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The Vermont Department of Health (Health) develops and maintains two sets of chemical-specific soil guidance values, Residential Soil Values (RSVs) and Commercial Soil Values (CSVs), which may be used in the evaluation of potential exposure to chemicals in soil. RSVs are appropriate for consideration in the assessment of potential residential exposure to chemicals in soil. CSVs are appropriate for consideration in the assessment of potential exposure to chemicals in soil under a hypothetical nonresidential (e.g., commercial worker) exposure scenario.

The list of chemicals examined and associated values presented in Attachments 1a and 1b supplants any earlier guidance. Additional chemicals may be considered for evaluation and potential inclusion based on request by other State of Vermont offices, in response to public comments or as deemed appropriate by Health.

A detailed summary of toxicity values employed, exposure route and endpoint-specific risk-based concentrations and any chemical-specific notes of interest is presented in Attachment 2a for RSVs and Attachment 2b for CSVs.

Each value is based upon the best available information at the time of derivation; therefore, is subject to change as updated information and risk assessment methodologies become available.

This memo provides an overview of the general approach used to develop the RSVs and CSVs and how these values are recommended to be applied.

RSV and CSV DERIVATION PROCESS AND APPLICATION

In general, RSVs are risk-based values generated by combining current toxicity values (*e.g.*, oral reference doses, inhalation reference concentrations, oral cancer slope factors and inhalation unit risks) with a hypothetical residential exposure scenario using standard point estimate risk assessment procedures to derive an estimate of the concentration of each individual chemical (or in a few specific instances, a group of chemicals) in soil that corresponds to a fixed level of risk i.e., a target Hazard Quotient (THQ) of 1.0 for noncarcinogenic (systemic, threshold) effects or incremental lifetime cancer risk (ILCR) of one-in-one-million ($1x10^{-6}$).

CSVs are similarly derived using a hypothetical nonresidential exposure scenario (i.e., commercial worker).

For each scenario, where a chemical is known to have both carcinogenic and noncarcinogenic effects and toxicity values are available, a risk-based value is derived based on each endpoint with the most

conservative reported as the soil guidance value for that chemical under that specific scenario. Thus, the most conservative value derived for each chemical based on the residential scenario is reported as the RSV for that chemical. Likewise, the most conservative value derived for each chemical based on the nonresidential scenario is reported as the CSV for that chemical.

If more than one chemical is reported in excess of its analytical laboratory reporting limit, cumulative (total) cancer risk and noncancer hazard should be evaluated.

For carcinogens, it is recommended that a medium-specific cumulative (total) ILCR be estimated for each receptor, i.e., a Residential Soil or Nonresidential (Commercial) Soil cumulative ILCR, and compared to a target cumulative ILCR of $1x10^{-6}$ (one-in-one-million). This can be accomplished using the following approach where *i* represents the i^{th} such chemical reported in soil and, as described above, the target ICLR associated with each cancer risk-based value is $1x10^{-6}$:

$$MediumCumulativeILCR_{(\mathrm{Re}\,sident\,or\,Nonresident)} = \sum_{i=1}^{n}(SiteConcentration_i)(1x10^{-6})/(\mathrm{Re}\,sidentialorNonresidentialSL_i) \cdot$$

A medium-specific cumulative ILCR in excess of $1x10^{-6}$ for a receptor suggests further consideration is warranted.

Similarly, for noncarcinogenic effects, it is recommended that a medium-specific total HQ, termed a Hazard Index (HI is the sum of two or more HQs), be estimated for each receptor (Residential and Nonresidential i.e., Commercial) and compared to a target Total HI=1.0. HQ are summed across all chemicals to develop the HI; chemicals are not segregated by critical effect. This can be accomplished using the following approach where *i* represents the i^{th} such chemical reported in soil and, as described above, the target HQ associated with each noncancer risk-based value is 1:

$$MediumTotalHazardIndex_{(\mathrm{Re}\,sident\,or\,Nonresident)} = \sum_{i=1}^{n}(SiteConcentration_i)(1)\,/\,(\mathrm{Re}\,sidentialorNonresidentialSL_i)$$

A medium-specific total HI in excess of 1 for a receptor suggests further consideration is warranted.

Direct exposure via incidental ingestion, dermal contact, inhalation of particles emitted from soil (i.e., fugitive dust) and, in the case of volatile compounds, inhalation due to volatilization from soil to ambient air were considered in the development of the values.

For purpose of this effort, chemicals with a Henry's Law constant greater than $1x10^{-5}$ atmosphere-cubic meter/mole (atm-m^3/mol) or a vapor pressure greater than 1 millimeter of mercury (mm Hg) at 25°C were deemed sufficiently volatile to warrant consideration of this route of exposure. These chemicals are flagged "v" in Attachments 2a and 2b. As recommended by the Vermont Department of Environmental Conservation, for this subset, chemical–specific volatilization factors based on a groundwater temperature of 15°C were developed using the Regional Screening Levels (RSL) on-line calculator (accessed various times 9/10/18 through 2/4/2019). The RSL calculator was also used to generate chemical-specific soil saturation concentrations (Csat) for members of this group that are not solid at ambient temperature. If the derived cancer or noncancer risk-based value for soil inhalation was greater than the corresponding Csat, the Csat was used in its place.

In addition, for "v" chemicals only, at the advice of the Vermont IRULE workgroup, a snow cover modification factor (SCMF) less than 1 was employed in the development of residential soil inhalation risk-based values (cancer and noncancer). An SCMF of 0.7342 was applied to generate a residential soil inhalation exposure frequency of 268 days. This reflects the estimated average number of days per year in Vermont with less than one inch of snow cover over the last decade (a ten year average of approximately 97

days with at least one inch of snow cover was provided for consideration in this effort). At present, risk-based values for the soil inhalation pathway are developed by considering exposure via inhalation as volatile and as fugitive dust in a single equation. At the advice of the IRULE workgroup, the SCMF was applied to the entire equation, not just the volatile component, given the level of uncertainty regarding dissipation over time of "v" chemicals from dust. Such application implies that exposure to any residual particulate emissions indoors does not contribute significantly to the inhalation route of exposure. An SCMF of 1 was used for other residential soil routes of exposure and for all routes of exposure for chemicals not meeting the "v" criteria.

Estimates of chemical-specific physical properties, such as Henry's Law constant, were primarily obtained from the Estimation Programs Interface (EPI) Suite™ which is a screening level tool developed by the U.S. Environmental Protection Agency (U.S. EPA) Office of Pollution Prevention and Toxics and Syracuse Research Corporation. In accordance with EPI Suite guidance, experimental (measured) values are used when both experimental and estimated values are available.

An oral relative bioavailability factor of 1 is employed in the development of soil guidance values (i.e., bioavailability is assumed to be similar between the medium of environmental exposure and that associated with the toxicity value).

Consistent with current guidance (EPA, 2004), dermal exposure is evaluated using oral toxicity values adjusted for gastrointestinal absorption efficiency, where warranted, and incorporation of a dermal absorption fraction from soil. For purposes of this effort, a default gastrointestinal absorption efficiency of 1 is used in the evaluation of chemicals not listed in Exhibit 4-1 of said guidance. Chemical-specific dermal absorption fractions provided in Exhibit 3-4 are employed including the recommended default value of 0.1 for those semivolatile organic compounds not called out by name in the list. In addition, Health employs a dermal absorption fraction of 0.01 for inorganics that are not listed in Exhibit 3-4 and a value of 0.03 in the evaluation of volatiles.

These evaluations do not take into account existing background concentrations of naturally occurring inorganics. In some cases, it is possible that the theoretical derived value may be below naturally occurring levels. In such instances, the theoretical derived value may not be applicable, as clean-up below background is usually not advisable.

Toxicity

Toxicity information and oral and inhalation toxicity values are obtained and reviewed from a number of relevant and appropriate sources including:

- U.S. EPA Integrated Risk Information System
- U.S. EPA Office of Pesticide Programs
- U.S. EPA Office of Research and Development/National Center for Environmental Assessment/Superfund Health Risk Technical Support Center (STSC) Provisional Peer Reviewed Toxicity Values
- International Agency for Research on Cancer
- National Toxicology Program
- California EPA Office of Environmental Health Hazard Assessment
- California Department of Pesticide Regulation
- Agency for Toxic Substances and Disease Registry

Mutagenic Mode of Action

Consistent with U.S. EPA guidance (EPA, 2005), multipliers termed Age Dependent Adjustment Factors (ADAFs) are used in the evaluation of carcinogens identified by U.S. EPA to operate via a mutagenic mode of action. Such chemicals are noted in the detailed Summary Table (Attachment 2a). Per the guidance, ADAFs "…reflect the potential for early-life exposure to make a greater contribution to the cancers appearing later in life."

Chemical-specific ADAFs are used if available.

Otherwise, the following non-chemical specific, default adjustments provided by U.S. EPA are used:

- A 10 fold increase for exposures between the day of birth up until the second birthday.
- A 3 fold increase for exposures between the second birthday up until the sixteenth birthday.
- No adjustment is made for exposures occurring after turning 16 years of age.

Toxicity Equivalence Factors and Relative Potency Factors

Some chemicals are members of the same family or group and have been shown to exhibit similar toxicological properties; however, each chemical may differ in the degree of toxicity (EPA, 2019). In some such instances, a toxicity equivalency factor (TEF) or relative potency factor (RPF) must be applied to convert the reported concentration of each member of the group to a toxicity equivalent concentration (TEQ) relative to the toxicity of the index chemical for the group. The index chemical is assigned a TEF of 1. Total TEQ for a sample can then be compared to the value for the index chemical.

Dioxins, Furans and dioxin-like Polychlorinated Biphenyls (PCBs)

The index chemical for this group is 2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (2,3,7,8-TCDD). As of this writing, Health recommends that the 2005 World Health Organization TEFs (Van den Berg et al., 2006) be employed in the evaluation of dioxins, furans and dioxin-like PCBs. These values are also presented in the May 2013 U.S. EPA fact sheet, "Use of Dioxin TEFs in Calculating Dioxin TEQs at CERCLA and RCRA Sites" which references the 2010 U.S. EPA report, "Recommended Toxicity Equivalency Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-*p*-dioxin and Dioxin-Like Compounds" (EPA, 2019). TEFs for Di-ortho PCBs may be obtained from Ahlborg, U.G. et al., 1994 (EPA, 2019). TEFs may be applied to the ingestion, dermal (see EPA, 2004) or inhalation routes of exposure and adjusted values may be used in the assessment of both cancer and noncarcinogenic effects (EPA, 2013). The sum of adjusted concentrations is often referred to as 2,3,7,8-TCDD TEQ.

Dioxin Toxicity Equivalence Factors (EPA, 2019)

CAS Registry Number	Compound	2,3,7,8-TCDD Toxicity Equivalence Factor
Chlorinated dibenzo-p-dioxins		
1746-01-6	2,3,7,8-TCDD	1
40321-76-4	1,2,3,7,8-PeCDD	1
39227-28-6	1,2,3,4,7,8-HxCDD	0.1
72918-21-9	1,2,3,6,7,8-HxCDD	0.1

57653-85-7	1,2,3,7,8,9-HxCDD	0.1
35822-46-9	1,2,3,4,6,7,8-HpCDD	0.01
3268-87-9	OCDD	0.0003
Chlorinated dibenzofurans		
51207-31-9	2,3,7,8-TCDF	0.1
57117-41-6	1,2,3,7,8-PeCDF	0.03
57117-31-4	2,3,4,7,8-PeCDF	0.3
70648-26-9	1,2,3,4,7,8-HxCDF	0.1
57117-44-9	1,2,3,6,7,8-HxCDF	0.1
72918-21-9	1,2,3,7,8,9-HxCDF	0.1
60851-34-5	2,3,4,6,7,8-HxCDF	0.1
35822-46-9	1,2,3,4,6,7,8-HpCDF	0.01
55673-89-7	1,2,3,4,7,8,9-HpCDF	0.01
39001-02-0	OCDF	0.0003

PCBs			
	IUPAC No.	**Structure**	
Non-*ortho*			
32598-13-3	77	3,3',4,4'-TetraCB	0.0001
70362-50-4	81	3,4,4',5-TetraCB	0.0003
57465-28-8	126	3,3',4,4',5-PeCB	0.1
32774-16-6	169	3,3',4,4',5,5'-HxCB	0.03
Mono-*ortho*			
32598-14-4	105	2,3,3',4,4'-PeCB	0.00003
74472-37-0	114	2,3,4,4',5-PeCB	0.00003
31508-00-6	118	2,3',4,4',5-PeCB	0.00003
65510-44-3	123	2',3,4,4',5-PeCB	0.00003
38380-08-4	156	2,3,3',4,4',5-HxCB	0.00003
69782-90-7	157	2,3,3',4,4',5'-HxCB	0.00003
52663-72-6	167	2,3',4,4',5,5'-HxCB	0.00003
39635-31-9	189	2,3,3',4,4',5,5'-HpCB	0.00003
Di-*ortho**			
35065-30-6	170	2,2',3,3',4,4',5-HpCB	0.0001

35065-29-3	180	2,2',3,4,4',5,5'-HpCB	0.00001

*Di-ortho values come from Ahlborg, U.g., et al (1994), which are the WHO 1994 values from Toxic equivalency factors for dioxin-like PCBs: Report on WHO-ECEH and IPCS consultation. December 1993. Chemosphere Volume 28, Issue 6. March 1994. Pages 1049-1067.

Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAH)

Benzo(a)pyrene is the index chemical for this group of compounds. As of this writing, Health recommends that the following RPFs (EPA, 1993) be employed in the evaluation of cPAH. Adjusted values are summed and expressed as Benz(a)pyrene toxic equivalents i.e., B(a)P-TE. B(a)P-TE is assessed for cancer risk only. Only B(a)P itself is assessed for potential noncarcinongenic effects.

Relative Potency Factors for Carcinogenic Polycyclic Aromatic Hydrocarbons

Compound	Benzo(a)pyrene Relative Potency Factor
Benzo(a)pyrene	**1**
Benzo(a)anthracene	**0.1**
Benzo(b)fluoranthene	**0.1**
Benzo(k)fluoranthene	**0.01**
Chrysene	**0.001**
Dibenzo(a,h)anthracene	**1**
Indeno(1,2,3cd)pyrene	**0.1**

Food Quality Protection Act Safety Factor

The Food Quality Protection Act (FQPA) of 1996 amended the Federal Insecticide, Fungicide and Rodenticide Act and the Federal Food, Drugs and Cosmetic Act and significantly revised the way in which pesticides are evaluated by the U.S. EPA.

The FQPA mandates that "in the case of threshold effects, an additional tenfold margin of safety for the pesticide chemical residue and other sources of exposure shall be applied for infants and children to take into account potential pre- and post-natal toxicity and completeness of data with respect to exposure and toxicity to infants and children. Notwithstanding such requirement for an additional margin of safety, the Administrator [of the U.S. EPA] may use a different margin of safety for the pesticide chemical residue only if, on the basis of reliable data, such margin will be safe for infants and children" (FQPA, 1996).

Risk-based values derived for pesticides based on threshold type effects may reflect incorporation of a U.S. EPA derived FQPA Safety Factor (SF). Use of any FQPA SF greater than 1 is noted in the detailed Summary Table (Attachment 2a).

Exposure

Several conservative assumptions are made in order to estimate the potential intake of a chemical in soil by a hypothetical receptor. In reality, the magnitude and frequency of exposure will vary depending on individual circumstances. The use of such health protective assumptions, which tend to represent reasonable upper bound estimates of exposure, adds additional conservatism to the risk-based soil values derived.

Overall, for the residential scenario a 70 year age-weighted approach (birth to age 70 years) is employed in the assessment of carcinogens while a hypothetical Young Child (birth to age 6 years) is the focus of assessment of noncarcinogenic (systemic, threshold) effects. Exposure is assumed to occur each day of the year.

The Commercial Worker scenario assumes a 30 year exposure duration as an adult. A duration weighted approach based on a lifetime of 70 years is employed in the assessment of carcinogens. The receptor is assumed to be on-site and exposed 250 days of the year for 10 hours per day.

A summary of exposure assumptions and factors employed in the development of the RSVs and CSVs is presented in Attachments 3a and 3b.

Equations

Endpoint and exposure route specific equations that may be used to develop residential and nonresidential risk-based values are presented in Attachments 4a and 4b. These equations combine chemical-specific toxicity information with scenario-specific exposure assumptions to generate a level in soil estimated to correspond to a fixed level of risk i.e., a THQ of 1.0 or ILCR of $1x10^{-6}$ for the receptor considered.

REFERENCES

EPA, 1993. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. U.S. Environmental Protection Agency. Research Triangle Park, N.C. EPA/600/R-93/089, July 1993.

EPA, 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. U.S. Environmental Protection Agency. Washington, D.C. OSWER 9285.7-02EP. July 2004.

EPA, 2005. Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens. U.S. Environmental Protection Agency. Washington, D.C. EPA/630/R-03/003F. March 2005.

EPA, 2008. Child-Specific Exposure Factor Handbook. U.S. Environmental Protection Agency. Office of Research and Development, National Center for Environmental Assessment. Washington, D.C. EPA/600/R-06/096F. September 2008.

EPA, 2019. United States Environmental Protection Agency. Regional Screening Levels for Chemical Contaminants at Superfund Sites. User's Guide. November 2018 edition. (accessed February 27, 2019).

FQPA, 1996. Food Quality Protection Act of August 3, 1996 as amended. United States Public Law 104-170.

Van den Berg et al., 2006. The 2005 World Health Organization re-evaluation of human and mammalian toxic equivalency factors for dioxins and dioxin-like compounds. Toxicol Sci 93(2):223-241.

ATTACHMENT 1a
VERMONT DEPARTMENT OF HEALTH
RESIDENTIAL SOIL VALUES (RSV) (mg/kg)
INCIDENTAL INGESTION, DERMAL CONTACT AND INHALATION

Chemical Name	CAS Number	RSV (mg/kg)	Endpoint
Acetochlor	34256-82-1	1.22E+03	nc
Acetone	67-64-1	4.06E+04	nc
Alachlor	15972-60-8	6.08E+01	nc
Aldrin	309-00-2	2.02E-02	c
Aluminum	7429-90-5	7.25E+04	nc
Antimony	7440-36-0	2.60E+01	nc
Arsenic, Inorganic	7440-38-2	2.32E-01	c
Barium	7440-39-3	1.12E+04	nc
Benomyl	17804-35-2	1.16E+02	c
Benzene	71-43-2	6.98E-01	c
Benzo(a)pyrene	50-32-8	7.28E-02	c-mmoa[(a)]
Beryllium	7440-41-7	3.45E+01	nc
Bis(2-chloro-1-methyl ethyl)ether	108-60-1	2.80E+03	nc
Boron	7440-42-8	1.47E+04	nc
Bromate	15541-45-4	5.36E-01	c
Bromochloromethane	74-97-5	1.93E+02	nc
Bromoxynil	1689-84-5	2.69E+00	c
Butylbenzene, n-	104-51-8	3.50E+03	nc
Butylbenzene, sec-	135-98-8	7.01E+03	nc
Butylbenzene, tert-	98-06-6	7.01E+03	nc
Cadmium (food)	7440-43-9	6.86E+00	nc
Carbaryl	63-25-2	3.17E+02	c
Carbon Disulfide	75-15-0	6.08E+02	nc
Carbon tetrachloride	56-23-5	3.72E-01	c
Chlorobenzene	108-90-7	4.14E+02	nc
Chromium (III) (insoluble salts)	16065-83-1	4.02E+04	nc
Chromium (VI)	18540-29-9	9.06E-02	c-mmoa
Cobalt	7440-48-4	2.19E+01	nc
Copper	7440-50-8	1.04E+04	nc
Di (2-ethylhexyl) phthalate	117-81-7	1.98E+01	c
Dibromochloropropane	96-12-8	6.00E-03	c-mmoa
Dibromoethane, 1,2-	106-93-4	2.27E-02	c
Dichloroethane, 1,1-	75-34-3	2.10E+00	c
Dichloroethane, 1,2-	107-06-2	2.85E-01	c
Dichloroethylene, cis 1,2-	156-59-2	1.40E+02	nc
Dichloroethylene, trans 1,2-	156-60-5	1.40E+03	nc
Dichloropropane, 1,2-	78-87-5	1.51E+00	c
Dioxane, 1,4-	123-91-1	2.78E+00	c
Ethylbenzene	100-41-4	3.68E+00	c
Fluoranthene	206-44-0	2.30E+03	nc
Fluorene	86-73-7	2.30E+03	nc
Hexachlorobenzene	118-74-1	1.31E-01	c
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	4.60E+00	c
Iron	7439-89-6	5.13E+04	nc
Isopropylbenzene (cumene)	98-82-8	2.56E+02	nc
Lead [(e)]	7439-92-1	4.10E+01	nc
Manganese (non-diet)	7439-96-5	1.12E+03	nc
Mercury (elemental)	7439-97-6	3.13E+00	nc
Methyl ethyl ketone	78-93-3	1.70E+04	nc
Methyl tert-butyl ether (MTBE)	1634-04-4	6.49E+02	nc
Molybdenum	7439-98-7	3.66E+02	nc
Naphthalene	91-20-3	2.72E+00	c
Nickel	7440-02-0	9.40E+02	nc
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	3.70E+03	nc
Pentachlorophenol	87-86-5	4.84E-01	c
Pentaerythritol tetranitrate (PETN)	78-11-5	1.22E+02	nc
Perchlorate	14797-73-0	5.13E+01	nc
Perfluoroheptanoic acid (PFHpA)	375-85-9	1.22E+00	nc[(b)]
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	1.22E+00	nc[(b)]
Perfluorononanoic acid (PFNA)	375-95-1	1.22E+00	nc[(b)]
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	1.22E+00	nc[(b)]
Perfluorooctanoic acid (PFOA)	335-67-1	1.22E+00	nc[(b)]
Polychlorinated biphenyls (PCBs)	1336-36-3	1.14E-01	c[(c)]
Propoxur (Baygon)	114-26-1	7.88E+01	c
Propyl benzene, n-	103-65-1	2.53E+02	nc
Selenium	7782-49-2	3.66E+02	nc
Silver	7440-22-4	2.37E+02	nc
Tetrachlorodibenzo-p-dioxin, 2,3,7,8- (TCDD)	1746-01-6	2.25E-06	c
Tetrachloroethane, 1,1,1,2-	630-20-6	1.32E+00	c
Tetrachloroethylene	127-18-4	2.38E+00	c
Thallium (soluble Thallium)	7440-28-0*	7.33E-01	nc

ATTACHMENT 1a
VERMONT DEPARTMENT OF HEALTH
RESDIENTIAL SOIL VALUES (RSV) (mg/kg)
INCIDENTAL INGESTION, DERMAL CONTACT AND INHALATION

Chemical Name	CAS Number	RSV (mg/kg)	Endpoint
Toluene	108-88-3	7.06E+02	nc
Trichloroethylene (non-moa / mmoa)	79-01-6	6.81E-01	c/c--mmoa
Trichloropropane, 1,2,3-	96-18-4	3.11E-03	c-mmoa
Trimethylbenzene, 1,2,3-	526-73-8	2.06E+02	nc
Trimethylbenzene, 1,2,4-	95-63-6	1.66E+02	nc
Trimethylbenzene, 1,3,5-	108-67-8	1.44E+02	nc(d)
Trinitrotoluene, 2,4,6- (TNT)	118-96-7	1.15E+01	c
Uranium (soluble salts)	NA	4.40E+01	nc
Vanadium	7440-62-2	2.77E+00	nc
Vinyl chloride	75-01-4	9.83E-02	c-mmoa
Xylenes	1330-20-7	2.52E+02	nc
Zinc	7440-66-6	2.20E+04	nc

Notes:
c - RSV corresponds to a one-in-one-million incremental lifetime cancer risk
c-mmoa - carcinogen identified by U.S. EPA to operate via mutagenic mode of action
nc - RSV corresponds to a noncarcinogenic Hazard Quotient as indicated (HQ=1.0) based on Hypothetical Young Child Resident scenario.
* - CAS Number is for Metallic Thallium
Groundwater temperature of 15°C used in derivation of volatiziation factors with May 2018 Regional Screening Level Calculator.
Csat substitution used if soil inhalation screening value greater than Csat. Csats derived using May 2018 Regional Screening Level Calculator.
All cancer-based soil inhalation values were less than respective Csat thus no substitutions.
Noncancer-based soil inhalation value above respective Csat thus Csat substitiouion employed for the following:
Acetone, Carbon Disulfide, Ethylbenzene, Isopropylbenzene (cumene), Mercury (elemental), Methyl ethyl ketone, Methyl tert-butyl ether, n-Propyl benzene, Tetrachloroethylene, Toluene, Trimethyl benzenes, Xylenes.
(a) Benzo(a)pyrene cancer-based value applicable to benzo(a)pyrene itself and to total benzo(a)pyrene toxic equivalents [B(a)P-TE]. Benzo(a)pyrene noncancer-based value applicable only to benzo(a)pyrene itself.
(b) PFAS - Sum of PFHpA, PFHxS, PFNA, PFOS and PFOA not to exceed 1.22 mg/kg.
(c) PCBs- sum of all PCBs not to exceed 1.14E-01 mg/kg (IRIS high risk and persistence cancer toxicity values used in cancer assessment; oral reference dose for Aroclor 1254 used in noncancer assessment).
(d) Trimethyl benzenes -Sum of the three isomers not to exceed 1.44E+02 mg/kg, based on the most conservative value derived for an individual isomer.
(e) Health used the current version of the IEUBK software to find the soil concentration that would result in 95% probability that no exposed child would exceed the Bll of < 3 ug/dL. Vermont DEC conducted a soil background study and determined the rural background level of lead is 41 mg/kg. Because the soil concentration that would result in a 95% probability that no exposed child would exceed the Bll < 3 ug/dL is less than the Vermont background level, the background level is recommended.

ATTACHMENT 1b
VERMONT DEPARTMENT OF HEALTH
2019 COMMERICAL WORKER SOIL VALUES (CSV) (mg/kg)
INCIDENTAL INGESTION, DERMAL CONTACT AND INHALATION

Chemical name	CAS Number	CSV (mg/kg)	Endpoint
Acetochlor	34256-82-1	1.44E+04	nc
Acetone	67-64-1	1.00E+05	nc
Alachlor	15972-60-8	7.18E+02	nc
Aldrin	309-00-2	9.76E-02	c
Aluminum	7429-90-5	9.42E+05	nc
Antimony	7440-36-0	3.19E+02	nc
Arsenic, Inorganic	7440-38-2	1.41E+00	c
Barium	7440-39-3	1.27E+05	nc
Benomyl	17804-35-2	7.01E+02	c
Benzene	71-43-2	4.19E+00	c
Benzo(a)pyrene[a]	50-32-8	1.54E+00	c
Beryllium	7440-41-7	2.89E+02	nc
Bis(2-chloro-1-methyl ethyl)ether	108-60-1	3.63E+04	nc
Boron	7440-42-8	1.96E+05	nc
Bromate	15541-45-4	3.27E+00	c
Bromochloromethane	74-97-5	5.97E+02	nc
Bromoxynil	1689-84-5	1.63E+01	c
Butylbenzene, n-	104-51-8	5.11E+04	nc
Butylbenzene, sec-	135-98-8	1.02E+05	nc
Butylbenzene, tert-	98-06-6	1.02E+05	nc
Cadmium (food)	7440-43-9	8.72E+01	nc
Carbaryl	63-25-2	1.91E+03	c
Carbon Disulfide	75-15-0	6.62E+02	nc
Carbon tetrachloride	56-23-5	2.23E+00	c
Chlorobenzene	108-90-7	7.26E+02	nc
Chromium (III) (insoluble salts)	16065-83-1	3.60E+05	nc
Chromium (VI)	18540-29-9	1.75E+00	c
Cobalt	7440-48-4	2.91E+02	nc
Copper	7440-50-8	1.39E+05	nc
Di (2-ethylhexyl) phthalate	117-81-7	1.20E+02	c
Dibromochloropropane	96-12-8	6.15E-02	c
Dibromoethane, 1,2-	106-93-4	1.39E-01	c
Dichloroethane, 1,1-	75-34-3	1.26E+01	c
Dichloroethane, 1,2-	107-06-2	1.71E+00	c
Dichloroethylene, cis 1,2-	156-59-2	1.81E+03	nc
Dichloroethylene, trans 1,2-	156-60-5	1.81E+04	nc
Dichloropropane, 1,2-	78-87-5	9.06E+00	c
Dioxane, 1,4-	123-91-1	1.69E+01	c
Ethylbenzene	100-41-4	2.21E+01	c
Fluoranthene	206-44-0	2.64E+04	nc
Fluorene	86-73-7	2.64E+04	nc
Hexachlorobenzene	118-74-1	6.86E-01	c
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	2.80E+01	c
Iron	7439-89-6	6.86E+05	nc
Isopropylbenzene (cumene)	98-82-8	2.64E+02	nc
Manganese (non-diet)	7439-96-5	1.14E+04	nc
Mercury (elemental)	7439-97-6	3.13E+00	nc
Methyl ethyl ketone	78-93-3	2.70E+04	nc
Methyl tert-butyl ether (MTBE)	1634-04-4	4.46E+03	nc
Molybdenum	7439-98-7	4.90E+03	nc
Naphthalene	91-20-3	1.64E+01	c
Nickel	7440-02-0	9.71E+03	nc
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	4.98E+04	nc
Pentachlorophenol	87-86-5	2.90E+00	c
Pentaerythritol tetranitrate (PETN)	78-11-5	1.44E+03	nc
Perchlorate	14797-73-0	6.86E+02	nc
Perfluoroheptanoic acid (PFHpA)[b]	375-85-9	1.44E+01	nc
Perfluorohexane sulfonic acid (PFHxS)[b]	355-46-4	1.44E+01	nc
Perfluorononanoic acid (PFNA)[b]	375-95-1	1.44E+01	nc
Perfluorooctane sulfonic acid (PFOS)[b]	1763-23-1	1.44E+01	nc
Perfluorooctanoic acid (PFOA)[b]	335-67-1	1.44E+01	nc
Polychlorinated biphenyls (PCBs)[c]	1336-36-3	6.83E-01	c
Propoxur (Baygon)	114-26-1	4.76E+02	c
Propyl benzene, n-	103-65-1	2.61E+02	nc
Selenium	7782-49-2	4.90E+03	nc
Silver	7440-22-4	2.48E+03	nc
Tetrachlorodibenzo-p-dioxin, 2,3,7,8- (TCDD)	1746-01-6	1.37E-05	c
Tetrachloroethane, 1,1,1,2-	630-20-6	8.00E+00	c
Tetrachloroethylene	127-18-4	1.43E+01	c
Thallium (soluble Thallium)	7440-28-0*	1.96E+05	nc

ATTACHMENT 1b
VERMONT DEPARTMENT OF HEALTH
2019 COMMERICAL WORKER SOIL VALUES (CSV) (mg/kg)
INCIDENTAL INGESTION, DERMAL CONTACT AND INHALATION

Chemical name	CAS Number	CSV (mg/kg)	Endpoint
Toluene	108-88-3	7.98E+02	nc
Trichloroethylene (non-moa)	79-01-6	6.47E+00	c
Trichloropropane, 1,2,3-	96-18-4	7.05E-02	c
Trimethylbenzene, 1,2,3- (d)	526-73-8	2.82E+02	nc
Trimethylbenzene, 1,2,4- (d)	95-63-6	2.12E+02	nc
Trimethylbenzene, 1,3,5- (d)	108-67-8	1.77E+02	nc
Trinitrotoluene, 2,4,6- (TNT)	118-96-7	7.00E+01	c
Uranium (soluble salts)	Uranium	5.88E+02	nc
Vanadium	7440-62-2	2.72E+01	nc
Vinyl chloride	75-01-4	5.93E-01	c
Xylenes	1330-20-7	2.57E+02	nc
Zinc	7440-66-6	2.94E+05	nc

Notes:

* - CAS Number is for Metallic Thallium

Groundwater temperature of 15°C used in derivation of volatiziation factors with May 2018 Regional Screening Level Calculator.

Csat substitution used if soil inhalation value greater than Csat. Csats derived using May 2018 Regional Screening Level Calculator.

Commercial Noncancer-based soil inhalation value above respective Csat thus Csat substitiouion employed for the following:

Acetone, Carbon Disulfide, Carbon Tetrachloride, Chlorobenzene, Ethylbenzene, Isopropylbenzene (cumene), Mercury (elemental), Methyl ethyl ketone,Methyl tert-butyl ether, n-Propyl benzene, Tetrachloroethylene, Toluene, Trimethyl benzenes, Xylenes.

(a) Benzo(a)pyrene cancer-based value applicable to benzo(a)pyrene itself and to total benzo(a)pyrene toxic equivalents [B(a)P-TE]. Benzo(a)pyrene noncancer-based value applicable only to benzo(a)pyrene itself.

(b) PFAS - Sum of PFHpA, PFHxS, PFNA, PFOS and PFOA not to exceed 14.4 mg/kg.

(c) Polychlorinated Biphenyls -IRIS high risk and persistence cancer toxicity values employed; noncancer assessment of Total PCBs based on oral reference dose and VF for Aroclor 1254.

(d) Trimethyl benzenes -Sum of the three isomers not to exceed 1.77E+02 mg/kg, based on the most conservative value derived for an individual isomer.

ATTACHMENT 2a
SUMMARY TABLE
RESDIENTIAL SOIL VALUES (RSV) (mg/kg)
INCIDENTAL INGESTION, DERMAL CONTACT AND INHALATION

		Toxicity and Chemical Specific Information										Residential - Soil										HQ=1 & ILCR=1E^{-6}	
												Cancer Target Risk=1E^{-6}					Noncancer Target Hazard Quotient=1						
Chemical Name	CAS No.	CSFo (mg/kd-d)$^{-1}$	Ref	IUR (μg/m^3)$^{-1}$	Ref	RfDo mg/kg-d	Ref	RfC mg/m^3	Ref	Vol	mmoa	Ingestion mg/kg	Dermal mg/kg	Ing&Derm mg/kg	Inhalation mg/kg	Combined mg/kg	Ingestion mg/kg	Dermal mg/kg	Ing&Derm mg/kg	Inhalation mg/kg	Combined mg/kg	Min RSV mg/kg	endpoint
Acetochlor	34256-82-1	NA	O	NA	O	2.00E-02	I,O	NA	--	n	--	NA	NA	NA	NA	NA	1.50E+03	6.42E+03	1.22E+03	NA	1.22E+03	1.22E+03	nc
Acetone	67-64-1	NA	I	NA	I	9.00E-01	I	3.10E+01	A	V	--	NA	NA	NA	NA	NA	6.75E+04	9.63E+05	6.31E+04	1.14E+05	4.06E+04	4.06E+04	nc
Alachlor	15972-60-8	NA	O	NA	O	1.00E-03	O,I[a]	NA	--	n	--	NA	NA	NA	NA	NA	7.50E+01	3.21E+02	6.08E+01	NA	6.08E+01	6.08E+01	nc
Aldrin	309-00-2	1.70E+01	I	4.90E-03	I	3.00E-05	I	NA	--	V	--	2.30E-02	1.88E-01	2.05E-02	1.61E+00	2.02E-02	2.25E+00	3.21E+01	2.10E+00	NA	2.10E+00	2.02E-02	c
Aluminum	7429-90-5	NA	P	NA	P	1.00E+00	P	5.00E-03	P	n	--	NA	NA	NA	NA	NA	7.50E+04	3.21E+06	7.33E+04	6.80E+06	7.25E+04	7.25E+04	nc
Antimony	7440-36-0	NA	I	NA	I	4.00E-04	I	NA	I	n	--	NA	NA	NA	NA	NA	3.00E+01	1.93E+02	2.60E+01	NA	2.60E+01	2.60E+01	nc
Arsenic, Inorganic	7440-38-2	1.50E+00	I	4.30E-03	I	3.00E-04	I	1.50E-05	CE	n	--	2.60E-01	2.13E+00	2.32E-01	3.16E+02	2.32E-01	2.25E+01	3.21E+02	2.10E+01	2.04E+04	2.10E+01	2.32E-01	c
Barium	7440-39-3	NA	I	NA	I	2.00E-01	I	NA	--	n	--	NA	NA	NA	NA	NA	1.50E+04	4.49E+04	1.12E+04	NA	1.12E+04	1.12E+04	nc
Benomyl	17804-35-2	2.39E-03	O	NA	O	1.30E-02	O[b]	NA	--	n	--	1.63E+02	4.01E+02	1.16E+02	NA	1.16E+02	9.75E+02	4.17E+03	7.90E+02	NA	7.90E+02	1.16E+02	c
Benzene	71-43-2	5.50E-02	(c)	7.80E-06	(d)	4.00E-03	I	3.00E-02	I	V	--	7.10E+00	5.81E+01	6.33E+00	7.84E-01	6.98E-01	3.00E+02	4.28E+03	2.80E+02	1.83E+02	1.11E+02	6.98E-01	c
Benzo(a)pyrene	50-32-8	1.00E+00	I	6.00E-04	I	3.00E-04	I	2.00E-06	I	n	m	1.02E-01	2.55E-01	7.28E-02	1.37E+03	7.28E-02	2.25E+01	7.41E+01	1.73E+01	2.72E+03	1.72E+01	7.28E-02	c-mmoa[(r)]
Beryllium	7440-41-7	NA	I	2.40E-03	I	2.00E-03	I	2.00E-05	I	n	--	NA	NA	NA	5.67E+02	5.67E+02	1.50E+02	4.49E+01	3.46E+01	2.72E+04	3.45E+01	3.45E+01	nc
Bis(2-chloro-1-methyl ethyl)ether	108-60-1	NA	P	NA	P	4.00E-02	I	NA	I	V	--	NA	NA	NA	NA	NA	3.00E+03	4.28E+04	2.80E+03	NA	2.80E+03	2.80E+03	nc
Boron	7440-42-8	NA	I	NA	I	2.00E-01	I	NA	I	n	--	NA	NA	NA	NA	NA	1.50E+04	6.42E+05	1.47E+04	NA	1.47E+04	1.47E+04	nc
Bromate	15541-45-4	7.00E-01	I	NA	I	4.00E-03	I	NA	I	n	--	5.58E-01	1.37E+01	5.36E-01	NA	5.36E-01	3.00E+02	1.28E+04	2.93E+02	NA	2.93E+02	5.36E-01	c
Bromochloromethane	74-97-5	NA	I	NA	I	1.30E-02	E	4.00E-02	P	V	--	NA	NA	NA	NA	NA	9.75E+02	1.39E+04	9.11E+02	2.45E+02	1.93E+02	1.93E+02	nc
Bromoxynil	1689-84-5	1.03E-01	O	NA	O	1.50E-02	O	NA	--	n	--	3.79E+00	9.31E+00	2.69E+00	NA	2.69E+00	1.13E+03	4.82E+03	9.12E+02	NA	9.12E+02	2.69E+00	c
Butylbenzene, n-	104-51-8	NA	P	NA	P	5.00E-02	P	NA	--	V	--	NA	NA	NA	NA	NA	3.75E+03	5.35E+04	3.50E+03	NA	3.50E+03	3.50E+03	nc
Butylbenzene, sec-	135-98-8	NA	P	NA	P	1.00E-01	PA	NA	--	V	--	NA	NA	NA	NA	NA	7.50E+03	1.07E+05	7.01E+03	NA	7.01E+03	7.01E+03	nc
Butylbenzene, tert-	98-06-6	NA	P	NA	P	1.00E-01	PA	NA	--	V	--	NA	NA	NA	NA	NA	7.50E+03	1.07E+05	7.01E+03	NA	7.01E+03	7.01E+03	nc
Cadmium (food)	7440-43-9	NA	I	1.80E-03	I	1.00E-04	(e)	1.00E-05	A	n	--	NA	NA	NA	7.56E+02	7.56E+02	7.50E+00	8.03E+01	6.86E+00	1.36E+04	6.86E+00	6.86E+00	nc
Carbaryl	63-25-2	8.75E-04	O	NA	O	1.00E-01	I[(f)]	NA	--	n	--	4.46E+02	1.10E+03	3.17E+02	NA	3.17E+02	7.50E+03	3.21E+04	6.08E+03	NA	6.08E+03	3.17E+02	c
Carbon Disulfide	75-15-0	NA	--	NA	--	1.00E-01	I	7.00E-01	I	V	--	NA	NA	NA	NA	NA	7.50E+03	1.07E+05	7.01E+03	6.66E+02	6.08E+02	6.08E+02	nc
Carbon tetrachloride	56-23-5	7.00E-02	I	6.00E-06	I	4.00E-03	I	1.00E-01	I	V	--	5.58E+00	4.56E+01	4.97E+00	4.02E-01	3.72E-01	3.00E+02	4.28E+03	2.80E+02	2.41E+02	1.30E+02	3.72E-01	c
Chlorobenzene	108-90-7	NA	I	NA	I	2.00E-02	I	5.00E-02	P	V	--	NA	NA	NA	NA	NA	1.50E+03	2.14E+04	1.40E+03	5.87E+02	4.14E+02	4.14E+02	nc
Chromium (III) (insoluble salts)	16065-83-1	NA	I	NA	I	1.50E+00	I	NA	I	n	--	NA	NA	NA	NA	NA	1.13E+05	6.26E+04	4.02E+04	NA	4.02E+04	4.02E+04	nc
Chromium (VI)	18540-29-9	5.00E-01	(g)	8.40E-02	(h)	3.00E-03	I	1.00E-04	I	n	m	2.04E-01	1.66E-01	9.15E-02	9.77E+00	9.06E-02	2.25E+02	2.41E+02	1.16E+02	1.36E+05	1.16E+02	9.06E-02	c-mmoa
Cobalt	7440-48-4	NA	P	9.00E-03	P	3.00E-04	P	6.00E-06	P	n	--	NA	NA	NA	1.51E+02	1.51E+02	2.25E+01	9.63E+02	2.20E+01	8.16E+03	2.19E+01	2.19E+01	nc
Copper	7440-50-8	NA	I	NA	I	1.42E-01	CE	NA	--	n	--	NA	NA	NA	NA	NA	1.07E+04	4.56E+05	1.04E+04	NA	1.04E+04	1.04E+04	nc
Di (2-ethylhexyl) phthalate	117-81-7	1.40E-02	I	NA	I	2.00E-02	I	NA	--	n	--	2.79E+01	6.85E+01	1.98E+01	NA	1.98E+01	1.50E+03	6.42E+03	1.22E+03	NA	1.22E+03	1.98E+01	c
Dibromochloropropane	96-12-8	8.00E-01	P	6.00E-03	P	2.00E-04	P	2.00E-04	I	V	m	1.27E-01	1.38E+00	1.17E-01	6.33E-03	6.00E-03	1.50E+01	2.14E+02	1.40E+01	1.26E+01	6.63E+00	6.00E-03	c-mmoa
Dibromoethane, 1,2-	106-93-4	2.00E+00	I	6.00E-04	I	9.00E-03	I	9.00E-03	I	V	--	1.95E-01	1.60E+00	1.74E-01	2.61E-02	2.27E-02	6.75E+02	9.63E+03	6.31E+02	1.41E+02	1.15E+02	2.27E-02	c
Dichloroethane, 1,1-	75-34-3	5.70E-03	CE	1.60E-06	CE	2.00E-01	P	NA	--	V	--	6.85E+01	5.61E+02	6.10E+01	2.17E+00	2.10E+00	1.50E+04	2.14E+05	1.40E+04	NA	1.40E+04	2.10E+00	c
Dichloroethane, 1,2-	107-06-2	9.10E-02	I	2.60E-05	I	6.00E-03	P	7.00E-03	P	V	--	4.29E+00	3.51E+01	3.82E+00	3.08E-01	2.85E-01	4.50E+02	6.42E+03	4.21E+02	5.61E+01	4.95E+01	2.85E-01	c
Dichloroethylene, cis 1,2-	156-59-2	NA	I	NA	I	2.00E-03	I	NA	I	V	--	NA	NA	NA	NA	NA	1.50E+02	2.14E+03	1.40E+02	NA	1.40E+02	1.40E+02	nc
Dichloroethylene, trans 1,2-	156-60-5	NA	I	NA	I	2.00E-02	I	NA	I	V	--	NA	NA	NA	NA	NA	1.50E+03	2.14E+04	1.40E+03	NA	1.40E+03	1.40E+03	nc
Dichloropropane, 1,2-	78-87-5	3.70E-02	P	3.70E-06	P	4.00E-02	P	4.00E-03	I	V	--	1.06E+01	8.64E+01	9.40E+00	1.79E+00	1.51E+00	3.00E+03	4.28E+04	2.80E+03	2.65E+01	2.63E+01	1.51E+00	c
Dioxane, 1,4-	123-91-1	1.00E-01	I	5.00E-06	I	3.00E-02	I	3.00E-02	I	V	--	3.90E+00	3.20E+01	3.48E+00	1.39E+01	2.78E+00	2.25E+03	3.21E+04	2.10E+03	2.09E+03	1.05E+03	2.78E+00	c
Ethylbenzene	100-41-4	1.10E-02	CE	2.50E-06	CE	1.00E-01	I	2.60E-01	A	V	--	3.55E+01	2.90E+02	3.16E+01	4.16E+00	3.68E+00	7.50E+03	1.07E+05	7.01E+03	4.75E+02	4.45E+02	3.68E+00	c
Fluoranthene	206-44-0	NA	I	NA	I	4.00E-02	I	NA	I	n	--	NA	NA	NA	NA	NA	3.00E+03	9.88E+03	2.30E+03	NA	2.30E+03	2.30E+03	nc
Fluorene	86-73-7	NA	I	NA	I	4.00E-02	I	NA	I	V	--	NA	NA	NA	NA	NA	3.00E+03	9.88E+03	2.30E+03	NA	2.30E+03	2.30E+03	nc
Hexachlorobenzene	118-74-1	1.60E+00	I	4.60E-04	I	8.00E-04	I	NA	I	V	--	2.44E-01	2.00E+00	2.17E-01	3.32E-01	1.31E-01	6.00E+01	8.56E+02	5.61E+01	NA	5.61E+01	1.31E-01	c
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	8.00E-02	I	NA	I	4.00E-03	I	NA	I	n	--	4.88E+00	7.99E+01	4.60E+00	NA	4.60E+00	3.00E+02	8.56E+03	2.90E+02	NA	2.90E+02	4.60E+00	c
Iron	7439-89-6	NA	P	NA	P	7.00E-01	P	NA	P	n	--	NA	NA	NA	NA	NA	5.25E+04	2.25E+06	5.13E+04	NA	5.13E+04	5.13E+04	nc
Isopropylbenzene (cumene)	98-82-8	NA	I	NA	I	1.00E-01	I	4.00E-01	I	V	--	NA	NA	NA	NA	NA	7.50E+03	1.07E+05	7.01E+03	2.66E+02	2.56E+02	2.56E+02	nc
Lead [(u)]	7439-92-1	NA	--	NA	--	NA	--	NA	--	n	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	nc
Manganese (non-diet)	7439-96-5	NA	I	NA	I	2.40E-02	I	5.00E-05	I	n	--	NA	NA	NA	NA	NA	1.80E+03	3.08E+03	1.14E+03	6.80E+04	1.12E+03	1.12E+03	nc
Mercury (elemental)	7439-97-6	NA	I	NA	I	NA	I	3.00E-04	I	V	--	NA	NA	NA	NA	NA	NA	NA	NA	3.13E+00	3.13E+00	3.13E+00	nc
Methyl ethyl ketone	78-93-3	NA	I	NA	I	6.00E-01	I	5.00E+00	I	V	--	NA	NA	NA	NA	NA	4.50E+04	6.42E+05	4.21E+04	2.84E+04	1.70E+04	1.70E+04	nc
Methyl tert-butyl ether (MTBE)	1634-04-4	NA	I	NA	I	1.00E-02	VH	3.00E+00	I	V	--	NA	NA	NA	NA	NA	7.50E+02	1.07E+04	7.01E+02	8.81E+03	6.49E+02	6.49E+02	nc
Molybdenum	7439-98-7	NA	I	NA	I	5.00E-03	I	NA	I	n	--	NA	NA	NA	NA	NA	3.75E+02	1.61E+04	3.66E+02	NA	3.66E+02	3.66E+02	nc
Naphthalene	91-20-3	NA	I	3.40E-05	CE	2.00E-02	I	3.00E-03	I	V	--	NA	NA	NA	2.72E+00	2.72E+00	1.50E+03	4.94E+03	1.15E+03	2.78E+02	2.24E+02	2.72E+00	c
Nickel	7440-02-0	NA	I	2.60E-04	CE	2.00E-02	I[(i)]	9.00E-05	A	n	--	NA	NA	NA	5.23E+03	5.23E+03	1.50E+03	2.57E+03	9.47E+02	1.22E+05	9.40E+02	9.40E+02	nc
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	NA	I	NA	I	5.00E-02	I	NA	--	n	--	NA	NA	NA	NA	NA	3.75E+03	2.68E+05	3.70E+03	NA	3.70E+03	3.70E+03	nc
Pentachlorophenol	87-86-5	4.00E-01	I	NA	I	5.00E-03	I	NA	I	n	--	9.76E-01	9.59E-01	4.84E-01	NA	4.84E-01	3.75E+02	6.42E+02	2.37E+02	NA	2.37E+02	4.84E-01	c
Pentaerythritol tetranitrate (PETN)	78-11-5	NA	--	NA	--	2.00E-03	P	NA	--	n	--	NA	NA	NA	NA	NA	1.50E+02	6.42E+02	1.22E+02	NA	1.22E+02	1.22E+02	nc
Perchlorate	14797-73-0	NA	I	NA	I	7.00E-04	VH	NA	I	n	--	NA	NA	NA	NA	NA	5.25E+01	2.25E+03	5.13E+01	NA	5.13E+01	5.13E+01	nc
Perfluoroheptanoic acid (PFHpA)	375-85-9	NA	--	NA	--	2.00E-05	(j)	NA	--	n	--	NA	NA	NA	NA	NA	1.50E+00	6.42E+00	1.22E+00	NA	1.22E+00	1.22E+00	nc[(s)]
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	NA	--	NA	--	2.00E-05	(j)	NA	--	n	--	NA	NA	NA	NA	NA	1.50E+00	6.42E+00	1.22E+00	NA	1.22E+00	1.22E+00	nc[(s)]
Perfluorononanoic acid (PFNA)	375-95-1	NA	--	NA	--	2.00E-05	(j)	NA	--	n	--	NA	NA	NA	NA	NA	1.50E+00	6.42E+00	1.22E+00	NA	1.22E+00	1.22E+00	nc[(s)]
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	NA	E	NA	E	2.00E-05	E	NA	E	n	--	NA	NA	NA	NA	NA	1.50E+00	6.42E+00	1.22E+00	NA	1.22E+00	1.22E+00	nc[(s)]
Perfluorooctanoic acid (PFOA)	335-67-1	7.00E-02	E	NA	E	2.00E-05	E	NA	E	n	--	5.58E+00	1.37E+01	3.96E+00	NA	3.96E+00	1.50E+00	6.42E+00	1.22E+00	NA	1.22E+00	1.22E+00	nc[(s)]
Polychlorinated biphenyls (PCBs)	1336-36-3	2.00E+00	I[(k)]	5.70E-04	I[(k)]	2.50E-05	I[(k)]	NA	I	V	--	1.95E-01	3.42E-01	1.24E-01	1.30E+00	1.14E-01	1.50E+00	4.59E+00	1.13E+00	NA	1.13E+00	1.14E-01	c
Propoxur (Baygon)	114-26-1	3.52E-03	O	NA	O	4.00E-03	I[(f)]	NA	--	n	--	1.11E+02	2.72E+02	7.88E+01	NA	7.88E+01	3.00E+02	1.28E+03	2.43E+02	NA	2.43E+02	7.88E+01	c
Propyl benzene, n-	103-65-1	NA	--	NA	--	1.00E-01	(l)	2.60E-01	(m)	V	--	NA	NA	NA	NA	NA	7.50E+03	1.07E+05	7.01E+03	2.62E+02	2.53E+02	2.53E+02	nc
Selenium	7782-49-2	NA	I	NA	I	5.00E-03	I	1.80E-03	VA[(n)]	n	--	NA	NA	NA	NA	NA	3.75E+02	1.61E+04	3.66E+02	2.45E+06	3.66E+02	3.66E+02	nc
Silver	7440-22-4	NA	I	NA	I	5.00E-03	I	NA	--	n	--	NA	NA	NA	NA	NA	3.75E+02	6.42E+02	2.37E+02	NA	2.37E+02	2.37E+02	nc
Tetrachlorodibenzo-p-dioxin, 2,3,7,8- (TCDD)	1746-01-6	1.50E+05	H	3.30E+01	H	7.00E-10	I	NA	--	V	--	2.60E-06	2.13E-05	2.32E-06	8.08E-05	2.25E-06	5.25E-05	7.49E-04	4.91E-05	NA	4.91E-05	2.25E-06	c
Tetrachloroethane, 1,1,1,2-	630-20-6	2.60E-02	I	7.40E-06	I	3.00E-02	I	NA	--	V	--	1.50E+01	1.23E+02	1.34E+01	1.46E+00	1.32E+00	2.25E+03	3.21E+04	2.10E+03	NA	2.10E+03	1.32E+00	c
Tetrachloroethylene	127-18-4	1.10E-02	(o)	1.60E-06	(p)	6.00E-03	I	4.00E-02	I	V	--	3.55E+01	2.90E+02	3.16E+01	2.57E+00	2.38E+00	4.50E+02	6.42E+03	4.21E+02	1.55E+02	1.13E+02	2.38E+00	c
Thallium (soluble Thallium)	7440-28-0*	NA	I	NA	I	1.00E-05	P	NA	I	n	--	NA	NA	NA	NA	NA	7.50E-01	3.21E+01	7.33E-01	NA	7.33E-01	7.33E-01	nc

ATTACHMENT 2a
SUMMARY TABLE
RESDIENTIAL SOIL VALUES (RSV) (mg/kg)
INCIDENTAL INGESTION, DERMAL CONTACT AND INHALATION

		Toxicity and Chemical Specific Information										Residential - Soil										HQ=1 & ILCR=1E^{-6}	
												Cancer Target Risk=1E^{-6}					Noncancer Target Hazard Quotient=1					Min	
Chemical Name	CAS No.	CSFo (mg/kd-d)$^{-1}$	Ref	IUR ($\mu g/m^3$)$^{-1}$	Ref	RfDo mg/kg-d	Ref	RfC mg/m^3	Ref	Vol	mmoa	Ingestion mg/kg	Dermal mg/kg	Ing&Derm mg/kg	Inhalation mg/kg	Combined mg/kg	Ingestion mg/kg	Dermal mg/kg	Ing&Derm mg/kg	Inhalation mg/kg	Combined mg/kg	RSV mg/kg	endpoint
Toluene	108-88-3	NA	I	NA	I	8.00E-02	I	5.00E+00	I	V	--	NA	NA	NA	NA	NA	6.00E+03	8.56E+04	5.61E+03	8.08E+02	7.06E+02	7.06E+02	nc
Trichloroethylene (non-moa / mmoa)	79-01-6	3.72E-02/9.3E-03	I	3.1E-06/1.0E-06	I	5.00E-04	I	2.00E-03	I	V	non-mmoa&c-mmoa	1.05E+01/1.1E+01	8.59E+01/1.19E+02	9.35E+00/1.0E+01	1.22E+00/2.28E+00	6.81E-01	3.75E+01	5.35E+02	3.50E+01	7.55E+00	6.21E+00	6.81E-01	c/c--mmoa
Trichloropropane, 1,2,3-	96-18-4	3.00E+01	I	NA	I	4.00E-03	I	3.00E-04	I	V	m	3.40E-03	3.69E-02	3.11E-03	NA	3.11E-03	3.00E+02	4.28E+03	2.80E+02	8.95E+00	8.67E+00	3.11E-03	c-mmoa
Trimethylbenzene, 1,2,3-	526-73-8	NA	I	NA	I	1.00E-02	I	6.00E-02	I	V	--	NA	NA	NA	NA	NA	7.50E+02	1.07E+04	7.01E+02	2.92E+02	2.06E+02	2.06E+02	nc
Trimethylbenzene, 1,2,4-	95-63-6	NA	I	NA	I	1.00E-02	I	6.00E-02	I	V	--	NA	NA	NA	NA	NA	7.50E+02	1.07E+04	7.01E+02	2.17E+02	1.66E+02	1.66E+02	nc
Trimethylbenzene, 1,3,5-	108-67-8	NA	I	NA	I	1.00E-02	I	6.00E-02	I	V	--	NA	NA	NA	NA	NA	7.50E+02	1.07E+04	7.01E+02	1.81E+02	1.44E+02	1.44E+02	nc[(t)]
Trinitrotoluene, 2,4,6- (TNT)	118-96-7	3.00E-02	I	NA	I	5.00E-04	I	NA	--	n	--	1.30E+01	9.99E+01	1.15E+01	NA	1.15E+01	3.75E+01	5.02E+02	3.49E+01	NA	3.49E+01	1.15E+01	c
Uranium (soluble salts)	NA	NA	(q)	NA	(q)	6.00E-04	(q)	NA	--	n	--	NA	NA	NA	NA	NA	4.50E+01	1.93E+03	4.40E+01	NA	4.40E+01	4.40E+01	nc
Vanadium	7440-62-2	NA	P	NA	P	7.00E-05	P	1.00E-04	A	n	--	NA	NA	NA	NA	NA	5.25E+00	5.84E+00	2.77E+00	1.36E+05	2.77E+00	2.77E+00	nc
Vinyl chloride	75-01-4	1.40E+00	I	8.80E-06	I	3.00E-03	I	1.00E-01	I	V	m	2.79E-01	2.28E+00	2.49E-01	1.63E-01	9.83E-02	2.25E+02	3.21E+03	2.10E+02	1.43E+02	8.51E+01	9.83E-02	c-mmoa
Xylenes	1330-20-7	NA	I	NA	I	2.00E-01	I	1.00E-01	I	V	--	NA	NA	NA	NA	NA	1.50E+04	2.14E+05	1.40E+04	2.57E+02	2.52E+02	2.52E+02	nc
Zinc	7440-66-6	NA	I	NA	I	3.00E-01	I	NA	I	n	--	NA	NA	NA	NA	NA	2.25E+04	9.63E+05	2.20E+04	NA	2.20E+04	2.20E+04	nc

References: A=ATSDR CE=CAL EPA E=U.S. Environmental Protection Agency H=HEAST, 1997 I=IRIS N=NCEA O=OPP P=PPRTV PA=PPRTV Appendix A VA = Vermont Air Pollution Control Regulations VH=Vermont Department of Health

c - RSV corresponds to a one in one million incremental lifetime cancer risk

c-mmoa - carcinogen identified by U.S. EPA to operate via mutagenic mode of action

nc - RSV corresponds to a noncarcinogenic Hazard Quotient as indicated (HQ=1) based on Hypothetical Young Child Resident scenario.

CSF_o - Oral Cancer Slope Factor

IUR - Inhalation Unit Risk

NA - Not Available/Not Applicable

RfC - Inhalation Reference Concentration

RfD_o - Oral Reference Dose

V - Denotes chemcial with a Henry's Law constant greater than 1 x 10-5 atm-m3/mole or a vapor pressure greater than 1 mm Hg

* - CAS Number is for Metallic Thallium

Groundwater temperature of 15°C used in derivation of volatiziation factors with May 2018 Regional Screening Level Calculator.

Csat substitution used if soil inhalation value greater than Csat. Csats derived using May 2018 Regional Screening Level Calculator.

All cancer-based soil inhalation values were less than respective Csat thus no substitutions.

Noncancer-based soil inhalation value above respective Csat thus Csat substitiouion employed for the following:

Acetone, Carbon Disulfide, Ethylbenzene, Isopropylbenzene (cumene), Mercury (elemental), Methyl ethyl ketone, Methyl tert-butyl ether, n-Propyl benzene, Tetrachloroethylene, Toluene, Trimethyl benzenes, Xylenes.

(a) Alachlor - Reflects incorporation of Vermont Department of Health Modifying Factor = 10 for carcinogenic potential

(b) Benomyl - Reflects incorporation of EPA Office of Pesticide Programs Food Quality Protection Act Safety Factor = 10 (for children and females 15-50 years).

(c) Benzene - Most conservative end of range of oral Cancer Slope Factors presented in IRIS citation dated 1/19/00 [1.5E-02 to 5.5E-02 (mg/kg-d)$^{-1}$]

(d) Benzene - Most conservative end of range of Inhalation Unit Risks presented in IRIS citation dated 1/19/00 [2.2E-06 to 7.8E-06 ($\mu g/m^3$)$^{-1}$]

(e) Cadmium -IRIS,1992 oral Reference Dose (food) adjusted with Vermont Department of Health Modifying Factor of 10 to account for unquantified carcinogenic potential.

(f) Carbaryl and Propoxur - EPA Office of Pesticide Programs does not employ a long-term or chronic oral RfD as they contend there is rapid recovery from acetylcholinesterase inhibition.
The Vermont Department of Health believes there are multiple other effects and potential concerns regarding extended exposure and assessment of chronic exposure is appropriate.

(g) Chromium (VI) - Considers information presented in OPP (CARC), 2008; IRIS, 2010 Draft; CAL EPA PHG, 2011 (mmoa); NJ DEP, 2009

(h) Chromium (VI)- The IRIS 9/3/98 IUR of 1.2E-2 (ug/m3)-1 assumes a ratio of Cr(VI) to Cr(III) of 1:6. To obtain a Cr(VI) specific IUR, this value was multiplied by 7. This is a conservative, health protective assumption.

(i) IRIS citation for Nickel, soluble salts

(j) PFAS - VDH, 2018 employs oral reference dose provided in the EPA 2016 Office of Water Health Effects Support Documents for PFOA and PFOS in the assessment of PFHpA, PFHxS, PFNA, PFOS and PFOA.

(k) Polychlorinated Biphenyls -IRIS high risk and persistence cancer toxicity values employed; noncancer assessment of Total PCBs based on oral reference dose and VF for Aroclor 1254.

(l) n- Propylbenzene - VDH employs $IRIS_{1987}$ oral Reference Dose for ethylbenzene as surrogate. $PPRTV_{2009}$ developed screeing chronic provisional values using ethylbenzene value as surrogate.

(m) n-Propylbenzene - VDH employs $ATSDR_{2010}$ inhalation chronic MRL for ethylbenzene as a surrogate. $PPRTV_{2009}$ develops provisional chronic RfC using older $IRIS_{1991}$ RfC for ethylbenzene as surrogate.

(n) Selenium - Consistent with Vermont Air Pollution Control Regulations, Hazardous Ambient Air Standard (HAAS) employed. HAAS derived by route to route extrapolation of IRIS oral RfD with 70 kg body weight, inhalation rate of 20 m3/d and an uncertainty factor of 10.

(o) Tetrachloroethylene - Geometric mean of oral Cancer Slope Factors noted in IRIS citation dated 2/10/12 [2.1E-3 (mg/kg-d)$^{-1}$ based on hepatocellular adenoma/carcinoma & 6E-2 (mg/kg-d)$^{-1}$ based on mononuclear cell leukemia]

(p) Tetrachloroethylene -Geometric mean of Inhalation Unit Risks presented in IRIS citation dated 2/10/12 [2.6E-07 ($\mu g/m^3$)$^{-1}$ based on hepatocellular adenoma/carcinoma & 1E-05 ($\mu g/m^3$)$^{-1}$ based on mononuclear cell leukemia]

(q) Uranium assessment based on non-radiogenic effects only. Assessment employs Oral Reference Dose presented in U.S. EPA National Primary Drinking Water Regulations; Radionuclides; Final Rule 12/7/00.

(r) Benzo(a)pyrene cancer-based value applicable to benzo(a)pyrene itself and to total benzo(a)pyrene toxic equivalents [B(a)P-TE]. Benzo(a)pyrene noncancer-based value applicable only to benzo(a)pyrene itself.

(s) PFAS - Sum of PFHpA, PFHxS, PFNA, PFOS and PFOA not to exceed 1.22 mg/kg.

(t) Trimethyl benzenes -Sum of the three isomers not to exceed 1.44E+02 mg/kg, based on the most conservative value derived for an individual isomer.

(u) Health used the current version of the IEUBK software to find the soil concentration that would result in 95% probability that no exposed child would exceed the Bll of < 3 ug/dL. Vermont DEC conducted a soil background study and determined the rural background level of lead is 41 mg/kg. Because the soil concentration that would result in a 95% probability that no exposed child would exceed the Bll < 3 ug/dL is less than the Vermont background level, the background level is recommended.

ATTACHMENT 2b
SUMMARY TABLE
2019 COMMERCIAL WORKER SOIL VALUES (CSV) (mg/kg)
INCIDENTAL INGESTION, DERMAL CONTACT AND INHALATION

Chemical Name	CAS No.	Commercial Worker - Soil										HQ=1 & ILCR=1E^{-6}	
		Cancer Target Risk=1E^{-6}					Noncancer Hazard Quotient=1					Min	
		Ingestion mg/kg	Dermal mg/kg	Ing&Derm mg/kg	Inhalation mg/kg	Combined mg/kg	Ingestion mg/kg	Dermal mg/kg	Ing&Derm mg/kg	Inhalation mg/kg	Combined mg/kg	CSV mg/kg	endpoint
Acetochlor	34256-82-1	-	-	-	-	-	2.04E+04	4.83E+04	1.44E+04	-	1.44E+04	1.44E+04	nc
Acetone	67-64-1	-	-	-	-	-	9.20E+05	7.24E+06	8.16E+05	1.14E+05	1.00E+05	1.00E+05	nc
Alachlor	15972-60-8	-	-	-	-	-	1.02E+03	2.41E+03	7.18E+02	-	7.18E+02	7.18E+02	nc
Aldrin	309-00-2	1.40E-01	3.31E-01	9.86E-02	9.65E+00	9.76E-02	3.07E+01	7.24E+01	2.15E+01	-	2.15E+01	9.76E-02	c
Aluminum	7429-90-5	-	-	-	-	-	1.02E+06	2.41E+07	9.81E+05	2.38E+07	9.42E+05	9.42E+05	nc
Antimony	7440-36-0	-	-	-	-	-	4.09E+02	1.45E+03	3.19E+02	-	3.19E+02	3.19E+02	nc
Arsenic, Inorganic	7440-38-2	1.59E+00	1.25E+01	1.41E+00	2.59E+03	1.41E+00	3.07E+02	2.41E+03	2.72E+02	7.15E+04	2.71E+02	1.41E+00	c
Barium	7440-39-3	-	-	-	-	-	2.04E+05	3.38E+05	1.27E+05	-	1.27E+05	1.27E+05	nc
Benomyl	17804-35-2	9.98E+02	2.36E+03	7.01E+02	-	7.01E+02	1.33E+04	3.14E+04	9.34E+03	-	9.34E+03	7.01E+02	c
Benzene	71-43-2	4.34E+01	3.41E+02	3.85E+01	4.71E+00	4.19E+00	4.09E+03	3.22E+04	3.63E+03	4.72E+02	4.18E+02	4.19E+00	c
Benzo(a)pyrene[(a)]	50-32-8	2.38E+00	4.33E+00	1.54E+00	1.85E+04	1.54E+00	3.07E+02	5.57E+02	1.98E+02	9.53E+03	1.94E+02	1.54E+00	c
Beryllium	7440-41-7	-	-	-	4.63E+03	4.63E+03	2.04E+03	3.38E+02	2.90E+02	9.53E+04	2.89E+02	2.89E+02	nc
Bis(2-chloro-1-methyl ethyl)ether	108-60-1	-	-	-	-	-	4.09E+04	3.22E+05	3.63E+04	-	3.63E+04	3.63E+04	nc
Boron	7440-42-8	-	-	-	-	-	2.04E+05	4.83E+06	1.96E+05	-	1.96E+05	1.96E+05	nc
Bromate	15541-45-4	3.41E+00	8.05E+01	3.27E+00	-	3.27E+00	4.09E+03	9.66E+04	3.92E+03	-	3.92E+03	3.27E+00	c
Bromochloromethane	74-97-5	-	-	-	-	-	1.33E+04	1.05E+05	1.18E+04	6.29E+02	5.97E+02	5.97E+02	nc
Bromoxynil	1689-84-5	2.32E+01	5.47E+01	1.63E+01	-	1.63E+01	1.53E+04	3.62E+04	1.08E+04	-	1.08E+04	1.63E+01	c
Butylbenzene, n-	104-51-8	-	-	-	-	-	5.11E+04	-	5.11E+04	-	5.11E+04	5.11E+04	nc
Butylbenzene, sec-	135-98-8	-	-	-	-	-	1.02E+05	-	1.02E+05	-	1.02E+05	1.02E+05	nc
Butylbenzene, tert-	98-06-6	-	-	-	-	-	1.02E+05	-	1.02E+05	-	1.02E+05	1.02E+05	nc
Cadmium (food)	7440-43-9	-	-	-	6.18E+03	6.18E+03	1.02E+02	6.04E+02	8.74E+01	4.77E+04	8.72E+01	8.72E+01	nc
Carbaryl	63-25-2	2.73E+03	6.44E+03	1.91E+03	-	1.91E+03	1.02E+05	2.41E+05	7.18E+04	-	7.18E+04	1.91E+03	c
Carbon Disulfide	75-15-0	-	-	-	-	-	1.02E+05	-	1.02E+05	6.66E+02	6.62E+02	6.62E+02	nc
Carbon tetrachloride	56-23-5	3.41E+01	2.68E+02	3.02E+01	2.41E+00	2.23E+00	4.09E+03	3.22E+04	3.63E+03	3.99E+02	3.59E+02	2.23E+00	c
Chlorobenzene	108-90-7	-	-	-	-	-	2.04E+04	1.61E+05	1.81E+04	7.56E+02	7.26E+02	7.26E+02	nc
Chromium (III) (insoluble salts)	16065-83-1	-	-	-	-	-	1.53E+06	4.71E+05	3.60E+05	-	3.60E+05	3.60E+05	nc
Chromium (VI)	18540-29-9	4.77E+00	2.82E+00	1.77E+00	1.32E+02	1.75E+00	3.07E+03	1.81E+03	1.14E+03	4.77E+05	1.14E+03	1.75E+00	c
Cobalt	7440-48-4	-	-	-	1.24E+03	1.24E+03	3.07E+02	7.24E+03	2.94E+02	2.86E+04	2.91E+02	2.91E+02	nc
Copper	7440-50-8	-	-	-	-	-	1.45E+05	3.43E+06	1.39E+05	-	1.39E+05	1.39E+05	nc
Di (2-ethylhexyl) phthalate	117-81-7	1.70E+02	4.02E+02	1.20E+02	-	1.20E+02	2.04E+04	4.83E+04	1.44E+04	-	1.44E+04	1.20E+02	c
Dibromochloropropane	96-12-8	2.98E+00	2.35E+01	2.64E+00	6.30E-02	6.15E-02	2.04E+02	1.61E+03	1.81E+02	3.24E+01	2.75E+01	6.15E-02	c
Dibromoethane, 1,2-	106-93-4	1.19E+00	-	1.19E+00	1.57E-01	1.39E-01	9.20E+03	-	9.20E+03	3.63E+02	3.49E+02	1.39E-01	c
Dichloroethane, 1,1-	75-34-3	4.18E+02	-	4.18E+02	1.30E+01	1.26E+01	2.04E+05	-	2.04E+05	-	2.04E+05	1.26E+01	c
Dichloroethane, 1,2-	107-06-2	2.62E+01	2.06E+02	2.33E+01	1.85E+00	1.71E+00	6.13E+03	4.83E+04	5.44E+03	1.44E+02	1.40E+02	1.71E+00	c
Dichloroethylene, cis 1,2-	156-59-2	-	-	-	-	-	2.04E+03	1.61E+04	1.81E+03	-	1.81E+03	1.81E+03	nc
Dichloroethylene, trans 1,2-	156-60-5	-	-	-	-	-	2.04E+04	1.61E+05	1.81E+04	-	1.81E+04	1.81E+04	nc
Dichloropropane, 1,2-	78-87-5	6.45E+01	5.08E+02	5.72E+01	1.08E+01	9.06E+00	4.09E+04	3.22E+05	3.63E+04	6.83E+01	6.81E+01	9.06E+00	c
Dioxane, 1,4-	123-91-1	2.38E+01	1.88E+02	2.12E+01	8.37E+01	1.69E+01	3.07E+04	2.41E+05	2.72E+04	5.38E+03	4.49E+03	1.69E+01	c
Ethylbenzene	100-41-4	2.17E+02	1.71E+03	1.92E+02	2.50E+01	2.21E+01	1.02E+05	8.05E+05	9.07E+04	4.75E+02	4.73E+02	2.21E+01	c
Fluoranthene	206-44-0	-	-	-	-	-	4.09E+04	7.43E+04	2.64E+04	-	2.64E+04	2.64E+04	nc
Fluorene	86-73-7	-	-	-	-	-	4.09E+04	7.43E+04	2.64E+04	-	2.64E+04	2.64E+04	nc
Hexachlorobenzene	118-74-1	1.49E+00	3.52E+00	1.05E+00	1.99E+00	6.86E-01	8.18E+02	1.93E+03	5.74E+02	-	5.74E+02	6.86E-01	c
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	2.98E+01	4.70E+02	2.80E+01	-	2.80E+01	4.09E+03	6.44E+04	3.84E+03	-	3.84E+03	2.80E+01	c
Iron	7439-89-6	-	-	-	-	-	7.15E+05	1.69E+07	6.86E+05	-	6.86E+05	6.86E+05	nc
Isopropylbenzene (cumene)	98-82-8	-	-	-	-	-	1.02E+05	-	1.02E+05	2.65E+02	2.64E+02	2.64E+02	nc
Manganese (non-diet)	7439-96-5	-	-	-	-	-	2.45E+04	2.32E+04	1.19E+04	2.38E+05	1.14E+04	1.14E+04	nc
Mercury (elemental)	7439-97-6	-	-	-	-	-	-	-	-	3.13E+00	3.13E+00	3.13E+00	nc
Methyl ethyl ketone	78-93-3	-	-	-	-	-	6.13E+05	4.83E+06	5.44E+05	2.84E+04	2.70E+04	2.70E+04	nc
Methyl tert-butyl ether (MTBE)	1634-04-4	-	-	-	-	-	1.02E+04	8.05E+04	9.07E+03	8.79E+03	4.46E+03	4.46E+03	nc
Molybdenum	7439-98-7	-	-	-	-	-	5.11E+03	1.21E+05	4.90E+03	-	4.90E+03	4.90E+03	nc
Naphthalene	91-20-3	-	-	-	1.64E+01	1.64E+01	2.04E+04	3.71E+04	1.32E+04	7.15E+02	6.78E+02	1.64E+01	c
Nickel	7440-02-0	-	-	-	4.28E+04	4.28E+04	2.04E+04	1.93E+04	9.93E+03	4.29E+05	9.71E+03	9.71E+03	nc
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	-	-	-	-	-	5.11E+04	2.01E+06	4.98E+04	-	4.98E+04	4.98E+04	nc
Pentachlorophenol	87-86-5	5.96E+00	5.63E+00	2.90E+00	-	2.90E+00	5.11E+03	4.83E+03	2.48E+03	-	2.48E+03	2.90E+00	c

ATTACHMENT 2b
SUMMARY TABLE
2019 COMMERCIAL WORKER SOIL VALUES (CSV) (mg/kg)
INCIDENTAL INGESTION, DERMAL CONTACT AND INHALATION

Chemical Name	CAS No.	Commercial Worker - Soil										HQ=1 & ILCR=1E^{-6}	
		Cancer Target Risk=1E^{-6}					Noncancer Hazard Quotient=1					Min CSV	
		Ingestion mg/kg	Dermal mg/kg	Ing&Derm mg/kg	Inhalation mg/kg	Combined mg/kg	Ingestion mg/kg	Dermal mg/kg	Ing&Derm mg/kg	Inhalation mg/kg	Combined mg/kg	mg/kg	endpoint
Pentaerythritol tetranitrate (PETN)	78-11-5	-	-	-	-	-	2.04E+03	4.83E+03	1.44E+03	-	1.44E+03	1.44E+03	nc
Perchlorate	14797-73-0	-	-	-	-	-	7.15E+02	1.69E+04	6.86E+02	-	6.86E+02	6.86E+02	nc
Perfluoroheptanoic acid (PFHpA)	375-85-9	-	-	-	-	-	2.04E+01	4.83E+01	1.44E+01	-	1.44E+01	1.44E+01	nc[(c)]
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	-	-	-	-	-	2.04E+01	4.83E+01	1.44E+01	-	1.44E+01	1.44E+01	nc[(c)]
Perfluorononanoic acid (PFNA)	375-95-1	-	-	-	-	-	2.04E+01	4.83E+01	1.44E+01	-	1.44E+01	1.44E+01	nc[(c)]
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	-	-	-	-	-	2.04E+01	4.83E+01	1.44E+01	-	1.44E+01	1.44E+01	nc[(c)]
Perfluorooctanoic acid (PFOA)	335-67-1	3.41E+01	8.05E+01	2.39E+01	-	2.39E+01	2.04E+01	4.83E+01	1.44E+01	-	1.44E+01	1.44E+01	nc[(c)]
Polychlorinated biphenyls (PCBs)[(b)]	1336-36-3	1.19E+00	2.01E+00	7.49E-01	7.83E+00	6.83E-01	2.04E+01	3.45E+01	1.28E+01	-	1.28E+01	6.83E-01	c
Propoxur (Baygon)	114-26-1	6.77E+02	1.60E+03	4.76E+02	-	4.76E+02	4.09E+03	9.66E+03	2.87E+03	-	2.87E+03	4.76E+02	c
Propyl benzene, n-	103-65-1	-	-	-	-	-	1.02E+05	-	1.02E+05	2.62E+02	2.61E+02	2.61E+02	nc
Selenium	7782-49-2	-	-	-	-	-	5.11E+03	1.21E+05	4.90E+03	8.58E+06	4.90E+03	4.90E+03	nc
Silver	7440-22-4	-	-	-	-	-	5.11E+03	4.83E+03	2.48E+03	-	2.48E+03	2.48E+03	nc
Tetrachlorodibenzo-p-dioxin, 2,3,7,8- (TCDD)	1746-01-6	1.59E-05	1.25E-04	1.41E-05	4.85E-04	1.37E-05	7.15E-04	5.63E-03	6.35E-04	-	6.35E-04	1.37E-05	c
Tetrachloroethane, 1,1,1,2-	630-20-6	9.17E+01	-	9.17E+01	8.76E+00	8.00E+00	3.07E+04	-	3.07E+04	-	3.07E+04	8.00E+00	c
Tetrachloroethylene	127-18-4	2.17E+02	1.71E+03	1.92E+02	1.54E+01	1.43E+01	6.13E+03	4.83E+04	5.44E+03	1.55E+02	1.51E+02	1.43E+01	c
Thallium (soluble Thallium)	7440-28-0*	-	-	-	-	-	2.04E+05	4.83E+06	1.96E+05	-	1.96E+05	1.96E+05	nc
Toluene	108-88-3	-	-	-	-	-	8.18E+04	6.44E+05	7.25E+04	8.07E+02	7.98E+02	7.98E+02	nc
Trichloroethylene (non-moa)	79-01-6	6.41E+01	5.05E+02	5.69E+01	7.31E+00	6.47E+00	5.11E+02	4.02E+03	4.53E+02	1.94E+01	1.86E+01	6.47E+00	c
Trichloropropane, 1,2,3-	96-18-4	7.95E-02	6.26E-01	7.05E-02	-	7.05E-02	4.09E+03	3.22E+04	3.63E+03	2.30E+01	2.29E+01	7.05E-02	c
Trimethylbenzene, 1,2,3-	526-73-8	-	-	-	-	-	1.02E+04	8.05E+04	9.07E+03	2.91E+02	2.82E+02	2.82E+02	nc[(d)]
Trimethylbenzene, 1,2,4-	95-63-6	-	-	-	-	-	1.02E+04	8.05E+04	9.07E+03	2.17E+02	2.12E+02	2.12E+02	nc[(d)]
Trimethylbenzene, 1,3,5-	108-67-8	-	-	-	-	-	1.02E+04	8.05E+04	9.07E+03	1.81E+02	1.77E+02	1.77E+02	nc[(d)]
Trinitrotoluene, 2,4,6- (TNT)	118-96-7	7.95E+01	5.87E+02	7.00E+01	-	7.00E+01	5.11E+02	3.77E+03	4.50E+02	-	4.50E+02	7.00E+01	c
Uranium (soluble salts)	Uranium	-	-	-	-	-	6.13E+02	1.45E+04	5.88E+02	-	5.88E+02	5.88E+02	nc
Vanadium	7440-62-2	-	-	-	-	-	7.15E+01	4.39E+01	2.72E+01	4.77E+05	2.72E+01	2.72E+01	nc
Vinyl chloride	75-01-4	1.70E+00	1.34E+01	1.51E+00	9.76E-01	5.93E-01	3.07E+03	2.41E+04	2.72E+03	3.68E+02	3.24E+02	5.93E-01	c
Xylenes	1330-20-7	-	-	-	-	-	2.04E+05	1.61E+06	1.81E+05	2.57E+02	2.57E+02	2.57E+02	nc
Zinc	7440-66-6	-	-	-	-	-	3.07E+05	7.24E+06	2.94E+05	-	2.94E+05	2.94E+05	nc

Notes:

* - CAS Number is for Metallic Thallium

Groundwater temperature of 15°C used in derivation of volatiziation factors with May 2018 Regional Screening Level Calculator.

Csat substitution used if soil inhalation value greater than Csat. Csats derived using May 2018 Regional Screening Level Calculator.

Commercial Noncancer-based soil inhalation value above respective Csat thus Csat substitiouion employed for the following:

Acetone, Carbon Disulfide, Carbon Tetrachloride, Chlorobenzene, Ethylbenzene, Isopropylbenzene (cumene), Mercury (elemental), Methyl ethyl ketone,Methyl tert-butyl ether, n-Propyl benzene, Tetrachloroethylene, Toluene, Trimethyl benzenes, Xylenes.

(a) Benzo(a)pyrene cancer-based value applicable to benzo(a)pyrene itself and to total benzo(a)pyrene toxic equivalents [B(a)P-TE]. Benzo(a)pyrene noncancer-based value applicable only to benzo(a)pyrene itself.

(b) PFAS - Sum of PFHpA, PFHxS, PFNA, PFOS and PFOA not to exceed 14.4 mg/kg.

(c) Polychlorinated Biphenyls -IRIS high risk and persistence cancer toxicity values employed; noncancer assessment of Total PCBs based on oral reference dose and VF for Aroclor 1254.

(d) Trimethyl benzenes -Sum of the three isomers not to exceed 1.77E+02 mg/kg, based on the most conservative value derived for an individual isomer.

ATTACHMENT 3a
VERMONT DEPARTMENT OF HEALTH
EXPOSURE ASSUMPTIONS, PARAMETER VALUES AND FACTORS
2019 RESIDENTIAL SOIL VALUES

SYMBOL	DEFINITION (units)	VALUE	REFERENCE
RSV	Residential Soil Value (mg/kg)	Chemical-Specific	Attachments 1, 2, 4
$RSV_{nc\text{-}ing}$	Resident, Soil, Noncancer, Ingestion (mg/kg)	Chemical-Specific	Attachment 4
$RSV_{nc\text{-}der}$	Resident, Soil, Noncancer, Dermal (mg/kg)	Chemical-Specific	Attachment 4
$RSV_{nc\text{-}inh}$	Resident, Soil, Noncancer, Inhalation (mg/kg)	Chemical-Specific	Attachment 4
$RSV_{nc\text{-}comb}$	Resident, Soil, Noncancer, Combined Routes of Exposure (mg/kg)	Chemical-Specific	Attachment 4
$RSV_{ca\text{-}ing}$	Resident, Soil, Cancer, Ingestion (mg/kg)	Chemical-Specific	Attachment 4
$RSV_{ca\text{-}der}$	Resident, Soil, Cancer, Dermal (mg/kg)	Chemical-Specific	Attachment 4
$RSV_{ca\text{-}inh}$	Resident, Soil, Cancer, Inhalation (mg/kg)	Chemical-Specific	Attachment 4
$RSV_{ca\text{-}comb}$	Resident, Soil, Cancer, Combined Routes of Exposure (mg/kg)	Chemical-Specific	Attachment 4
$RSV_{m\text{-}ing}$	Resident, Soil, Mutagenic, Ingestion (mg/kg)	Chemical-Specific	Attachment 4
$RSV_{m\text{-}der}$	Resident, Soil, Mutagenic, Dermal (mg/kg)	Chemical-Specific	Attachment 4
$RSV_{m\text{-}inh}$	Resident, Soil, Mutagenic, Inhalation (mg/kg)	Chemical-Specific	Attachment 4
$RSV_{m\text{-}comb}$	Resident, Soil, Mutagenic, Combined Routes of Exposure (mg/kg)	Chemical-Specific	Attachment 4
RfD_O	Chronic Oral Reference Dose (mg/kg-d)	Chemical-Specific	Attachment 2
RfC	Chronic Inhalation Reference Concentration (mg/m^3)	Chemical-Specific	Attachment 2
CSF_O	Oral Cancer Slope Factor $(mg/kg\text{-}d)^{-1}$	Chemical-Specific	Attachment 2
IUR	Inhalation Unit Risk $(\mu g/m^3)^{-1}$	Chemical-Specific	Attachment 2
THQ	Target Hazard Quotient (unitless)	1.0	See Text
TR	Target Incremental Lifetime Cancer Risk (unitless)	$1x10^{-6}$	See Text
LT	Lifetime (years)	70	EPA, 1989
$AT_{R\text{-}nc}$	Averaging Time, Resident, Noncancer (days)	$365 \times ED_{YC} = 2190$	Calculated
$AT_{R\text{-}ca}$	Averaging Time, Resident, Cancer (days)	$365 \times ED_{LT} = 25550$	Calculated
IR_{YC}	Soil Ingestion Rate, Young $Child_{Birth\text{-}<6years}$ (mg/day)	200	EPA, 1991
IR_{OC}	Soil Ingestion Rate, Older $Child_{6\text{-}<18years}$ (mg/day)	100	EPA, 1991
$IR_{Birth\text{-}<2\ yr}$	Soil Ingestion Rate, Fine Age Range $Child_{Birth\text{-}<2years}$ (mg/day)	200	EPA, 1991
$IR_{2\text{-}<6yr}$	Soil Ingestion Rate, Fine Age Range $Child_{2\text{-}<6years}$ (mg/day)	200	EPA, 1991
$IR_{6\text{-}<16yr}$	Soil Ingestion Rate, Fine Age Range $Child_{6\text{-}<16years}$ (mg/day)	100	EPA, 1991
$IR_{16\text{-}<18yr}$	Soil Ingestion Rate, Fine Age Range $Child_{16\text{-}<18years}$ (mg/day)	100	EPA, 1991
IR_A	Soil Ingestion Rate, Adult (mg/day)	100	EPA, 1991
$IFS_{R\text{-}adj}$	Resident Soil Ingestion Rate Factor, Age-adjusted (mg/kg)	65,439	Attachment 4
$IFSM_{R\text{-}adj}$	Resident Mutagenic Soil Ingestion Rate Factor, Age-adjusted (mg/kg)	250,620	Attachment 4
SA_{YC}	Skin Surface Area, Young $Child_{Birth\text{-}<6years}$ (cm^2)	2336	(a)
SA_{OC}	Skin Surface Area, Older $Child_{6\text{-}<18years}$ (cm^2)	4591	(a)
$SA_{Birth\text{-}<2\ yr}$	Skin Surface Area, Fine Age Range $Child_{Birth\text{-}<2years}$ (cm^2)	2028	(a)
$SA_{2\text{-}<6yr}$	Skin Surface Area, Fine Age Range $Child_{2\text{-}<6years}$ (cm^2)	2490	(a)
$SA_{6\text{-}<16yr}$	Skin Surface Area, Fine Age Range $Child_{6\text{-}<16years}$ (cm^2)	4407	(a)
$SA_{16\text{-}<18yr}$	Skin Surface Area, Fine Age Range $Child_{16<18years}$ (cm^2)	5512	(a)
SA_A	Skin Surface Area, Adult (cm^2)	6034	(a)
$DFS_{R\text{-}adj}$	Soil Dermal Contact Factor, Age-adjusted (mg/kg)	266,522	Attachment 4
$DFSM_{R\text{-}adj}$	Mutagenic Soil Dermal Contact Factor, Age-adjusted (mg/kg)	770,281	Attachment 4
AD_c	Soil on Skin Adherence Factor, Child (mg/cm^2)	0.2	EPA, 2002
AD_A	Soil on Skin Adherence Factor, Adult (mg/cm^2)	0.07	EPA, 2002
BW_{YC}	Body Weight, Young $Child_{Birth\text{-}<6years}$ (kg)	15	(b)
BW_{OC}	Body Weight, Older $Child_{6\text{-}<18years}$ (kg)	48	(b)

$BW_{Birth-<2yr}$	Body Weight, Fine Age Range, $Child_{Birth-<2years}$ (kg)	10	(b)
$BW_{2-<6yr}$	Body Weight, Fine Age Range, $Child_{2-<6years}$ (kg)	17	(b)
$BW_{6-<16yr}$	Body Weight, Fine Age Range, $Child_{6-<16years}$ (kg)	44	(b)
$BW_{16-<18yr}$	Body Weight, Fine Age Range, $Child_{16<18years}$ (kg)	67	(b)
BW_A	Body Weight, Adult (kg)	70	EPA, 1991
ABS_d	Fraction of chemical absorbed from soil due to dermal contact (unitless)	Chemical-specific	EPA, 2004 (Exhibit 3-4); See Text
ABS_{GI}	Fraction of chemical absorbed in gastrointestinal tract (unitless). If ABS_{GI} >50%, a value of 1 (100%) used.	Chemical-specific	EPA, 2004 (Exhibit 4-1)
EF_{YC}	Exposure Frequency, Young $Child_{Birth-<6years}$ (days/year)	365	See Text
EF_{OC}	Exposure Frequency, Older $Child_{6-<18years}$ (days/year)	365	See Text
$EF_{Birth-<2yr}$	Exposure Frequency, Fine Age Range $Child_{Birth-<2years}$ (days/year)	365	See Text
$EF_{2-<6yr}$	Exposure Frequency, Fine Age Range $Child_{2-<6years}$ (days/year)	365	See Text
$EF_{6-<16yr}$	Exposure Frequency, Fine Age Range $Child_{6-<16years}$ (days/year)	365	See Text
$EF_{16-<18yr}$	Exposure Frequency, Fine Age Range $Child_{16-<18years}$ (days/year)	365	See Text
EF_A	Exposure Frequency, Adult (days/year)	365	See Text
ED_{YC}	Exposure Duration, Young $Child_{Birth-<6years}$ (years)	6	EPA, 1991
ED_{OC}	Exposure Duration, Older $Child_{6-<18years}$ (years)	12	Calculated
$ED_{Birth-<2yr}$	Exposure Duration, Fine Age Range $Child_{Birth-<2years}$ (years)	2	Calculated
$ED_{2-<6yr}$	Exposure Duration, Fine Age Range $Child_{2-<6years}$ (years)	4	Calculated
$ED_{6-<16yr}$	Exposure Duration, Fine Age Range $Child_{6-<16years}$ (years)	10	Calculated
$ED_{16-<18yr}$	Exposure Duration, Fine Age Range, $Child_{16-<18years}$ (years)	2	Calculated
ED_A	Exposure Duration, Adult (years)	52	Calculated
ET_{YC}	Exposure Time, Young $Child_{Birth-<6years}$ (hours/day)	24	EPA, 2018
ET_{OC}	Exposure Time, Older $Child_{6-<18years}$ (hours/day	24	EPA, 2018
$ET_{Birth-<2yr}$	Exposure Time, Fine Age Range $Child_{Birth-<2years}$ (hours/day)	24	EPA, 2018
$ET_{2-<6yr}$	Exposure Time, Fine Age Range $Child_{2-<6years}$ (hours/day)	24	EPA, 2018
$ET_{6-<16yr}$	Exposure Time, Fine Age Range $Child_{6-<16years}$ (hours/day)	24	EPA, 2018
$ET_{16-<18yr}$	Exposure Time, Fine Age Range $Child_{16-<18years}$ (hours/day)	24	EPA, 2018
ET_A	Exposure Time, Adult (hours/day)	24	EPA, 2018
$InFSM_{R-adj}$	Mutagenic Soil Inhalation Factor, Age-adjusted (days)	42,340	Attachment 4
PEF	Particulate Emission Factor (wind-driven) (m^3/kg)	1.36×10^9	EPA, 2018[(c)]
VF	Volatilization Factor (m^3/kg)	Chemical-Specific	EPA, 2018[(d)]
RBA	Relative Bioavailability (unitless)	1	See Text
SCMF	Snow Cover Modification Factor (unitless)	(e)	See Text

Notes:

(a) Surface areas derived using information presented in EPA, 2011 and Boniol et al., 2007 for sexes combined. Mean of 50th percentile (consistent with EPA, 1989 p. 3-39) Total Body Surface Area for each age range of interest developed. Head, hands, forearms, lower legs and feet considered in contact/exposed for all Child age ranges. Consistent with EPA, 2004 (p. 3-10), head, hands, forearms and lower legs considered for Adult. Percent of Total Surface Area represented by body parts considered in contact/exposed was calculated (mean across age range of interest).

(b) Average mean annual Body Weight for age range of interest (based on both sexes) derived using information presented in Portier, et al., 2007.

(c) Default value employed in U.S. EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites. (accessed January 2019).

(d) Chemical-specific Volatilization Factors from U.S. EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites. (accessed September 10, 2018 through February 4, 2019).

(e) Snow Cover Modification Factor (SCMF) of 0.7342 applied only to soil inhalation route and only for chemicals that meet "v" criteria (effectively yields exposure frequency of 268 days per year for this route of exposure for this receptor). SCMF of 1 employed for all other routes and for chemicals that do not meet "v" criteria.

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ATTACHMENT 3b
VERMONT DEPARTMENT OF HEALTH
EXPOSURE ASSUMPTIONS, PARAMETER VALUES AND FACTORS
2019 COMMERCIAL WORKER SOIL VALUES

SYMBOL	DEFINITION (units)	VALUE	REFERENCE
CSV	Commercial Worker Soil Value (mg/kg)	Chemical-Specific	Attachments 1, 2, 4
$CSV_{nc\text{-}ing}$	Commercial Worker, Soil, Noncancer, Ingestion (mg/kg)	Chemical-Specific	Attachment 4
$CSV_{nc\text{-}der}$	Commercial Worker, Soil, Noncancer, Dermal (mg/kg)	Chemical-Specific	Attachment 4
$CSV_{nc\text{-}inh}$	Commercial Worker, Soil, Noncancer, Inhalation (mg/kg)	Chemical-Specific	Attachment 4
$CSV_{nc\text{-}comb}$	Commercial Worker, Soil, Noncancer, Combined Routes of Exposure (mg/kg)	Chemical-Specific	Attachment 4
$CSV_{ca\text{-}ing}$	Commercial Worker, Soil, Cancer, Ingestion (mg/kg)	Chemical-Specific	Attachment 4
$CSV_{ca\text{-}der}$	Commercial Worker, Soil, Cancer, Dermal (mg/kg)	Chemical-Specific	Attachment 4
$CSV_{ca\text{-}inh}$	Commercial Worker, Soil, Cancer, Inhalation (mg/kg)	Chemical-Specific	Attachment 4
$CSV_{ca\text{-}comb}$	Commercial Worker, Soil, Cancer, Combined Routes of Exposure (mg/kg)	Chemical-Specific	Attachment 4
RfD_O	Chronic Oral Reference Dose (mg/kg-d)	Chemical-Specific	Attachment 2
RfC	Chronic Inhalation Reference Concentration (mg/m^3)	Chemical-Specific	Attachment 2
CSF_O	Oral Cancer Slope Factor $(mg/kg\text{-}d)^{-1}$	Chemical-Specific	Attachment 2
IUR	Inhalation Unit Risk $(\mu g/m^3)^{-1}$	Chemical-Specific	Attachment 2
THQ	Target Hazard Quotient (unitless)	1.0	See Text
TR	Target Incremental Lifetime Cancer Risk (unitless)	$1x10^{-6}$	See Text
LT	Lifetime (years)	70	EPA, 1989
$AT_{R\text{-}nc}$	Averaging Time, Commercial Worker, Noncancer (days)	$365 \times ED_W = 9125$	Calculated
$AT_{R\text{-}ca}$	Averaging Time, Commercial Worker, Cancer (days)	$365 \times ED_{LT} = 25550$	Calculated
IR_W	Soil Ingestion Rate, Commercial Worker (mg/day)	100	EPA, 1991
SA_W	Skin Surface Area, Adult (cm^2)	3527	(a)
AD_W	Soil on Skin Adherence Factor, Adult (mg/cm^2)	0.12	EPA, 2014
BW_W	Body Weight, Adult (kg)	70	EPA, 1991
ABS_d	Fraction of chemical absorbed from soil due to dermal contact (unitless)	Chemical-specific	EPA, 2004 (Exhibit 3-4); See Text
ABS_{GI}	Fraction of chemical absorbed in gastrointestinal tract (unitless). If ABS_{GI} >50%, a value of 1 (100%) used.	Chemical-specific	EPA, 2004 (Exhibit 4-1)
EF_W	Exposure Frequency, Ingestion & Dermal Commercial Worker (days/year)	250	EPA, 1991
ET_W	Exposure Time, Adult (hours/day)	10	BLS, 2016
PEF	Particulate Emission Factor (wind-driven) (m^3/kg)	1.36×10^9	EPA, 2018[(c)]
VF	Volatilization Factor (m^3/kg)	Chemical-Specific	EPA, 2018[(d)]
RBA	Relative Bioavailability (unitless)	1	See Text

Notes:
(a) Surface areas derived using information presented in EPA, 2011, Table 7-2; weighted average of mean values for head, hands, and forearms (male and female, 21+years)
(b) Average mean annual Body Weight for age range of interest (based on both sexes) derived using information presented in Portier, et al., 2007.
(c) Default value employed in U.S. EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites (accessed January 2019).

(d) Chemical-specific Volatilization Factors from U.S. EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites (accessed September 10, 2018 through February 2019).

References:

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Portier et al., 2007. Body weight distributions for risk assessment. Risk Anal 27(1):11-26.

ATTACHMENT 4a
VERMONT DEPARTMENT OF HEALTH
ENDPOINT AND PATHWAY SPECIFIC EQUATIONS
2019 RESIDENTIAL SOIL VALUES

- **Noncarcinogenic (threshold type, systemic effects)**
  Residential Soil Values

  - Ingestion

$$RSV_{nc-ing}(mg/kg) = \frac{THQ * AT_{R-nc}\left(\frac{365\ days}{year} * ED_{YC}(6\ years)\right) * BW_{YC}(15\ kg)}{EF_{YC}\left(\frac{365\ days}{year}\right) * ED_{YC}(6\ years) * \frac{RBA}{RfD_0\left(\frac{mg}{kg-day}\right)} * IR_{YC}\left(\frac{200\ mg}{day}\right) * \frac{10^{-6}\ kg}{1\ mg}}$$

  - Dermal

$$RSV_{nc-der}(mg/kg) = \frac{THQ * AT_{R-nc}\left(\frac{365\ days}{year} * ED_{YC}(6\ years)\right) * BW_{YC}(15\ kg)}{EF_{YC}\left(\frac{365\ days}{year}\right) * ED_{YC}(6\ years) * \frac{1}{\left(RfD_0\left(\frac{mg}{kg-day}\right) * ABS_{GI}\right)} * SA_{YC}\left(\frac{2336\ cm^2}{day}\right) * AD_C\left(\frac{0.2\ mg}{cm^2}\right) * ABS_d * \frac{10^{-6}\ kg}{1\ mg}}$$

  - Inhalation

$$RSV_{nc-inh}(mg/kg) = \frac{THQ * AT_{R-nc}\left(\frac{365\ days}{year} * ED_{YC}(6\ years)\right)}{EF_{YC}\left(\frac{365\ days}{year}\right) * SCMF * ED_{YC}(6\ years) * ET_{YC}\left(\frac{24\ hours}{day} * \frac{1\ day}{24\ hours}\right) * \frac{1}{RfC\left({}^{mg}/_{m^3}\right)} * \left(\frac{1}{VF\left(\frac{m^3}{kg}\right)} + \frac{1}{PEF\left(\frac{m^3}{kg}\right)}\right)}$$

  - Combined Routes of Exposure
    RSVs for individual routes of exposure and various routes combined are presented in Attachment 2a

$$RSV_{nc-comb}(mg/kg) = \frac{1}{\frac{1}{RSV_{nc-ing}} + \frac{1}{RSV_{nc-der}} + \frac{1}{RSV_{nc-inh}}}$$

- **Carcinogenic**
  Residential Soil Values

  - Ingestion

$$RSV_{ca-ing}(mg/kg) = \frac{TR * AT_{R-ca}\left(\frac{365\ days}{year} * LT(70\ years)\right)}{CSF_0\left(\frac{mg}{kg-day}\right)^{-1} * RBA * IFS_{R-adj}\left(\frac{65{,}439\ mg}{kg}\right) * \frac{10^{-6}\ kg}{mg}}$$

Where:

$$IFS_{R-adj}\left(\frac{65{,}439\ mg}{kg}\right) = \frac{EF_{YC}\left(\frac{365\ days}{year}\right) * ED_{YC}(6\ years) * IRS_{YC}\left(\frac{200\ mg}{day}\right)}{BW_{YC}(15\ kg)} + \frac{EF_{OC}\left(\frac{365\ days}{year}\right) * ED_{OC}(12\ years) * IRS_{OC}\left(\frac{100\ mg}{day}\right)}{BW_{OC}(48\ kg)} + \frac{EF_A\left(\frac{365\ days}{year}\right) * ED_A(52\ years) * IRS_A\left(\frac{100\ mg}{day}\right)}{BW_A(70\ kg)}$$

- Dermal

$$RSV_{ca-der}(mg/kg) = \frac{TR * AT_{R-ca}\left(\frac{365\ days}{year} * LT(70\ years)\right)}{\left(\frac{CSF_0\left(\frac{mg}{kg-day}\right)^{-1}}{ABS_{GI}}\right) * DFS_{R-adj}\left(\frac{266{,}522\ mg}{kg}\right) * ABS_d * \left(\frac{10^{-6}\ kg}{mg}\right)}$$

Where:

$$DFS_{R-adj}\left(\frac{266{,}522\ mg}{kg}\right) = \frac{EF_{YC}\left(\frac{365\ days}{year}\right) * ED_{YC}(6\ years) * SA_{YC}\left(\frac{2336\ cm^2}{day}\right) * AD_C\left(\frac{0.2\ mg}{cm^2}\right)}{BW_{yc}(15\ kg)} + \frac{EF_{OC}\left(\frac{365\ days}{year}\right) * ED_{OC}(12\ years) * SA_{OC}\left(\frac{4591\ cm^2}{day}\right) * AD_C\left(\frac{0.2\ mg}{cm^2}\right)}{BW_{OC}(48\ kg)} + \frac{EF_A\left(\frac{365\ days}{year}\right) * ED_A(52\ years) * SA_A\left(\frac{6034\ cm^2}{day}\right) * AD_A\left(\frac{0.07\ mg}{cm^2}\right)}{BW_A(70\ kg)}$$

- Inhalation

$$RSV_{ca-inh}(mg/kg) = \frac{TR * AT_{R-ca}\left(\frac{365\ days}{year} * LT\ (70\ years)\right)}{IUR(^{\mu g}/_{m^3})^{-1} * \left(\frac{1000\ \mu g}{mg}\right) * EF_R\left(\frac{365\ days}{year}\right) * SCMF * \left(\frac{1}{VF\left(\frac{m^3}{kg}\right)} + \frac{1}{PEF\left(\frac{m^3}{kg}\right)}\right) * ED_R(70\ years) * ET_R\left(\frac{24\ hours}{day} * \frac{1\ day}{24\ hours}\right)}$$

- Combined Routes of Exposure

RSVs for individual routes of exposure and various routes combined are presented in Attachment 2a

$$RSV_{ca-comb}(mg/kg) = \frac{1}{\frac{1}{RSV_{ca-ing}} + \frac{1}{RSV_{ca-der}} + \frac{1}{RSV_{ca-inh}}}$$

- **Carcinogenic via Mutagenic Mode of Action and Default ADAFs used**

Residential Soil Values

- Ingestion

$$RSV_{m-ing}(mg/kg) = \frac{TR * AT_{R-ca}\left(\frac{365\ days}{year} * LT(70\ years)\right)}{CSF_0\left(\frac{mg}{kg-day}\right)^{-1} * RBA * IFSM_{R-adj}\left(\frac{250{,}620\ mg}{kg}\right) * \frac{10^{-6}\ kg}{mg}}$$

Where:

$$IFSM_{R-adj}\left(\frac{250{,}620\ mg}{kg}\right) = \frac{EF_{Birth-<2yr}\left(\frac{365\ days}{year}\right) * ED_{Birth-<2yr}(2\ years) * IR_{Birth-<2yr}\left(\frac{200\ mg}{day}\right) * 10}{BW_{Birth-<2yrs}(10\ kg)} + \frac{EF_{2-<6yr}\left(\frac{365\ days}{year}\right) * ED_{2-<6yr}(4\ years) * IR_{2-<6yr}\left(\frac{200\ mg}{day}\right) * 3}{BW_{2-<6yrs}(17\ kg)} + \frac{EF_{6-<16yr}\left(\frac{365\ days}{year}\right) * ED_{6-<16yr}(10\ years) * IR_{6-<16yr}\left(\frac{100\ mg}{day}\right) * 3}{BW_{6-<16yr}(44\ kg)} + \frac{EF_{16-<18yr}\left(\frac{365\ days}{year}\right) * ED_{16-<18yr}(2\ years) * IR_{16-<18yr}\left(\frac{100\ mg}{day}\right) * 1}{BW_{16-<18yr}(67\ kg)} + \frac{EF_A\left(\frac{365\ days}{year}\right) * ED_A(52\ years) * IR_A\left(\frac{100\ mg}{day}\right) * 1}{BW_A(70\ kg)}$$

- Dermal

$$RSV_{m-der}(mg/kg) = \frac{TR * AT_{R-ca}\left(\frac{365\ days}{year} * LT(70\ years)\right)}{\left(\frac{CSF_0\left(\frac{mg}{kg-day}\right)^{-1}}{ABS_{GI}}\right) * DFSM_{R-adj}\left(\frac{770{,}281\ mg}{kg}\right) * ABS_d * \left(\frac{10^{-6}\ kg}{mg}\right)}$$

Where:

$$DFSM_{R-adj}\left(\frac{770{,}281\ mg}{kg}\right) =$$

$$\frac{EF_{Birth-<2yr}\left(\frac{365\ days}{year}\right) * ED_{Birth-<2yr}(2\ years) * SA_{Birth-<2yr}\left(\frac{2028\ cm^2}{day}\right) * AD_C\left(\frac{0.2\ mg}{cm^2}\right) * 10}{BW_{Birth-<2yrs}(10\ kg)}$$
$$+ \frac{EF_{2-<6yr}\left(\frac{365\ days}{year}\right) * ED_{2-<6yr}(4\ years) * SA_{2-<6yr}\left(\frac{2490\ cm^2}{day}\right) * AD_C\left(\frac{0.2\ mg}{cm^2}\right) * 3}{BW_{2-<6yr}(17\ kg)}$$
$$+ \frac{EF_{6-<16yr}\left(\frac{365\ days}{year}\right) * ED_{6-<16yr}(10\ years) * SA_{6-<16yr}\left(\frac{4407\ cm^2}{day}\right) * AD_C\left(\frac{0.2\ mg}{cm^2}\right) * 3}{BW_{6-<16yr}(44\ kg)}$$
$$\frac{EF_{16-<18yr}\left(\frac{365\ days}{year}\right) * ED_{16-<18yr}(2\ years) * SA_{16-<18yr}\left(\frac{5512\ cm^2}{day}\right) * AD_C\left(\frac{0.2\ mg}{cm^2}\right) * 1}{BW_{16-<18yr}(67\ kg)}$$
$$+ \frac{EF_A\left(\frac{365\ days}{year}\right) * ED_A(52\ years) * SA_A\left(\frac{6034\ cm^2}{day}\right) * AD_A\left(\frac{0.07\ mg}{cm^2}\right) * 1}{BW_A(70\ kg)}$$

- Inhalation

$$RSV_{m-inh}(mg/kg) = \frac{TR * AT_{R-ca}\left(\frac{365\ days}{year} * LT\ (70\ years)\right)}{IUR(^{\mu g}/_{m^3})^{-1} * \left(\frac{1000\ \mu g}{mg}\right) * SCMF * \left(\frac{1}{VF\left(\frac{m^3}{kg}\right)} + \frac{1}{PEF\left(\frac{m^3}{kg}\right)}\right) * \ InFSM_{R-adj}(42{,}340\ days)}$$

Where:

$InFSM_{R\text{-}adj}$ (42,340 days) =

$$[ET_{Birth-<2yr}\left(\frac{24\ hours}{day} * \frac{1\ day}{24\ hours}\right) * EF_{Birth-<2yr}\left(\frac{365\ days}{year}\right) * ED_{Birth-<2yr}(2\ years) * 10] +$$
$$[ET_{2-<6yr}\left(\frac{24\ hours}{day} * \frac{1\ day}{24\ hours}\right) * EF_{2-<6yr}\left(\frac{365\ days}{year}\right) * ED_{2-<6yr}(4\ years) * 3] +$$
$$[ET_{6-<16yr}\left(\frac{24\ hours}{day} * \frac{1\ day}{24\ hours}\right) * EF_{6-<16yr}\left(\frac{365\ days}{year}\right) * ED_{6-<16yr}(10\ years) * 3] +$$
$$[ET_{16-<18yr}\left(\frac{24\ hours}{day} * \frac{1\ day}{24\ hours}\right) * EF_{16-<18yr}\left(\frac{365\ days}{year}\right) * ED_{16-<18yr}(2\ years) * 1] +$$
$$[ET_A\left(\frac{24\ hours}{day} * \frac{1\ day}{24\ hours}\right) * EF_A\left(\frac{365\ days}{year}\right) * ED_A(52\ years) * 1]$$

- Combined Pathways

RSVs for individual routes of exposure and various routes combined are presented in Attachment 2a

$$RSV_{m-comb}(mg/kg) = \frac{1}{\frac{1}{RSV_{m-ing}} + \frac{1}{RSV_{m-der}} + \frac{1}{RSV_{m-inh}}}$$

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VERMONT DEPARTMENT OF HEALTH
ENDPOINT AND PATHWAY SPECIFIC EQUATIONS
2019 COMMERCIAL WORKER SOIL VALUES

- **Noncarcinogenic (threshold type, systemic effects)**
  Commercial Worker Soil Values

  - Ingestion

$$CSV_{nc-ing}(mg/kg) = \frac{THQ * AT_{W-nc}\left(\frac{365\ days}{year} * ED_W(30\ years)\right) * BW_W(70\ kg)}{EF_W\ \left(\frac{250\ days}{year}\right) * ED_W(30\ years) * \frac{RBA}{RfD_0\left(\frac{mg}{kg-day}\right)} * IR_W\left(\frac{100\ mg}{day}\right) * \frac{10^{-6}\ kg}{1\ mg}}$$

  - Dermal

$$CSV_{nc-der}(mg/kg) = \frac{THQ * AT_{W-nc}\left(\frac{365\ days}{year} * ED_W(30\ years)\right) * BW_W(70\ kg)}{EF_W\ \left(\frac{250\ days}{year}\right) * ED_W(30\ years) * \frac{1}{\left(RfD_0\left(\frac{mg}{kg-day}\right) * ABS_{GI}\right)} * SA_W\left(\frac{3527}{day}\right) * AD_W\left(\frac{0.12\ mg}{cm^2}\right) * ABS_d * \frac{10^{-6}\ kg}{1\ mg}}$$

  - Inhalation

$$CSV_{nc-inh}(mg/kg) = \frac{THQ * AT_{W-nc}\left(\frac{365\ days}{year} * ED_W(30\ years)\right)}{EF_W\left(\frac{250\ days}{year}\right) * ED_W(30\ years) * ET_W\left(\frac{10\ hours}{day} * \frac{1\ day}{24\ hours}\right) * \frac{1}{RfC\left({}^{mg}/_{m^3}\right)} * \left(\frac{1}{VF\left(\frac{m^3}{kg}\right)} + \frac{1}{PEF\left(\frac{m^3}{kg}\right)}\right)}$$

  - Combined Routes of Exposure
    CSVs for individual routes of exposure and various routes combined are presented in Attachment 2b

$$CSV_{nc-comb}(mg/kg) = \frac{1}{\frac{1}{CSV_{nc-ing}} + \frac{1}{CSV_{nc-der}} + \frac{1}{CSV_{nc-inh}}}$$

- **Carcinogenic**
- Commercial Worker Soil Values
    - Ingestion

$$CSV_{ca-ing}(mg/kg) = \frac{TR * AT_{W-ca}\left(\frac{365\ days}{year} * LT(70\ years)\right)}{CSF_0\left(\frac{mg}{kg-day}\right)^{-1} * RBA * \left(\frac{EF_W\left(\frac{250\ days}{year}\right) * ED_W(30 years) * IRS_W\left(\frac{100\ mg}{day}\right)}{BW\ (70kg)}\right) * \frac{10^{-6}\ kg}{mg}}$$

    - Dermal

$$CSV_{ca-der}(mg/kg) = \frac{TR * AT_{W-ca}\left(\frac{365\ days}{year} * LT(70\ years)\right)}{\left(\frac{CSF_0\left(\frac{mg}{kg-day}\right)^{-1}}{ABS_{GI}}\right) * \left(\frac{EF_W\left(\frac{250\ days}{year}\right) * ED_W(30\ years) * SA_W\left(\frac{3527\ cm^2}{day}\right) * AD_W\left(\frac{0.12\ mg}{cm^2}\right)}{BW\ (70kg)}\right) * ABS_d * \left(\frac{10^{-6}\ kg}{mg}\right)}$$

    - Inhalation

$$CSV_{ca-inh}(mg/kg) = \frac{TR * AT_{W-ca}\left(\frac{365\ days}{year} * LT\ (70\ years)\right)}{IUR(^{\mu g}/_{m^3})^{-1} * \left(\frac{1000\ \mu g}{mg}\right) * EF_W\left(\frac{250\ days}{year}\right) * \left(\frac{1}{VF\left(\frac{m^3}{kg}\right)} + \frac{1}{PEF\left(\frac{m^3}{kg}\right)}\right) * ED_W(30\ years) * ET_W\left(\frac{10\ hours}{day} * \frac{1\ day}{24\ hours}\right)}$$

    - Combined Routes of Exposure

      CSVs for individual routes of exposure and various routes combined are presented in Attachment 2b

$$CSV_{ca-comb}(mg/kg) = \frac{1}{\frac{1}{CSV_{ca-ing}} + \frac{1}{CSV_{ca-der}} + \frac{1}{CSV_{ca-inh}}}$$