APPENDIX B

Exposure Equations and Default Input Parameters

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Table B-1.1

Scenario 1- General Residential Exposure

Pathway R1- Incidental Ingestion of Radionuclides in Soil

Equation for age -integrated (adult/child) receptors

$$Intake_{res-sol-Ing.}(pCi) = \frac{C_S\left(\frac{pCi}{g}\right) * \left(1 - e^{-\lambda t_r}\right) * IFS_{R-adj}\left(\frac{120mg}{day}\right) * EF_r\left(350\frac{day}{yr}\right) * ED_r\,(30\,yr) * \left(\frac{g}{1000mg}\right)}{t_r(yr) * \lambda\left(\frac{1}{yr}\right)}$$

$$IFS_{r-adj}\left(120\frac{mg}{day}\right) = \frac{(IRS_{r-c}\left(\frac{200mg}{day}\right) * ED_{r-c}(6\,yr) + IRS_{r-a}\left(100\frac{mg}{day}\right) * ED_{r-a}(24yr))}{ED_r(30\,yr)}$$

Where:

Variable	Value
C_s (UCL or maximum detected concentration in soil) pCi/g	Site-specific
ED_{r-a} (exposure duration - resident adult) yr	24
EF_r (exposure frequency - resident) day/yr	350
IRS_{r-a} (soil intake rate - resident adult) mg/day	100
IRS_{r-c} (soil intake rate - resident child) mg/day	200
IFS_{r-adj} (age-adjusted soil ingestion factor - resident) mg/day	120
ED_{r-c} (exposure duration - resident child) yr	6
ED_r (exposure duration - resident) yr	30
T_r (time-resident) yr	30
λ (lambda decay constant)	Isotopic-specific

Table B-1.2

Scenario 1- General Residential Exposure

Pathway R2- External Exposure to Ionizing Radiation from Contaminants in Soil

$$External_{res-sol-ext} = \frac{C_s\left(\frac{pCi}{g}\right) * \left(1 - e^{-\lambda t_r}\right) * ACF * EF_r\left(\frac{350\ days}{yr}\right) * \left(\frac{1yr}{365days}\right) * ED_r(30\ yr) * [ET_{r-o}(0.073) + \left(ET_{r-i}(0.684) * GSF_i(0.4)\right)]}{t_r(yr) * \lambda(\frac{1}{yr})}$$

Where:

Variable	Value
C_s (UCL or maximum detected concentration in soil) pCi/g	Site-specific
Slab size for ACF (Area Correction factor) m^3	Default (isotope-specific)
EF_r (exposure frequency-resident) day/yr	350
ED_r (exposure duration-resident) yr	30
ET_{r-o} (exposure time-outdoor resident) hr/hr	0.073
ET_{r-I} (exposure time-indoor resident) hr/hr	0.684
GSF_i (gamma shielding factor-indoor)unitless	0.4
T_r (time-resident) yr	30
λ (lambda decay constant)	Isotopic-specific

Table B-1.3

Scenario 1- General Residential Exposure

Pathway R3- Inhalation of Contaminants in Airborne Particulates

$$Intake_{res-sol-inh.}(\boldsymbol{pCi}) = \frac{\boldsymbol{Cs_{res-sol-inh}\left(\frac{pCi}{g}\right) * \left(1 - e^{-\lambda t_r}\right) * IFA_{r-adj}\left(18\frac{m^3}{day}\right) * EF_r\left(350\frac{day}{yr}\right) * ED_r(30\ yr) * \frac{1}{PEF\left(\frac{m^3}{kg}\right)} * ET_r\left(24\frac{hr}{day}\right) * \left(\frac{1day}{24hr}\right) * \left(\frac{1000g}{kg}\right)}}{\boldsymbol{t_r(yr) * \lambda\left(\frac{1}{yr}\right)}}$$

$$IFA_{r-adj}\left(18\frac{m^3}{day}\right) = \frac{IRA_{r-c}\left(10\frac{m^3}{day}\right) * ED_{r-c}(6\ yr) + IRA_{r-a}\left(20\frac{m^3}{day}\right) * ED_{r-a}\ (24\ yr)}{ED_r\ (30\ yr)}$$

Where:

Variable	Value
C_s (UCL or maximum detected concentration in soil) pCi/g	Site-specific
IFA_{r-adj} (age-adjusted soil inhalation factor-resident) m^3/day	18
EF_r (exposure frequency-resident) day/yr	350
ED_r (exposure duration-resident) yr	30
PEF (particulate emission factor) m^3/kg	1.36E+09
ET_r (exposure time-resident) hr/day	24
IRA_{r-c} (inhalation rate-resident child) m^3/day	10
IRA_{r-a} (inhalation rate-resident adult) m^3/day	20
ED_{r-a} (exposure duration-resident adult) yr	24
ED_{r-c} (exposure duration-resident child) yr	6
T_r (time-resident) yr	30
λ (lambda decay constant)	Isotopic-specific

Table B-1.4

Scenario 1- General Residential Exposure

Pathway R4- Ingestion of Contaminants in Tap Water

Equation for age -integrated (adult/child) receptors

$$Intake_{water-ing.}\,(pCi) = C_w\left(\frac{pCi}{L}\right) * EF_r\left(350\frac{day}{yr}\right) * ED_r(30\,yr) * IFW_{r-adj}\,(1.8\frac{L}{day})$$

$$IFW_{r-adj}\left(1.8\frac{L}{day}\right) = \frac{ED_{r-c}\,(6\,yr) * IRW_{r-c}\left(1\frac{L}{day}\right) + ED_{r-a}(24\,yr) * IRW_{r-a}(2\frac{L}{day})}{ED_r\,(30\,yr)}$$

Where:

Variable	Value
C_w (contaminant concentration in water) pCi/L	Site specific
ED_{r-a} (exposure duration - resident adult) yr	24
ED_{r-c} (exposure duration - resident child) yr	6
EF_r (exposure frequency - resident) day/yr	350
IRW_{r-a} (water intake rate - resident adult) L/day	2
IRW_{r-c} (water intake rate - resident child) L/day	1
IFW_{r-adj} (age-adjusted water ingestion factor - resident) L/day	1.8
ED_r (exposure duration-resident) yr	30

Table B-1.5 Scenario 1- General Residential Exposure Pathway R5- Inhalation of Contaminants in Tap Water
Equation for age -integrated (adult/child) receptors
$$Intake_{water-inh.}\,(pCi) = C_w\left(\frac{pCi}{L}\right) * EF_r\left(350\frac{day}{yr}\right) * ED_r(30\ yr) * IFA_{r-adj}\left(18\frac{m^3}{day}\right) * K\left(\frac{0.5L}{m^3}\right) * ET_r\left(\frac{24hr}{day}\right) * \left(\frac{1day}{24hr}\right)$$ $$IFA_{r-adj}\left(18\frac{m^3}{day}\right) = \frac{ED_{r-c}\,(6\ yr) * IRA_{r-c}\left(10\frac{m^3}{day}\right) + ED_{r-a}(24\ yr) * IRA_{r-a}\left(20\frac{m^3}{day}\right)}{ED_r\,(30\ yr)}$$

Where:

Variable	Value
C_w (contaminant concentration in water) pCi/L	Site specific
ED_{r-a} (exposure duration - resident adult) yr	24
ED_{r-c} (exposure duration - resident child) yr	6
EF_r (exposure frequency - resident) day/yr	350
IRA_{r-a} (water intake rate - resident adult) m^3/day	20
IRA_{r-c} (water intake rate - resident child) m^3/day	10
IFA_{r-adj} (age-adjusted water ingestion factor - resident) m^3/day	18
K (Andelman volatilization Factor) L/m^3	0.5
ED_r (exposure duration-resident) yr	30
ET_r (exposure time-resident) hr	24

Table B-1.6

Scenario 1- General Residential Exposure

Pathway R6- Ingestion of Produce (Fruits and Vegetables) Grown in Contaminated Soil

Equation for age -integrated (adult/child) receptors

$$Intake_{res-produce-Ing.}(pCi) = \frac{C_S\left(\frac{pCi}{g}\right) * \left(1 - e^{-\lambda t_r}\right) * (IFF_{r-adj}\left(\frac{17.5kg}{year}\right) + IFV_{r-adj}\left(\frac{9.1kg}{year}\right)) * EF_r\left(350\frac{day}{yr}\right) * \left(\frac{1yr}{365day}\right) * ED_r\,(30\,yr) * \left(\frac{1000g}{kg}\right) * TF_p\left(\frac{day}{kg}\right) * CPF_r\,(0.25)}{t_r(yr) * \lambda\left(\frac{1}{yr}\right)}$$

Where:

$$IFF_{r-adj}\left(17.5\frac{kg}{year}\right) = \frac{(IRF_{r-c}\left(\frac{5.4kg}{year}\right) * ED_{r-c}(6\,yr) + IRF_{r-a}\left(20.5\frac{kg}{year}\right) * ED_{r-a}(24yr))}{ED_r(30\,yr)}$$

and

$$IFV_{r-adj}\left(9.1\frac{kg}{year}\right) = \frac{(IRV_{r-c}\left(\frac{3.8kg}{year}\right) * ED_{r-c}(6\,yr) + IRV_{r-a}\left(10.4\frac{kg}{year}\right) * ED_{r-a}(24yr))}{ED_r(30\,yr)}$$

Table B-1.6 (Contd.) Scenario 1- General Residential Exposure Pathway R6- Ingestion of Produce (Fruits and Vegetables) Grown in Contaminated Soil- Continued.	
Parameters for age -integrated (adult/child) receptors	
Variable	Value
C_s (UCL or maximum detected concentration in soil) pCi/g	Site-specific
$IFF_{r\text{-}adj}$ (age-adjusted fruit ingestion-resident) kg/yr	17.5
$IFV_{r\text{-}adj}$ (age-adjusted vegetables ingestion-resident) kg/yr	9.1
EF_r (exposure frequency-resident) day/yr	350
ED_r (exposure duration-resident) yr	30
TF_P (Soil to plant transfer factor) pCi/gram-plant per pCi/gram-soil	Isotope- specific
CPF_r (Contaminated Plant Fraction-resident) unitless	0.25
$IRF_{r\text{-}c}$ (Ingestion of fruit rate-resident child) kg/year	5.4
$IRF_{r\text{-}a}$ (Ingestion of fruit rate-resident adult) kg/year	20.5
$IRV_{r\text{-}c}$ (Ingestion of vegetable rate-resident child) kg/year	3.8
$IRV_{r\text{-}a}$ (ingestion of vegetable rate-resident adult) kg/year	10.4
$ED_{r\text{-}a}$ (exposure duration-resident adult) yr	24
$ED_{r\text{-}c}$ (exposure duration-resident child) yr	6
T_r (time-resident) yr	30
λ (lambda decay constant)	Isotopic-specific

Table B-1.7 Scenario 1- General Residential Exposure Pathway R7- Inhalation of Ambient Air (without half-life decay)
Equation for age -integrated (adult/child) receptors
$$Intake_{res-air-Inh.-no\ decay}(pCi) = C_a\left(\frac{pCi}{m^3}\right) * ET_r\left(\frac{24hr}{day}\right) * (\frac{1day}{24hr}) * IFA_{r-adj}\left(\frac{18m^3}{day}\right) * EF_r\left(350\frac{day}{yr}\right) * ED_r\,(30\ yr)$$ $$IFA_{r-adj}\left(18\frac{m^3}{day}\right) = \frac{(IRA_{r-c}\left(\frac{10m^3}{day}\right) * ED_{r-c}(6\ yr) + IRA_{r-a}\left(\frac{20m^3}{day}\right) * ED_{r-a}(24yr))}{ED_r(30\ yr)}$$

Where:

Variable	Value
C_a (concentration in air) pCi/m^3	Site-specific
IFA_{r-adj} (age-adjusted air inhalation factor-resident) m^3/day	18
EF_r (exposure frequency-resident) day/yr	350
ED_r (exposure duration-resident) yr	30
ET_r (exposure time-resident) hr/day	24
IRA_{r-c} (inhalation rate-resident child) m^3/day	10
IRA_{r-a} (inhalation rate-resident adult) m^3/day	20
ED_{r-a} (exposure duration-resident adult) yr	24
ED_{r-c} (exposure duration-resident child) yr	6

Table B-1.8 Scenario 1- General Residential Exposure Pathway R8- External Exposure to Ionizing Radiation in Ambient Air (without half-life decay)
Equation for adult receptors
$$Intake_{res-air-Inh.-no\ decay}(pCi-yr)/m^3) = C_a\left(\frac{pCi}{m^3}\right) * ET_r\left(\frac{24hr}{day}\right) * \left(\frac{1day}{24hr}\right) * EF_r\left(350\frac{day}{yr}\right) * ED_r\,(30\ yr) * \left(\frac{1yr}{365day}\right) * GSF_o(1.0)$$

Where:

Variable	Value
C_a (concentration in air - submersion) pCi/m^3	Site-specific
EF_r (exposure frequency-resident) day/yr	350
ED_r (exposure duration-resident) yr	30
ET_r(exposure time-outdoor resident) hr/day	24
GSF_o(gamma shielding factor-outdoor)unitless	1.0

Table B-2.1 Scenario 2- Farmer Exposure Pathway R1- Incidental Ingestion of Contaminants in Soil
Equation for age -integrated (adult/child) receptors
$$Intake_{f-sol-Ing.}(pCi) = \frac{C_S\left(\frac{pCi}{g}\right) * \left(1 - e^{-\lambda t_f}\right) * IFS_{f-adj}\left(\frac{115mg}{day}\right) * EF_f\left(350\frac{day}{yr}\right) * ED_f\,(40\ yr) * \left(\frac{g}{1000mg}\right)}{t_f(yr) * \lambda\left(\frac{1}{yr}\right)}$$ $$IFS_{f-adj}\left(115\frac{mg}{day}\right) = \frac{(IRS_{f-c}\left(\frac{200mg}{day}\right) * ED_{f-c}(6\ yr) + IRS_{f-a}\left(100\frac{mg}{day}\right) * ED_{f-a}(34yr))}{ED_f(40\ yr)}$$

Where:

Variable	Value
C_s (UCL or maximum detected concentration in soil) pCi/g	Site-specific
ED_{f-a} (exposure duration - adult farmer) yr	34
EF_f (exposure frequency - farmer) day/yr	350
IRS_{f-a} (soil intake rate – adult farmer) mg/day	100
IRS_{f-c} (soil intake rate – child farmer) mg/day	200
IFS_{f-adj} (age-adjusted soil ingestion factor - farmer) mg/day	115
ED_{f-c} (exposure duration – child farmer) yr	6
ED_f (exposure duration - farmer) yr	40
T_f (time-farmer) yr	40
λ (lambda decay constant	Isotopic-specific

Table B-2.2

Scenario 2- Agriculture Farmer Exposure

Pathway R2- External Exposure to Ionizing Radiation from Contaminants in Soil

$$External_{f-sol-ext} = \frac{C_s\left(\frac{pCi}{g}\right) * \left(1 - e^{-\lambda t_f}\right) * ACF * EF_f\left(\frac{350\ days}{yr}\right) * \left(\frac{1yr}{365days}\right) * ED_f(40\ yr) * [ET_{f-o}(0.507) + \left(ET_{f-i}(0.417) * GSF_i(0.4)\right)]}{t_f(yr) * \lambda(\frac{1}{yr})}$$

Where:

Variable	Value
C_s (UCL or maximum detected concentration in soil) pCi/g	Site-specific
Slab size for ACF (Area Correction factor) m^3	Default (isotope-specific)
EF_f (exposure frequency-farmer) day/yr	350
ED_f (exposure duration-farmer) yr	40
ET_{f-o} (exposure time-outdoor farmer) hr/hr	0.507
ET_{f-I} (exposure time-indoor farmer) hr/hr	0.417
GSF_i (gamma shielding factor-indoor)unitless	0.4
T_f (time-farmer) yr	40
λ (lambda decay constant)	Isotopic-specific

Table B-2.3

Scenario 2- Agriculture Farmer Exposure

Pathway R3- Inhalation of Contaminants in Airborne Particulates

$$Intake_{f-sol-inh.}(\boldsymbol{pCi}) = \frac{\boldsymbol{Cs_{f-sol-inh}}\left(\frac{\boldsymbol{pCi}}{\boldsymbol{g}}\right) * \left(\boldsymbol{1 - e^{-\lambda t_r}}\right) * \boldsymbol{IFA_{f-adj}}\left(\boldsymbol{18.5}\,\frac{\boldsymbol{m^3}}{\boldsymbol{day}}\right) * \boldsymbol{EF_f}\left(\boldsymbol{350}\,\frac{\boldsymbol{day}}{\boldsymbol{yr}}\right) * \boldsymbol{ED_f}(\boldsymbol{40\ yr}) * \frac{\boldsymbol{1}}{\boldsymbol{PEF}\left(\frac{\boldsymbol{m^3}}{\boldsymbol{kg}}\right)} * \boldsymbol{ET_f}\left(\boldsymbol{24}\,\frac{\boldsymbol{hr}}{\boldsymbol{day}}\right) * \left(\frac{\boldsymbol{1day}}{\boldsymbol{24hr}}\right) * \left(\frac{\boldsymbol{1000g}}{\boldsymbol{kg}}\right)}{\boldsymbol{t_f}(\boldsymbol{yr}) * \boldsymbol{\lambda}\left(\frac{\boldsymbol{1}}{\boldsymbol{yr}}\right)}$$

$$IFA_{f-adj}\left(18.5\,\frac{m^3}{day}\right) = \frac{IRA_{f-c}\left(10\,\frac{m^3}{day}\right) * ED_{f-c}(6\ yr) + IRA_{f-a}\left(20\,\frac{m^3}{day}\right) * ED_{f-a}\,(34\ yr)}{ED_f\,(40\ yr)}$$

Where:

Variable	Value
C_s (UCL or maximum detected concentration in soil) pCi/g	Site-specific
$IFA_{f\text{-}adj}$ (age-adjusted soil inhalation factor-farmer) m^3/day	18.5
EF_f (exposure frequency- farmer) day/yr	350
ED_f (exposure duration- farmer) yr	40
PEF (particulate emission factor) m^3/kg	1.36E+09
ET_f (exposure time- farmer) hr/day	24
$IRA_{f\text{-}c}$ (inhalation rate-child farmer) m^3/day	10
$IRA_{f\text{-}a}$ (inhalation rate-adult farmer) m^3/day	20
$ED_{f\text{-}a}$ (exposure duration-adult farmer) yr	34
$ED_{f\text{-}c}$ (exposure duration- child farmer) yr	6
T_f (time- farmer) yr	40
λ (lambda decay constant)	Isotopic-specific

Table B-2.4

Scenario 2- Agriculture Farmer Exposure

Pathway R4- Ingestion of Produce (Fruits and Vegetables) Grown in Contaminated Soil

Equation for age -integrated (adult/child) receptors

$$Intake_{f-produce-Ing.}(pCi) = \frac{C_S\left(\frac{pCi}{g}\right) * \left(1 - e^{-\lambda t_r}\right) * IFF_{f-adj}\left(\frac{18.235kg}{year}\right) + IFV_{f-adj}\left(\frac{9.41kg}{year}\right) * EF_f\left(350\frac{day}{yr}\right) * \left(\frac{1yr}{365day}\right) * ED_f\,(40\ yr) * \left(\frac{1000g}{kg}\right) * TF_p\left(\frac{day}{kg}\right) * CPF_f(1.0)}{t_f(yr) * \lambda\left(\frac{1}{yr}\right)}$$

Where:

$$IFF_{f-adj}\left(18.235\frac{kg}{year}\right) = \frac{(IRF_{f-c}\left(\frac{5.4kg}{year}\right) * ED_{f-c}(6\ yr) + IRF_{f-a}\left(20.5\frac{kg}{year}\right) * ED_{f-a}(34yr))}{ED_f(40\ yr)}$$

and

$$IFV_{f-adj}\left(9.41\frac{kg}{year}\right) = \frac{(IRV_{f-c}\left(\frac{3.8kg}{year}\right) * ED_{f-c}(6\ yr) + IRV_{f-a}\left(10.4\frac{kg}{year}\right) * ED_{f-a}(34yr))}{ED_f(40\ yr)}$$

Table B-2.4 (Contd.)

Scenario 2- Agriculture Farmer Exposure

Pathway R4- Ingestion of Produce (Fruits and Vegetables) Grown in Contaminated Soil- Continued.

Parameters for age -integrated (adult/child) receptors	
Variable	Value
C_s (UCL or maximum detected concentration in soil) pCi/g	Site-specific
$IFF_{f\text{-}adj}$ (age-adjusted fruit ingestion-farmer) kg/yr	18.235
$IFV_{f\text{-}adj}$ (age-adjusted vegetables ingestion-farmer) kg/yr	9.41
EF_f (exposure frequency-farmer) day/yr	350
ED_f (exposure duration-farmer) yr	40
TF_P (Soil to plant transfer factor) pCi/gram-plant per pCi/gram-soil	Isotope- specific
CPF_f (Contaminated Plant Fraction-farmer) unitless	1.0
$IRF_{f\text{-}c}$ (Ingestion of fruit rate- child farmer) kg/year	5.4
$IRF_{f\text{-}a}$ (Ingestion of fruit rate-adult farmer) kg/year	20.5
$IRV_{f\text{-}c}$ (Ingestion of vegetable rate-child farmer) kg/year	3.8
$IRV_{f\text{-}a}$ (ingestion of vegetable rate-adult farmer) kg/year	10.4
$ED_{f\text{-}a}$ (exposure duration-adult farmer) yr	34
$ED_{f\text{-}c}$ (exposure duration-child farmer) yr	6
T_f (time-farmer) yr	40
λ (lambda decay constant)	Isotopic-specific

Table B-2.5

Scenario 2- Agriculture Farmer Exposure

Pathway R5- Consumption of Beef

Equation for age -integrated (adult/child) receptors

$$Intake_{soil-f-beef-Ing.}(pCi) = C_S\left(\frac{pCi}{g}\right) * \ (1 - e^{-\lambda t_f}) * IFB_{f-adj}\left(\frac{43.375kg}{year}\right) * EF_f\left(350\frac{day}{yr}\right) * \left(\frac{1yr}{365day}\right) * ED_f\,(40\ yr) * \left(\frac{1000g}{kg}\right) *$$

$$\frac{\{(TF_{beef} * FI_{beef} * TF_p) + (TF_{beef} * FI_{beef-s}) + (TF_{beef} * FI_{beef-w} * \ (1/(K_d + \sigma * \left(\frac{s}{\rho}\right) * \left(\frac{1}{DF_w}\right)\}}{t_f(yr) * \ \lambda\ \left(\frac{1}{yr}\right)}$$

Where:

$$IFF_{f-adj}\left(43.375\frac{kg}{year}\right) = \frac{(IRB_{f-c}\ \left(\frac{4.7kg}{year}\right) * ED_{f-c}(6\ yr) + IRB_{f-a}\left(50.2\frac{kg}{year}\right) * ED_{f-a}(34yr)}{ED_f(40\ yr)}$$

Table B-2.5 (Contd.)

Scenario 2- Agriculture Farmer Exposure

Pathway R5- Consumption of Beef

Parameters for age -integrated (adult/child) receptors	
Variable	Value
C_s (UCL or maximum detected concentration in soil) pCi/g	Site-specific
$IFB_{f\text{-}adj}$ (age-adjusted beef ingestion rate-farmer) kg/yr	43.375
FI_{beef} (beef fodder intake rate) kg/day	11.77
EF_f (exposure frequency-farmer) day/yr	350
ED_f (exposure duration-farmer) yr	40
TF_P (Soil to plant transfer factor) pCi/gram-plant per pCi/gram-soil	Isotope- specific
$FI_{beef\text{-}s}$ (beef soil intake rate) kg/day	0.39
$FI_{beef\text{-}W}$ (beef water intake rate) L/day	53
K_d (soil to water partition coefficient) L/kg	Isotopic-specific
σ (Total soil porosity) L water/L pore space	0.5
S (Fraction water content) L water/L porespace	0.3
P (Soil bulk density) kg/L soil	1.5
$IRB_{f\text{-}c}$ (beef Ingestion rate- child farmer) kg/year	4.7
$IRB_{f\text{-}a}$ (beef Ingestion rate-adult farmer) kg/year	50.2
DF_w (Dilution factor for drinking water) unitless	1
TF_{beef} (Beef transfer factor) day/kg	Isotopic-specific
$ED_{f\text{-}a}$ (exposure duration-adult farmer) yr	34
$ED_{f\text{-}c}$ (exposure duration-child farmer) yr	6
T_f (time-farmer) yr	40
λ (lambda decay constant)	Isotopic-specific

Table B-2.6

Scenario 2- Agriculture Farmer Exposure

Pathway R6- Consumption of Milk From Locally Raised Cows

Equation for age -integrated (adult/child) receptors

$$Intake_{soil-f-dairy-Ing.}(pCi) = C_S\left(\frac{pCi}{g}\right) * \ (1 - e^{-\lambda t_f}) * IFD_{f-adj}\left(\frac{43.375kg}{year}\right) * EF_f\left(350\frac{day}{yr}\right) * \left(\frac{1yr}{365day}\right) * ED_f\,(40\ yr) * \left(\frac{1000g}{kg}\right) *$$

$$\frac{\{(TF_{dairy} * FI_{dairy} * TF_p) + (TF_{dairy} * FI_{dairy-s}) + (TF_{dairy} * FI_{dairy-w} * \ (1/(K_d + \sigma * \left(\frac{s}{\rho}\right) * \left(\frac{1}{DF_w}\right)\}}{t_f(yr) * \ \lambda\ \left(\frac{1}{yr}\right)}$$

Where:

$$IFF_{f-adj}\left(43.375\frac{kg}{year}\right) = \frac{(IRD_{f-c}\ \left(\frac{4.7kg}{year}\right) * ED_{f-c}(6\ yr) + IRD_{f-a}\left(50.2\frac{kg}{year}\right) * ED_{f-a}(34yr)}{ED_f\,(40\ yr)}$$

Table B-2.6 (Contd.)

Scenario 2- Agriculture Farmer Exposure

Pathway R6- Consumption of Milk

Parameters for age -integrated (adult/child) receptors	
Variable	Value
C_s (UCL or maximum detected concentration in soil) pCi/g	Site-specific
$IFD_{f\text{-}adj}$ (age-adjusted milk ingestion rate-farmer) kg/yr	205.275
FI_{dairy} (dairy fodder intake rate) kg/day	16.9
EF_f (exposure frequency-farmer) day/yr	350
ED_f (exposure duration-farmer) yr	40
TF_P (Soil to plant transfer factor) pCi/gram-plant per pCi/gram-soil	Isotope- specific
$FI_{dairy\text{-}s}$ (Dairy soil intake rate) kg/day	0.41
$FI_{dairy\text{-}W}$ (dairy water intake rate) L/day	92
K_d (soil to water partition coefficient) L/kg	Isotopic-specific
σ (Total soil porosity) L water/L pore space	0.5
S (Fraction water content) L water/L porespace	0.3
P (Soil bulk density) kg/L soil	1.5
$IRD_{f\text{-}c}$ (milk Ingestion rate- child farmer) kg/year	96.9
$IRD_{f\text{-}a}$ (milk Ingestion rate-adult farmer) kg/year	224.4
DF_w (Dilution factor for drinking water) unitless	1
TF_{dairy} (dairy transfer factor) day/kg	Isotopic-specific
$ED_{f\text{-}a}$ (exposure duration-adult farmer) yr	34
$ED_{f\text{-}c}$ (exposure duration-child farmer) yr	6
T_f (time-farmer) yr	40
λ (lambda decay constant)	Isotopic-specific

Table B-2.7

Scenario 2- Agriculture Farmer Exposure

Pathway R7- Consumption of Home Raised Poultry

Equation for age -integrated (adult/child) receptors

$$Intake_{soil-f-po-Ing.}(pCi) = C_S\left(\frac{pCi}{g}\right) * \left(1 - e^{-\lambda t_f}\right) * IFP_{f-adj}\left(\frac{31.18kg}{year}\right) * EF_f\left(350\frac{day}{yr}\right) * \left(\frac{1yr}{365day}\right) * ED_f\,(40\,yr) * \left(\frac{1000g}{kg}\right) *$$

$$\frac{\left\{\left(TF_{po}\left(\frac{day}{kg}\right) * FI_{po}\left(\frac{0.2kg}{day}\right) * TF_p\left(\frac{pCi}{g-plant}\ per\ \frac{pCi}{g-soil}\right)\right) + \left(TF_{po}\left(\frac{day}{kg}\right) * FI_{po-s}\left(\frac{0.022kg}{day}\right)\right)\right\}}{t_f(yr) * \lambda\left(\frac{1}{yr}\right)}$$

Where:

$$IFP_{f-adj}\left(31.18\frac{kg}{year}\right) = \frac{\left(IRP_{f-c}\left(\frac{5kg}{year}\right) * ED_{f-c}(6\,yr) + IRD_{f-a}\left(35.8\frac{kg}{year}\right) * ED_{f-a}(34yr)\right.}{ED_f(40\,yr)}$$

Table B-2.7 (Contd.) Scenario 2- Agriculture Farmer Exposure Pathway R7- Consumption of Poultry	
Parameters for age -integrated (adult/child) receptors	
Variable	Value
C_s (UCL or maximum detected concentration in soil) pCi/g	Site-specific
$IFP_{f\text{-}adj}$ (age-adjusted poultry ingestion rate-farmer) kg/yr	31.18
FI_{po} (poultry intake rate) kg/day	0.2
EF_f (exposure frequency-farmer) day/yr	350
ED_f (exposure duration-farmer) yr	40
TF_P (Soil to plant transfer factor) pCi/gram-plant per pCi/gram-soil	Isotope- specific
$FI_{po\text{-}s}$ (poultry soil intake rate) kg/day	0.022
$IRP_{f\text{-}c}$ (poultry Ingestion rate- child farmer) kg/year	5
$IRP_{f\text{-}a}$ (poultry Ingestion rate-adult farmer) kg/year	35.8
TF_{po} (poultry transfer factor) day/kg	Isotopic-specific
$ED_{f\text{-}a}$ (exposure duration-adult farmer) yr	34
$ED_{f\text{-}c}$ (exposure duration-child farmer) yr	6
T_f (time-farmer) yr	40
λ (lambda decay constant)	Isotopic-specific

Table B-2.8

Scenario 2- Agriculture Farmer Exposure

Pathway R8- Consumption of Eggs From Home Raised Poultry

Equation for age -integrated (adult/child) receptors

$$Intake_{soil-f-egg-Ing.}(pCi) = C_S\left(\frac{pCi}{g}\right) * \left(1 - e^{-\lambda t_f}\right) * IFP_{f-adj}\left(\frac{13.01kg}{year}\right) * EF_f\left(350\frac{day}{yr}\right) * \left(\frac{1yr}{365day}\right) * ED_f\,(40\,yr) * \left(\frac{1000g}{kg}\right) *$$

$$\frac{\left\{\left(TF_e(\frac{day}{kg}) * FI_{po}(0.2\frac{kg}{day}) * TF_p(\frac{pCi}{g-plant}per\frac{pCi}{g-soil}\right) + \left(TF_e * FI_{po-s}\,(\frac{0.022kg}{day})\right)\right\}}{t_f(yr) * \lambda\left(\frac{1}{yr}\right)}$$

Where:

$$IFE_{f-adj}\left(31.01\frac{kg}{year}\right) = \frac{(IRE_{f-c}\left(\frac{2.3kg}{year}\right) * ED_{f-c}(6\,yr) + IRE_{f-a}\left(14.9\frac{kg}{year}\right) * ED_{f-a}(34yr)}{ED_f(40\,yr)}$$

Table B-2.8 (Contd.) Scenario 2- Agriculture Farmer Exposure Pathway R8- Consumption of Eggs	
Parameters for age -integrated (adult/child) receptors	
Variable	Value
C_s (UCL or maximum detected concentration in soil) pCi/g	Site-specific
$IFE_{f\text{-}adj}$ (age-adjusted egg ingestion rate-farmer) kg/yr	31.01
FI_{po} (poultry intake rate) kg/day	0.2
EF_f (exposure frequency-farmer) day/yr	350
ED_f (exposure duration-farmer) yr	40
TF_P (Soil to plant transfer factor) pCi/gram-plant per pCi/gram-soil	Isotope- specific
$FI_{po\text{-}s}$ (poultry soil intake rate) kg/day	0.022
$IRE_{f\text{-}c}$ (egg Ingestion rate- child farmer) kg/year	2.3
$IRE_{f\text{-}a}$ (egg Ingestion rate-adult farmer) kg/year	14.9
TF_e (egg transfer factor) day/kg	Isotopic-specific
$ED_{f\text{-}a}$ (exposure duration-adult farmer) yr	34
$ED_{f\text{-}c}$ (exposure duration-child farmer) yr	6
T_f (time-farmer) yr	40
λ (lambda decay constant)	Isotopic-specific

Table B-3.1

Scenario 3- General Residential Exposure

Pathway R1- Incidental Ingestion of Chemicals in Soil

Equation for age -integrated (adult/child) receptors – **Non-Cancer**

$$Intake_{res-sol-Ing.}\left(\frac{mg}{Kg-day}\right) = \frac{C_S\left(\frac{mg}{Kg}\right) * IFS_{r-adj}\left(\frac{114mg-yr}{Kg-day}\right) * EF_r\left(350\,\frac{day}{yr}\right) * \left(10^{-6}\,\frac{Kg}{mg}\right)}{ATr\ (30\ years) * \left(\frac{365days}{year}\right)}$$

$$IFS_{r-adj}\left(114\,\frac{mg-yr}{Kg-day}\right) = \frac{\left(IRS_{r-c}\left(\frac{200mg}{day}\right) * ED_{r-c}(6\ yr)\right.}{BW_c\ (15\ Kg)} + \frac{+IRS_{r-a}\left(100\,\frac{mg}{day}\right) * ED_{r-a}(24yr)}{BW_a\ (70\ Kg)}$$

Where:

Variable	Value
C_s (UCL or maximum detected concentration in soil) mg/Kg	Site-specific
ED_{r-a} (exposure duration - resident adult) yr	24
EF_r (exposure frequency - resident) day/yr	350
IRS_{r-a} (soil intake rate - resident adult) mg/day	100
IRS_{r-c} (soil intake rate - resident child) mg/day	200
IFS_{r-adj} (age-adjusted soil ingestion factor - resident) mg-yr/Kg-day	114
ED_{r-c} (exposure duration - resident child) yr	6
ED_r (exposure duration - resident) yr	30
AT_r (time-resident) yr	30

Table B-3.2 Scenario 3- General Residential Exposure Pathway R2- Inhalation of Chemicals in Airborne Particulates
Non-Cancer
$$Intake_{res-sol-inh.}\left(\frac{mg}{m^3}\right) = \frac{Cs_{res-sol-inh}\left(\frac{mg}{Kg}\right) * EF_r\left(350\frac{day}{yr}\right) * \frac{1}{PEF\left(\frac{m^3}{kg}\right)} * ET_r\left(24\frac{hr}{day}\right) * \left(\frac{1day}{24hr}\right) * ED_r(30\ yr}{AT_r(30yr) * \frac{365days}{year}}$$

Where:

Variable	Value
C_s (UCL or maximum detected concentration in soil) mg/Kg	Site-specific
EF_r (exposure frequency-resident) day/yr	350
ED_r (exposure duration-resident) yr	30
PEF (particulate emission factor) m^3/kg	1.36E+09
ET_r (exposure time-resident) hr/day	24
AT_r (time-resident) yr	30

Table B-3.3

Scenario 3- General Residential Exposure

Pathway R3- Dermal Contact of Chemicals in Soil

Equation for age -integrated (adult/child) receptors – **Non-Cancer**

$$Intake_{res-sol-Ing.}\left(\frac{mg}{Kg-day}\right) = \frac{C_S\left(\frac{mg}{Kg}\right) * DFS_{r-adj}\left(\frac{361mg-yr}{Kg-day}\right) * EF_r\left(350\frac{day}{yr}\right) * \left(10^{-6}\frac{Kg}{mg}\right) * ABS_d/ABS_o}{ATr\ (30\ years) * \left(\frac{365days}{year}\right)}$$

$$DFS_{r-adj}\left(361\frac{mg-yr}{Kg-day}\right) = \frac{SA_{r-c}\left(\frac{2800cm^2}{day}\right) * ED_{r-c}(6\ yr) * AF_c\left(\frac{0.2mg}{cm^2}\right)}{BW_c\ (15\ Kg)} + \frac{SA_{r-a}\left(5700\frac{cm^2}{day}\right) * ED_{r-a}(24yr) * AF_a\left(\frac{0.07mg}{cm^2}\right)}{BW_a\ (70\ Kg)}$$

Table B-3.3 (Contd.) Scenario 3- General Residential Exposure Pathway R3- Dermal Contact with Chemicals in Soil- Continued
Equation for age -integrated (adult/child) receptors – **Non-Cancer**

Variable	Value
C_s (UCL or maximum detected concentration in soil) mg/Kg	Site-specific
$DFS_{r\text{-}adj}$ (age-adjusted soil inhalation factor-resident) mg-yr/Kg-day	361
EF_r (exposure frequency-resident) day/yr	350
ED_r (exposure duration-resident) yr	30
$SA_{r\text{-}c}$ (Skin surface area- resident child) cm^2	2800
$SA_{r\text{-}a}$ (skin surface area-resident adult) cm^2	5700
$AF_{r\text{-}c}$ (Adherence factor-resident child) mg/cm^2	0.2
$AF_{r\text{-}a}$ (inhalation rate-resident adult) mg/cm^2	0.07
$ED_{r\text{-}a}$ (exposure duration-resident adult) yr	24
$ED_{r\text{-}c}$ (exposure duration-resident child) yr	6
AT_r (time-resident) yr	30
BW_c (body weight-child) Kg	15
BW_a (body weight- adult)Kg	70
ABS_d (dermal absorption) unitless	Chemcial specific
ABS_o (oral or GI absorption) unitless	Chemical specific

Table B-3.4

Scenario 3- General Residential Exposure

Pathway R4- Incidental Ingestion of Chemicals in Soil

Equation for age -integrated (adult/child) receptors – **Carcinogens**

$$Intake_{res-sol-Ing.}\left(\frac{mg}{Kg-day}\right) = \frac{C_S\left(\frac{mg}{Kg}\right) * IFS_{r-adj}\left(\frac{114mg-yr}{Kg-day}\right) * EF_r\left(350\,\frac{day}{yr}\right) * \left(10^{-6}\,\frac{Kg}{mg}\right)}{LT_r\ (70\ years) * \left(\frac{365days}{year}\right)}$$

$$IFS_{r-adj}\left(114\,\frac{mg-yr}{Kg-day}\right) = \frac{\left(IRS_{r-c}\left(\frac{200mg}{day}\right) * ED_{r-c}(6\ yr) + IRS_{r-a}\left(100\,\frac{mg}{day}\right) * ED_{r-a}(24yr)\right)}{BW_c\ (15\ Kg) + BW_a\ (70\ Kg)}$$

Where:

Variable	Value
C_s (UCL or maximum detected concentration in soil) mg/Kg	Site-specific
ED_{r-a} (exposure duration - resident adult) yr	24
EF_r (exposure frequency - resident) day/yr	350
IRS_{r-a} (soil intake rate - resident adult) mg/day	100
IRS_{r-c} (soil intake rate - resident child) mg/day	200
IFS_{r-adj} (age-adjusted soil ingestion factor - resident) mg-yr/Kg-day	114
ED_{r-c} (exposure duration - resident child) yr	6
ED_r (exposure duration - resident) yr	30
LT_r (Life time-resident) yr	70

Table B-3.5

Scenario 3- General Residential Exposure

Pathway R5- Inhalation of Chemicals in Airborne Particulates Emitted from Soil

Carcinogens

$$Intake_{res-sol-inh.}\left(\frac{\mu g}{m^3}\right) = \frac{Cs_{res-sol-inh}\left(\frac{mg}{Kg}\right) * 1000\left(\frac{\mu g}{mg}\right) * EF_r\left(350\frac{day}{yr}\right) * \frac{1}{PEF\left(\frac{m^3}{kg}\right)} * ET_r\left(24\frac{hr}{day}\right) * \left(\frac{1day}{24hr}\right) * ED_r\,(30\,yr)}{LT_r(70yr) * \frac{365days}{year}}$$

Where:

Variable	Value
C_s (UCL or maximum detected concentration in soil) mg/Kg	Site-specific
EF_r (exposure frequency-resident) day/yr	350
ED_r (exposure duration-resident) yr	30
PEF (particulate emission factor) m^3/kg	1.36E+09
ET_r (exposure time-resident) hr/day	24
LT_r (Life time-resident) yr	70

Table B-3.6 Scenario 3- General Residential Exposure Pathway R6- Dermal Contact of Chemicals in Soil
Equation for age -integrated (adult/child) receptors – **Carcinogenic**
$$Intake_{res-sol-Ing.}\left(\frac{mg}{Kg-day}\right) = \frac{C_S\left(\frac{mg}{Kg}\right) * DFS_{r-adj}\left(\frac{361mg-yr}{Kg-day}\right) * EF_r\left(350\frac{day}{yr}\right) * \left(10^{-6}\frac{Kg}{mg}\right) * ABS_d/ABS_o}{LTr\ (70\ years) * \left(\frac{365days}{year}\right)}$$ $$DFS_{r-adj}\left(361\frac{mg-yr}{Kg-day}\right) = \frac{SA_{r-c}\left(\frac{2800cm^2}{day}\right) * ED_{r-c}(6\ yr) * AF_c\left(\frac{0.2mg}{cm^2}\right)}{BW_c\ (15\ Kg)} + \frac{SA_{r-a}\left(5700\frac{cm^2}{day}\right) * ED_{r-a}(24yr) * AF_a\left(\frac{0.07mg}{cm^2}\right)}{BW_a\ (70\ Kg)}$$

Table B-3.6 (Contd.) Scenario 3- General Residential Exposure Pathway R6- Dermal Contact with Chemicals in Soil- Continued
Equation for age -integrated (adult/child) receptors – **Carcinogens**

Variable	Value
C_s (UCL or maximum detected concentration in soil) mg/Kg	Site-specific
$DFS_{r\text{-}adj}$ (age-adjusted soil inhalation factor-resident) mg-yr/Kg-day	361
EF_r (exposure frequency-resident) day/yr	350
ED_r (exposure duration-resident) yr	30
$SA_{r\text{-}c}$ (Skin surface area- resident child) cm^2	2800
$SA_{r\text{-}a}$ (skin surface area-resident adult) cm^2	5700
$AF_{r\text{-}c}$ (Adherence factor-resident child) mg/cm^2	0.2
$AF_{r\text{-}a}$ (Adherence factor-resident adult) mg/cm^2	0.07
$ED_{r\text{-}a}$ (exposure duration-resident adult) yr	24
$ED_{r\text{-}c}$ (exposure duration-resident child) yr	6
LT_r (Life time-resident) yr	70
BW_c (body weight-child) Kg	15
BW_a (body weight- adult)Kg	70
ABS_d (dermal absorption) unitless	Chemcial specific
ABS_o (oral or GI absorption) unitless	Chemical specific

Table B-3.7 Scenario 3- General Residential Exposure Pathway R7- Ingestion of Chemical Contaminants in Tap Water-Metal-Cancer
Equation for age -integrated (adult/child) receptors
$$Intake_{water-Ca-ing.}\left(\frac{mg}{Kg-day}\right)=\frac{C_w\left(\frac{\mu g}{L}\right)*EF_r\left(350\frac{day}{yr}\right)*IFW_{r-adj}\left(1.086\frac{L-yr}{Kg-day}\right)}{AT_r\left(365\frac{day}{yr}\right)*LT_r(70years)*\left(1000\frac{\mu g}{mg}\right)}$$ $$IFW_{r-adj}\left(1.086\frac{L-yr}{Kg-day}\right)=\frac{ED_{r-c}\,(6\,yr)*IRW_{r-c}\left(1\frac{L}{day}\right)}{BW_c(15\,Kg)}+\frac{ED_{r-a}(24\,yr)*IRW_{r-a}\left(2\frac{L}{day}\right)}{BW_a(70\,Kg)}$$

Where:

Variable	Value
C_w (contaminant concentration in water) µg/L	Site specific
ED_{r-a} (exposure duration - resident adult) yr	24
ED_{r-c} (exposure duration - resident child) yr	6
EF_r (exposure frequency - resident) day/yr	350
IRW_{r-a} (water intake rate - resident adult) L/day	2
IRW_{r-c} (water intake rate - resident child) L/day	1
IFW_{r-adj} (age-adjusted water ingestion factor - resident) L-yr/Kg-day	1.086
BWa (Body weight-resident adult) Kg	70
BWc (Body weight-resident child) Kg	15
LT_r (Life time-resident) yr	70

Table 3.8

Scenario 3- General Residential Exposure

Pathway R8- Dermal Contact of Chemical Contaminants in Tap Water-Inorganics-Cancer

Equation for age -integrated (adult/child) receptors

$$Intake_{water-Ca-der.}\left(\frac{mg}{Kg-day}\right)=\frac{C_w\left(\frac{\mu g}{L}\right)*K_p\left(\frac{cm}{hr}\right)*EF_r\left(350\frac{day}{yr}\right)*\ DFW_{r-adj}\left(8811.4\frac{cm^2-event-yr}{Kg-day}\right)*ET_{rw-adj}(0.664\frac{hr}{event})}{AT_r\left(365\frac{day}{yr}\right)*LT_r(70years)*\left(1000\ \frac{\mu g}{mg}\right)*\left(1000\frac{cm^3}{L}\right)*GIABS}$$

$$DFW_{r-adj}\left(8811.4\frac{cm^2-event-yr}{Kg-day}\right)$$
$$=\frac{ED_{r-c}\ (6\ yr)*EV_{r-c}\left(1\frac{event}{day}\right)*\ SA_c(6{,}600\ cm^2)}{BW_c(15\ Kg)}+\frac{ED_{r-a}(24\ yr)*EV_{r-a}\left(1\frac{event}{day}\right)*\ SA_c(18{,}000\ cm^2)}{BW_a(70\ Kg)}$$

$$ET_{rw-adj}\left(0.664\frac{hr}{event}\right)=\frac{ET_{rwc}\ \left(1\frac{hr}{event}\right)*ED_c\ (6\ years)+ET_{rwa}\ \left(0.58\frac{hr}{event}\right)*ED_a\ (24\ years)}{ED_r(30\ years)}$$

Table B-3.8 (Contd.) Scenario 3- General Residential Exposure Pathway R8- Dermal Contact with Chemicals in Tap Water-Metals-Cancer- Continued
Equation for age -integrated (adult/child) receptors – **Carcinogens**

Variable	Value
C_w (contaminant concentration in water) µg/L	Site-specific
$DFW_{r\text{-}adj}$ (age-adjusted water dermal factor - resident) cm^2-event-yr/Kg-day	8811.4
EF_r (exposure frequency-resident) day/yr	350
ED_r (exposure duration-resident) yr	30
$SA_{r\text{-}c}$ (Skin surface area- resident child) cm^2	6,600
$SA_{r\text{-}a}$ (skin surface area-resident adult) cm^2	18,000
K_p (dermal permeability coefficient)cm/hr	Chemical specific
$ET_{rw\text{-}adj}$ (exposure time-age adjusted-resident water)hr/event	0.664
ET_{rwc} (exposure time-water resident child) hr	1
ET_{rwa} (exposure time-water resident adult) hr	0.58
$ED_{r\text{-}a}$ (exposure duration-resident adult) yr	24
$ED_{r\text{-}c}$ (exposure duration-resident child) yr	6
LT_r (Life time-resident) yr	70
BW_c (body weight-child) Kg	15
BW_a (body weight- adult)Kg	70
$GIABS_o$ (oral or GI absorption) unitless	Chemical specific

Table B-3.9

Scenario 3- General Residential Exposure

Pathway R9- Ingestion of Chemical Contaminants in Tap Water-Metal-NonCancer

Equation for age -integrated (adult/child) receptors

$$Intake_{water-nc-ing.}\left(\frac{mg}{Kg-day}\right)=\frac{C_w\left(\frac{\mu g}{L}\right)*EF_r\left(350\frac{day}{yr}\right)*IFW_{r-adj}\left(1.086\frac{L-yr}{Kg-day}\right)}{AT_r\left(365\frac{day}{yr}\right)*ED_r(30years)*\left(1000\frac{\mu g}{mg}\right)}$$

$$IFW_{r-adj}\left(1.086\frac{L-yr}{Kg-day}\right)=\frac{ED_{r-c}\,(6\,yr)*IRW_{r-c}\left(1\frac{L}{day}\right)}{BW_c(15\,Kg)}+\frac{ED_{r-a}(24\,yr)*IRW_{r-a}\left(2\frac{L}{day}\right)}{BW_a(70\,Kg)}$$

Where:

Variable	Value
C_w (contaminant concentration in water) µg/L	Site specific
ED_r (exposure duration - resident) yr	30
ED_{r-a} (exposure duration - resident adult) yr	24
ED_{r-c} (exposure duration - resident child) yr	6
EF_r (exposure frequency - resident) day/yr	350
IRW_{r-a} (water intake rate - resident adult) L/day	2
IRW_{r-c} (water intake rate - resident child) L/day	1
IFW_{r-adj} (age-adjusted water ingestion factor - resident) L-yr/Kg-day	1.086
BWa (Body weight-resident adult) Kg	70
BWc (Body weight-resident child) Kg	15

Table B-3.10

Scenario 3- General Residential Exposure

Pathway 10- Dermal Contact of Chemical Contaminants in Tap Water-Inorganics-NonCancer

Equation for age -integrated (adult/child) receptors

$$Intake_{water-nc-der.}\left(\frac{mg}{Kg-day}\right)=\frac{C_w\left(\frac{\mu g}{L}\right)*K_p\left(\frac{cm}{hr}\right)*EF_r\left(350\frac{day}{yr}\right)*\ DFW_{r-adj}\left(8811.4\frac{cm^2-event-yr}{Kg-day}\right)*ET_{rw-adj}(0.664\frac{hr}{event})}{AT_r\left(365\frac{day}{yr}\right)*ED_r(30years)*\left(1000\ \frac{\mu g}{mg}\right)*\left(1000\frac{cm^3}{L}\right)*GIABS}$$

$$DFW_{r-adj}\left(8811.4\frac{cm^2-event-yr}{Kg-day}\right)$$
$$=\frac{ED_{r-c}\ (6\ yr)*EV_{r-c}\left(1\frac{event}{day}\right)*\ SA_c(6{,}600\ cm^2)}{BW_c(15\ Kg)}+\frac{ED_{r-a}(24\ yr)*EV_{r-a}\left(1\frac{event}{day}\right)*\ SA_c(18{,}000\ cm^2)}{BW_a(70\ Kg)}$$

$$ET_{rw-adj}\left(0.664\frac{hr}{event}\right)=\frac{ET_{rwc}\ \left(1\frac{hr}{event}\right)*ED_c\ (6\ years)+ET_{rwa}\ \left(0.58\frac{hr}{event}\right)*ED_a\ (24\ years)}{ED_r(30\ years)}$$

Table B-3.10 (Contd.) Scenario 3- General Residential Exposure Pathway R10- Dermal Contact with Chemicals in Tap Water-Metals-NonCancer- Continued
Equation for age -integrated (adult/child) receptors – **Carcinogens**

Variable	Value
C_w (contaminant concentration in water) µg/L	Site-specific
$DFW_{r\text{-}adj}$ (age-adjusted water dermal factor - resident) cm^2-event-yr/Kg-day	8811.4
EF_r (exposure frequency-resident) day/yr	350
ED_r (exposure duration-resident) yr	30
$SA_{r\text{-}c}$ (Skin surface area- resident child) cm^2	6,600
$SA_{r\text{-}a}$ (skin surface area-resident adult) cm^2	18,000
K_p (dermal permeability coefficient)cm/hr	Chemical specific
$ET_{rw\text{-}adj}$ (exposure time-age adjusted-resident water)hr/event	0.664
ET_{rwc} (exposure time-water resident child) hr	1
ET_{rwa} (exposure time-water resident adult) hr	0.58
$ED_{r\text{-}a}$ (exposure duration-resident adult) yr	24
$ED_{r\text{-}c}$ (exposure duration-resident child) yr	6
BW_c (body weight-child) Kg	15
BW_a (body weight- adult)Kg	70
$GIABS_o$ (oral or GI absorption) unitless	Chemical specific