-02	1.8E-05	4.7E-06
	Benzo(a)pyrene	4.7E-01	1.32E-02	6.2E-03	1.8E-06	4.7E-07
	Benzo(b)fluoranthene	5.5E+00	1.12E-02	6.2E-02	1.8E-05	4.7E-06
	Benzo(k)fluoranthene	8.8E+00	1.15E-02	1.0E-01	2.9E-05	7.7E-06
	Benzo(ghi)perylene	1.0E+01	5.70E-03	5.7E-02	1.6E-05	4.3E-06
	Chrysene	1.4E+01	1.97E-02	2.7E-01	7.6E-05	2.0E-05
	Dibenzo(a,h)anthracene	9.2E-01	6.78E-03	6.2E-03	1.8E-06	4.7E-07
	Fluoranthene	3.2E+01	4.99E-02	1.6E+00	4.5E-04	1.2E-04
	Fluorene	3.8E+00	1.45E-01	5.5E-01	1.6E-04	4.2E-05
	Indeno(1,2,3-cd)pyrene	9.0E+00	5.93E-03	5.3E-02	1.5E-05	4.0E-06
	1-Methylnaphthalene	7.1E-01	2.24E-01	1.6E-01	4.5E-05	1.2E-05
	2-Methylnaphthalene	7.3E-02	2.27E-01	1.7E-02	4.7E-06	1.3E-06
	Naphthalene	9.5E-01	4.79E-01	4.6E-01	1.3E-04	3.5E-05
	Phenanthrene	2.9E+01	9.70E-02	2.8E+00	8.1E-04	2.1E-04
	Pyrene	2.8E+01	5.70E-02	1.6E+00	4.5E-04	1.2E-04

¹Based upon ingestion of 5 oz of fruit/nuts per day; 80 kg adult body weight and 15 kg child body weight

²Moisture content of apples, USEPA 2011, Exposure Factors Handbook, Table 9-27

Appendix B-2b
 Summary of Cancer Risks and Hazard Indices - RBCL Soil Concentrations
 Adult and Child - Ingestion of Fruit/Nuts
 St. Ann Center for Intergenerational Care, Milwaukee, WI

Parameter	Contaminant	RfDo mg/kg-d	SFo (mg/kg-d) ⁻¹	HQo Adult	CRo Adult	HQo Child	CRo Child
PAHs							
CRo = Iag * ED * EF * SFo/AT * UC	Acenaphthene	6.0E-02	NA	1.5E-03	NA	3.9E-04	NA
HQo = Iag * ED * EF/ RfDo * AT * UC	Acenaphthylene	NA	NA	NA	NA	NA	NA
Where:	Anthracene	3.0E-01	NA	3.9E-04	NA	1.0E-04	NA
CS* = Values Specific to Contaminant:	Benzo(a)anthracene	NA	1.0E-01	NA	2E-07	NA	2E-08
CRo = Cancer Risk oral (--): CS*	Benzo(a)pyrene	3.0E-04	1.0E+00	2.9E-03	2E-07	7.8E-04	2E-08
HQo = Ingestion Hazard Index (--): CS*	Benzo(b)fluoranthene	NA	1.0E-01	NA	2E-07	NA	2E-08
Iag = Daily Intake of Contaminant from Fruit/Nuts (mg/d): CS*	Benzo(k)fluoranthene	NA	1.0E-02	NA	4E-08	NA	3E-09
SFo = Ingestion Slope Factor ((mg/kg-d)-1): CS*	Benzo(ghi)perylene	NA	NA	NA	NA	NA	NA
RfDo = Ingestion Reference Dose (mg/kg-d): CS*	Chrysene	NA	1.0E-03	NA	1E-08	NA	9E-10
ED = Exposure Duration (see below) (yr):	Dibenzo(a,h)anthracene	NA	1.0E+00	NA	3E-07	NA	2E-08
adult: 20	Fluoranthene	4.0E-02	NA	5.6E-03	NA	1.5E-03	NA
child: 6	Fluorene	4.0E-02	NA	1.9E-03	NA	5.2E-04	NA
EF = Exposure Frequency (day/yr): 180	Indeno(1,2,3-cd)pyrene	NA	1.0E-01	NA	2E-07	NA	2E-08
	1-Methylnaphthalene	7.0E-02	2.9E-02	3.2E-04	2E-07	8.5E-05	1E-08
AT = Averaging Time (yr): See Below	2-Methylnaphthalene	4.0E-03	NA	5.8E-04	NA	1.6E-04	NA
Cancer: 70	Naphthalene	2.0E-02	NA	3.2E-03	NA	8.5E-04	NA
Noncancer: See Below	Phenanthrene	NA	NA	NA	NA	NA	NA
adult: 20	Pyrene	3.0E-02	NA	7.4E-03	NA	2.0E-03	NA
child: 6							
UC = Units Conversion (day/yr): 365							

	Adult	Adult	Child	Child
	HQ	Cancer Risk	HQ	Cancer Risk
Totals	2E-02	1E-06	6E-03	1E-07