APPENDIX C

RISK CHARACTERIZATION EQUATIONS

Human Health Risk Assessment Protocol

July 1998

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RISK CHARACTERIZATION EQUATIONS

TABLE		PAGE
C-1-1	COPC INTAKE FROM SOIL	C-X
C-1-2	COPC INTAKE FROM PRODUCE	C-X
C-1-3	COPC INTAKE FROM BEEF, MILK, PORK, POULTRY, AND EGGS	C-X
C-1-4	COPC INTAKE FROM FISH	C-X
C-1-5	COPC INTAKE FROM DRINKING WATER	C-X
C-1-6	TOTAL DAILY INTAKE	C-X
C-1-7	INDIVIDUAL CANCER RISK: CARCINOGENS	C-X
C-1-8	HAZARD QUOTIENT: NONCARCINOGENS	C-X
C-1-9	TOTAL CANCER RISK: CARCINOGENS	C-X
C-1-10	TOTAL HAZARD INDEX: NONCARCINOGENS	C-X
C-1-11	SEGREGATED HAZARD INDEX FOR SPECIFIC ORGAN EFFECTS: NONCARCINOGENS	C-X
C-2-1	INHALATION CANCER RISK FOR INDIVIDUAL CHEMICALS: CARCINOGENS	C-X
C-2-2	INHALATION HAZARD QUOTIENT FOR COPCS: NONCARCINOGENS	C-X
C-2-3	TOTAL INHALATION CANCER RISK: CARCINOGENS	C-X
C-2-4	HAZARD INDEX FOR INHALATION: NONCARCINOGENS	C-X
C-3-1	CONCENTRATION OF DIOXINS IN BREAST MILK	C-X
C-3-2	AVERAGE DAILY DOSE TO THE EXPOSED INFANT	C-X
C-4-1	ACUTE HAZARD QUOTIENT	C-X

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LIST OF VARIABLES

ADD	=	Average daily dose (mg COPC/kg BW-day)
ADD_{infant}	=	Average daily dose for infant exposed to contaminated breast milk (pg [or mg] COPC/kg BW infant/day)
ADD_{mat}	=	Average daily dose, mother (pg COPC/kg BW mother/day)
ADI	=	Average daily COPC intake via inhalation (mg COPC/kg BW-day)
$AHQ_{inh(I)}$	=	Acute hazard quotient for inhalation of COPCs (unitless)
$AIEC$	=	COPC acute inhalation exposure criteria (mg/m^3)
A_i	=	Concentration of COPC *I* in animal tissue *j* (mg COPC/kg FW tissue)
AT	=	Averaging time (yr)
AT_{infant}	=	Averaging time for infant (yr)
BW	=	Body weight (kg)
BW_{infant}	=	Body weight of infant (kg)
C_a	=	Total COPC air concentration ($\mu g/m^3$)
C_{acute}	=	Acute air concentration ($\mu g/m^3$)
$Cancer\ Risk_i$	=	Individual lifetime risk through indirect exposure to COPC carcinogen *I* (unitless)
$Cancer\ Risk_{inh(I)}$	=	Individual lifetime cancer risk through direct inhalation of COPC carcinogen *I* (unitless)
C_{dw}	=	Dissolved phase water concentration (mg COPC/L water)
C_{fish}	=	Concentration in fish (mg COPC/kg FW tissue)
$C_{milk\ fat}$	=	Concentration in milk fat of breast milk for a specific exposure scenario (pg [or mg] COPC/kg milk fat)
CR_{ag}	=	Consumption rate of aboveground produce (kg DW plant/kg BW-day)
CR_{bg}	=	Consumption rate of belowground produce (kg DW plant/kg BW-day)
CR_{dw}	=	Consumption rate of drinking water (L water/day)
CR_{fish}	=	Consumption rate of fish (kg/kg BW-day)
CR_j	=	Consumption rate of animal tissue *j* (kg/kg-day FW)
CR_{pp}	=	Consumption rate of protected aboveground produce (kg DW plant/kg BW-day)
CR_{soil}	=	Consumption rate of soil (kg soil/day)
Cs	=	Average soil concentration over exposure duration (mg COPC/kg soil)
ED	=	Exposure duration (yr)
ED_{infant}	=	Exposure duration of infant to breast milk (yr)
EF	=	Exposure frequency (days/yr)
ET	=	Exposure time (hrs/day)
f_1	=	Fraction of ingested dioxin that is stored in fat (unitless)
f_2	=	Fraction of mother's weight that is fat (unitless)
f_3	=	Fraction of mother's breast milk that is fat (unitless)
f_4	=	Fraction of ingested COPC that is absorbed (unitless)
F_{ag}	=	Fraction of produce that is contaminated (unitless)
F_{bg}	=	Fraction of belowground produce that is contaminated (unitless)

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F_{dw}	=	Fraction of drinking water that is contaminated (unitless)
F_{fish}	=	Fraction of fish that is contaminated (unitless)
F_j	=	Fraction of animal tissue *j* that is contaminated (unitless)
F_{soil}	=	Fraction of soil that is contaminated (unitless)
h	=	Half-life of dioxin in adults (days)
$HI_{inh(j)}$	=	Hazard index for target organ effect *j* through direct inhalation of all COPCs (unitless)
HI_j	=	Hazard index for exposure pathway *j* (unitless)
HQ_i	=	Hazard quotient for COPC *I* (unitless)
$HQ_{\text{inh(I)}}$	=	Hazard quotient for direct inhalation of COPC *I* (unitless)
I	=	Total daily intake of COPC (mg COPC/kg BW-day)
I_i	=	Daily intake of COPC *I* from animal tissue *j* (mg COPC/kg BW-day)
I_{ag}	=	Daily intake of COPC from produce (mg COPC/kg BW-day)
I_{bg}	=	Daily intake of COPC from belowground produce (mg COPC/kg BW-day
I_{dw}	=	Daily intake of COPC from drinking water (mg COPC/kg BW-day)
I_{fish}	=	Daily intake of COPC from fish (mg COPC/kg BW-day)
$\boldsymbol{I_{soil}}$	**=**	**Daily intake of COPC from soil (mg COPC/kg BW-day)**
Inhalation CSF	=	Inhalation cancer slope factor $(mg/kg\text{-}day)^{-1}$
IR	=	Inhalation rate (m^3/hr)
IR_{milk}	=	Ingestion rate of breast milk by the infant (kg/day)
LADD	=	Lifetime average daily dose (mg COPC/kg BW-day)
m	=	Average maternal intake of dioxin for each adult exposure scenario (mg COPC/kg BW-day)
Oral CSF	=	Oral cancer slope factor $(mg/kg\text{-}day)^{-1}$
Pd	=	Aboveground exposed produce concentration due to direct (wet and dry) deposition onto plant surfaces (mg COPC/kg DW)
P_i	=	Total COPC concentration in plant type *I* eaten by the animal (mg/kg DW)
Pr	=	Aboveground exposed and protected produce concentration due to root uptake (mg COPC/kg DW)
Pr_{bg}	=	Belowground produce concentration due to root uptake (mg COPC/kg DW)
Pv	=	Concentration of COPC in plant due to air-to-plant transfer (mg COPC/kg DW)
RfC	=	Reference concentration (mg/kg)
RfD	=	Reference dose (mg/kg-day)
Total Cancer Risk	=	Individual lifetime cancer risk through indirect exposure to all COPC carcinogens (unitless)

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Total Cancer Risk$_{inh}$	=	Total individual lifetime cancer risk through direct inhalation of all COPC carcinogens (unitless)
URF	=	Unit risk factor $(\mu g/m^3)^{-1}$