Figure: 30 TAC §350.74(a)

Risk-Based Exposure Limit Equations and Default Exposure Factors for Residents

RBEL-1:

Inhalation of carcinogenic COCs - RBEL (mg/m^3)

$$^{Air}RBEL_{Inh-c} = \frac{RL \times ATc \times 365 \text{ days/yr}}{URF \times 1000 \text{ } \mu g/mg \times EF.res \times ED.A.res}$$

Inhalation of noncarcinogenic COCs - RBEL (mg/m^3)

$$^{Air}RBEL_{Inh-nc} = \frac{RfC \times HQ \times AT.A.res \times 365 \text{ days/yr}}{EF.res \times ED.A.res}$$

RBEL-2:

Dermal contact with carcinogenic COCs in soil - RBEL (mg/kg)

$$^{Soil}RBEL_{Derm-c} = \frac{RL \times ATc \times 365 \text{ days/yr}}{SF_d \times MF \times 10^{-6} \text{ kg/mg} \times EF.res \times DF.adj \times ABS.d}$$

where: $SF_d = \dfrac{SF_o}{ABS_{GI}}$ when $ABS_{GI} < 50\%$, otherwise $SF_d = SF_o$; and

$$DF.adj = \frac{(SA_{0<6})(AF_{0<6})(ED_{0<6})}{(BW_{0<6})} + \frac{(SA_{6<18})(AF_{6<18})(ED_{6<18})}{(BW_{6<18})} + \frac{(SA_{18<30})(AF_{18<30})(ED_{18<30})}{(BW_{18<30})}$$

Dermal contact with noncarcinogenic COCs in soil - RBEL (mg/kg)

$$^{Soil}RBEL_{Derm-nc} = \frac{HQ \times RfD_d \times BW.C \times AT.C.res \times 365 \text{ days/yr}}{10^{-6} \text{ kg/mg} \times ED.C.res \times EF.res \times SA.C.res \times AF.C.res \times ABS.d}$$

where $RfD_d = (RfD_o)(ABS_{GI})$ when $ABS_{GI} < 50\%$, otherwise $RfD_d = RfD_o$

RBEL-3:

Ingestion of carcinogenic COCs in soil - RBEL (mg/kg)

$$^{Soil}RBEL_{Ing-c} = \frac{RL \times ATc \times 365 \text{ days/yr}}{SF_o \times MF \times 10^{-6} \text{ kg/mg} \times EF.res \times IRsoil.AgeAdj.res \times RBAF}$$

Ingestion of noncarcinogenic COCs in soil - RBEL (mg/kg)

$$^{Soil}RBEL_{Ing-nc} = \frac{HQ \times BW.C \times RfD_o \times AT.C.res \times 365 \text{ days/yr}}{10^{-6} \text{ kg/mg} \times EF.res \times ED.C.res \times IRsoil.C.res \times RBAF}$$

RBEL-5:

Class 3 Groundwater RBEL

$$^{GW}RBEL_{Class \text{ } 3} = 100 \times RBEL\text{-}4$$

RBEL-7:

Ingestion of carcinogenic COCs in above-ground vegetables - RBEL (mg/kg)

$$^{AbgVeg}RBEL_{Ing-c} = \frac{RL \times ATc \times 365 \text{ day/yr}}{EF.res \times SF_o \times MF \times IRabg.AgeAdj.res}$$

Ingestion of noncarcinogenic COCs in above-ground vegetables - RBEL (mg/kg)

$$^{AbgVeg}RBEL_{Ing-nc} = \frac{HQ \times RfD_o \times BW.C \times AT.C.res \times 365 \text{ day/yr}}{EF.res \times ED.C.res \times IRabg.C.res}$$

Ingestion of carcinogenic COCs in below-ground vegetables - RBEL (mg/kg)

$$^{BgVeg}RBEL_{Ing-c} = \frac{RL \times ATc \times 365 \text{ day/yr}}{EF.res \times SF_o \times MF \times IRbg.AgeAdj.res}$$

Ingestion of noncarcinogenic COCs in below-ground vegetables - RBEL (mg/kg)

$$^{BgVeg}RBEL_{Ing-nc} = \frac{HQ \times RfD_o \times BW.C \times AT.C.res \times 365 \text{ day/yr}}{EF.res \times ED.C.res \times IRbg.C.res}$$

Risk-Based Exposure Limit Equations and Default Exposure Factors for Residents	
RBEL-4: Ingestion of carcinogenic COCs in water - RBEL (mg/L) $^{GW}RBEL_{Ing-c}$ = primary MCL when available, or a secondary MCL under the conditions described in §350.74(f)(3), otherwise $$\frac{RL \times AT_c \times 365 \text{ days/yr}}{SF_o \times MF \times IRw.AgeAdj.res \times EF.res}$$ Ingestion of noncarcinogenic COCs in water - RBEL (mg/L) $^{GW}RBEL_{Ing-nc}$ = primary MCL when available, or a secondary MCL under the conditions described in §350.74(f)(3), otherwise $$\frac{RfD_o \times HQ \times BW.C \times AT.C.res \times 365 \text{ days/yr}}{IRw.C.res \times EF.res \times ED.C.res}$$	RBEL-6: Surface Water RBEL $^{SW}RBEL$ = the lowest value of each COC established under §350.74(h)(1) - (5), unless the person has sufficient property-specific surface water quality information specific to the particular surface water body at the affected property to support an adjustment to the RBEL in accordance with §350.74(h)(6). $^{SW}RBEL$ determined pursuant to §350.74(h)(1) - (5) may require modification in response to §350.74(h)(7) - (8).

		Risk-Based Exposure Limit Equations and Default Exposure Factors for Residents			
Term	Exposure Factor	Default Exposure Factor	Change to Default Exposure Factor Allowed?	Citation for Change	
ABS.d[**]	Dermal Absorption Fraction (unitless)	(Figure: 30 TAC §350.74(c))	Tier 2/3	§350.74(j)(1)(B)	
ABS_{GI}	Gastrointestinal Absorption Fraction (unitless)	(Figure: 30 TAC §350.74(c))	Tier 2/3	§350.74(j)(1)(A)	
AF.C.res	Soil-to-Skin Adherence Factor (mg/cm^2-event) - Child	0.2	No	NA	
$AF_{(0<6)}$	Age-Specific Adherence Factor (mg/cm^2-event)	0.2	No	NA	
$AF_{(6<18)}$	Age-Specific Adherence Factor (mg/cm^2-event)	0.1	No	NA	
$AF_{(18<30)}$	Age-Specific Adherence Factor (mg/cm^2-event)	0.1	No	NA	
AT.A.res	Averaging Time - noncarcinogens (yr)-Adult	30	No	NA	
ATc	Averaging Time - carcinogens (yr)	70	No	NA	
AT.C.res	Averaging Time - noncarcinogens (yr) -Child	6	No	NA	
BW.C	Body Weight (kg) - Child	15	No	NA	
$BW_{(0<6)}$	Age-Specific Body Weight (kg)	15	No	NA	
$BW_{(6<18)}$	Age-Specific Body Weight (kg)	45	No	NA	
$BW_{(18<30)}$	Age-Specific Body Weight (kg)	70	No	NA	
DF.adj	Dermal Adjustment Factor (mg-yr/kg-event)	352	No	NA	
ED.A.res	Exposure Duration (yr) - Adult	30	No	NA	
ED.C.res	Exposure Duration (yr) - Child	6	No	NA	
$ED_{(0<6)}$	Age-Specific Exposure Duration (yr)	6	No	NA	
$ED_{(6<18)}$	Age-Specific Exposure Duration (yr)	12	No	NA	
$ED_{(18<30)}$	Age-Specific Exposure Duration (yr)	12	No	NA	
EF.res	Exposure Frequency (days/yr) (event/yr for dermal soil)	350	No	NA	
HQ	Hazard Quotient (unitless)	1	No	NA	
IRsoil.AgeAdj.res	Age-Adjusted Soil Ingestion Rate (mg-yr/kg-day)	120	No	NA	
IRsoil.C.res	Soil Ingestion Rate (mg/day) - Child	191	No	NA	
IRw.AgeAdj.res	Age-Adjusted Water Ingestion Rate (L-yr/kg-day)	0.80	No	NA	
IRw.C.res	Water Ingestion Rate (L/Day) - Child	0.64	No	NA	
MF	Modifying Factor for SFo (unitless)	1	No	NA	
	for Arsenic	0.1	No		
RBAF	Relative Bioavailability Factor (unitless)	1	Tier 2/3	§350.74(j)(1)(C)	
	for Arsenic	0.78	Tier 2/3	§350.74(j)(1)(C)	
RfC*	Reference Concentration (mg/m^3)	Chemical Specific	NA	§350.73(a) and (c)	
RfD$_o$	Oral Reference Dose (mg/kg-day)	Chemical Specific	NA	§350.73(a)	
RfD$_d$	Dermal Reference Dose (mg/kg-day)	Chemical Specific	NA	§350.73(a)	

			Risk-Based Exposure Limit Equations and Default Exposure Factors for Residents	

Term	Exposure Factor	Default Exposure Factor	Change to Default Exposure Factor Allowed?	Citation for Change
RL	Risk Level (unitless)	10^{-5}	No	NA
SA.C.res	Skin Surface Area (cm^2)- Child	2200	No	NA
$SA_{(0<6)}$	Age-specific Skin Surface Area (cm^2)	2200	No	NA
$SA_{(6<18)}$	Age-specific Skin Surface Area (cm^2)	3500	No	NA
$SA_{(18<30)}$	Age-specific Skin Surface Area (cm^2)	4800	No	NA
SF_d	Dermal Slope Factor $(mg/kg\text{-}day)^{-1}$	Chemical Specific	NA	§350.73(a)
SF_o	Oral Slope Factor $(mg/kg\text{-}day)^{-1}$	Chemical Specific	NA	§350.73(a)
URF*	Inhalation Unit Risk Factor $(\mu g/m^3)^{-1}$	Chemical Specific	NA	§350.73(a) and (c)
Vegetable Ingestion Rate - Age-Adjusted (kg-yr/kg-day)				
IRabg.AgeAdj.res Aboveground Vegetables		0.0028	No	NA
IRbg.AgeAdj.res Below-Ground Vegetables		0.0012	No	NA
Vegetable Ingestion Rate - Child (kg/day)				
IRabg.C.res Aboveground Vegetables		0.0024	No	NA
IRbg.C.res Below-Ground Vegetables		0.0010	No	NA

Footnote:

* When no RfC or URF is available, then the person shall use the most current TCEQ Chronic Remediation-Specific Effects Screening Level value as the RfC unless §350.73(b) applies.

** It is not necessary to calculate a soil dermal contact RBEL for COCs with a vapor pressure in mm HG $\geq$ 1.

NA means not applicable.

Risk Based Exposure Limit Equations and Default Exposure Factors for Commercial/Industrial Worker	
RBEL-1: Inhalation of carcinogenic COCs - RBEL (mg/m^3) $$^{Air}RBEL_{Inh-c} = \frac{RL \times ATc \times 365 \text{ days/yr}}{URF \times 1000 \text{ } \mu g/mg \times EF.w \times ED.w}$$ Inhalation of noncarcinogenic COCs - RBEL (mg/m^3) $$^{Air}RBEL_{Inh-nc} = \frac{RfC \times HQ \times AT.w \times 365 \text{ days/yr}}{EF.w \times ED.w}$$	**RBEL-4:** Ingestion of carcinogenic COCs in water - RBEL (mg/L) $^{GW}RBEL_{Ing-c}$ = primary MCL when available, or a secondary MCL under the conditions described in §350.74(f)(3), otherwise $$\frac{RL \times BW.A \times ATc \times 365 \text{ days/yr}}{SF_o \times MF \times IRw.w \times EF.w \times ED.w}$$ Ingestion of noncarcinogenic COCs in water - RBEL (mg/L) $^{GW}RBEL_{Ing-nc}$ = primary MCL when available, or a secondary MCL under the conditions described in §350.74(f)(3), otherwise $$\frac{RfD_o \times HQ \times BW.A \times AT.w \times 365 \text{ days/yr}}{IRw.w \times EF.w \times ED.w}$$
RBEL-2: Dermal contact with carcinogenic COCs in soil - RBEL (mg/kg) $$^{Soil}RBEL_{Derm-c} = \frac{RL \times BW.A \times ATc \times 365 \text{ days/yr}}{SF_d \times MF \times 10^{-6} \text{ kg/mg} \times ED.w \times EF.w \times SA.w \times AF.w \times ABS.d}$$ where: $SF_d = \dfrac{SF_o}{ABS_{GI}}$ when $ABS_{GI} < 50\%$, otherwise $SF_d = SF_o$ Dermal contact with noncarcinogenic COCs in soil - RBEL (mg/kg) $$^{Soil}RBEL_{Derm-nc} = \frac{HQ \times RfD_d \times BW.A \times AT.w \times 365 \text{ days/yr}}{10^{-6} \text{ kg/mg} \times ED.w \times EF.w \times SA.w \times AF.w \times ABS.d}$$ where $RfD_d = (RfD_o)(ABS_{GI})$ when $ABS_{GI} < 50\%$, otherwise $RfD_d = RfD_o$	**RBEL-5:** Class 3 groundwater RBEL $$^{GW}RBEL_{Class3} = 100 \times RBEL\text{-}4$$

Risk-Based Exposure Limit Equations and Default Exposure Factors for Commercial/Industrial Worker	
RBEL-3: Ingestion of carcinogenic COCs in soil - RBEL (mg/kg) $^{Soil}RBEL_{Ing-c} = \dfrac{RL \times BW.A \times AT_c \times 365 \text{ days/yr}}{SF_o \times MF \times 10^{-6} \text{ kg/mg} \times EF.w \times ED.w \times IRsoil.w \times RBAF}$ Ingestion of noncarcinogenic COCs in soil - RBEL (mg/kg) $^{Soil}RBEL_{Ing-nc} = \dfrac{HQ \times BW.A \times RfD_o \times AT.w \times 365 \text{ days/yr}}{10^{-6} \text{ kg/mg} \times EF.w \times ED.w \times IRsoil.w \times RBAF}$	**RBEL-6: Surface Water RBEL** $^{SW}RBEL$ = the lowest value of each COC established under §350.74(h)(1) - (5), unless the person has sufficient property-specific surface water quality information specific to the particular surface water body at the affected property to support an adjustment to the RBEL in accordance with §350.74(h)(6). $^{SW}RBEL$ determined pursuant to §350.74(h)(1) - (5) may require modification in response to §350.74(h)(7) - (8).

Risk-Based Exposure Limit Equations and Default Exposure Factors for Commercial/Industrial Worker

Term	Exposure Factor	Default Exposure Factor	Change to Default Exposure Factor Allowed?	Citation for Change
$ABS.d^{**}$	Dermal Absorption Fraction (unitless)	(Figure: 30 TAC §350.74(c))	Tier 2/3	§350.74(j)(1)(B)
ABS_{GI}	Gastrointestinal Absorption Fraction (unitless)	(Figure: 30 TAC §350.74(c))	Tier 2/3	§350.74(j)(1)(A)
$AF.w$	Soil-to-Skin Adherence Factor (mg/cm^2-event)	0.2	No	NA
ATc	Averaging Time - carcinogens (yr)	70	No	NA
$AT.w$	Averaging Time - noncarcinogens (yr)	25	Tier 2/3	§350.74(j)(2)
$BW.A$	Body Weight, adult (kg)	70	No	NA
$ED.w$	Exposure Duration (yr)	25	Tier 2/3	§350.74(j)(2)
$EF.w$	Exposure Frequency (days/yr) (event/yr for dermal soil)	250	Tier 2/3	§350.74(j)(2)
HQ	Hazard Quotient (unitless)	1	No	NA
$IRsoil.w$	Soil Ingestion Rate (mg/day)	100	No	NA
$IRw.w$	Water Ingestion Rate (L/day)	1.4	No	NA
MF	Modifying Factor for SF_o (unitless)	1	No	NA
	for Arsenic	0.1	No	NA
$RBAF$	Relative Bioavailability Factor (unitless)	1	Tier 2/3	§350.74(j)(1)(D)
	for Arsenic	0.78	Tier 2/3	§350.74(j)(1)(D)
RfC^*	Reference Concentration (mg/m^3)	Chemical-Specific	NA	§350.73(a) and (c)
RfD_o	Oral Reference Dose (mg/kg-day)	Chemical-Specific	NA	§350.73(a)
RfD_d	Dermal Reference Dose (mg/kg-day)	Chemical-Specific	NA	§350.73(a)
RL	Risk Level (unitless)	10^{-5}	No	NA
$SA.w$	Skin Surface Area (cm^2)	2500	No	NA
SF_d	Dermal Slope Factor (mg/kg-day)$^{-1}$	Chemical-Specific	NA	§350.73(a)
SF_o	Oral Slope Factor (mg/kg-day)$^{-1}$	Chemical-Specific	NA	§350.73(a)
URF^*	Inhalation Unit Risk Factor (g/m^3)$^{-1}$	Chemical-Specific	NA	§350.73(a) and (c)

Footnote:
* When no RfC or URF is available, then the person shall use the most current TCEQ Chronic Remediation-Specific Effects Screening Level value as the RfC unless §350.73(b) applies.
** It is not necessary to calculate a soil dermal contact RBEL for COCs with a vapor pressure in mm HG $\geq$ 1.
NA means not applicable.