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TRIM

Total Risk Integrated Methodology

TRIM.FaTE
Technical Support Document
Volume II: Description of Chemical Transport and Transformation Algorithms

U.S. Environmental Protection Agency
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PREFACE

This document, the *TRIM.FaTE Technical Support Document*, is part of a series of documentation for the overall Total Risk Integrated Methodology (TRIM) modeling system. The detailed documentation of TRIM's logic, assumptions, algorithms, equations, and input parameters is provided in comprehensive Technical Support Documents (TSDs) and/or user's guidance for each of the TRIM modules. This report, which supersedes earlier versions (U.S. EPA 1998a, U.S. EPA 1999a,b), documents the Environmental Fate, Transport, and Ecological Exposure module of TRIM (TRIM.FaTE) and is divided into two volumes. The first volume provides a description of terminology, model framework, and functionality of TRIM.FaTE, and the second volume presents a detailed description of the algorithms used in the module.

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ACRONYMS, ABBREVIATIONS, AND SYMBOLS

ACRONYMS

BAF	Bioaccumulation Factor
B(a)P	Benzo(a)pyrene
BASS	Bioaccumulation and Aquatic System Simulator
BCF	Bioconcentration Factor
BMR	Basal Metabolic Rate
BW	Body Weight
D	Dust
DOC	Dissolved Organic Carbon
EPA	United States Environmental Protection Agency
FIR	Free-living Inhalation Rate
GI	Gastrointestinal
GIS	Geographic Information Systems
GW	Ground Water
HAP	Hazardous Air Pollutant
IEM	Indirect Exposure Methodology
K_{AW}	Air/Water Parition Coefficient
K_{OA}	Octanol/Air Partition Coefficient
K_{OW}	Octanol/Water Partition Coefficient
LSODE	Livermore Solver for Ordinary Differential Equations
NERL	National Exposure Research Laboratory
OAQPS	EPA Office of Air Quality Planning and Standards
OPPT	Office of Pollution Prevention and Toxics
ORD	Office of Research and Development
OW	Office of Water
PAH	Polycyclic Aromatic Hydrocarbon
R-MCM	Regional Mercury Cycling Model
SAB	Science Advisory Board
SCF	Stem Concentration Factor
SW	Surface Water
TF	Transfer Factor
TOC	Total Organic Carbon
TRIM	Total Risk Integrated Methodology
TRIM.Expo	TRIM Exposure-Event module
TRIM.FaTE	TRIM Environmental Fate, Transport, and Ecological Exposure module
TRIM.Risk	TRIM Risk Characterization module
TSCF	Transpiration Stream Concentration Factor
TSD	Technical Support Document
WASP	Water Quality Analysis Simulation Program

UNIT ABBREVIATIONS

		μg	microgram
°C	degrees Centigrade	ng	nanogram
°K	degrees Kelvin	mm	millimeter
g	gram	mol	mole
hr	hour	nmol	nanomole
kg	kilogram	nM	nanomolar
L	liters	Pascals	Pa
m	meter	yr	year

SYMBOLS USED FOR VARIABLES

Greek

α (alpha)	proportion of equilibrium value
κ (kappa)	von Karmen's constant
κ_j	the equilibrium ratio between the concentration in phase *j* and the phase to which one is normalizing
ϵ (epsilon)	volume fraction gas/vapor/pure air
θ (theta)	volume fraction liquid
ϕ (phi)	porosity (volume fraction not solid)
ψ(psi)	volume fraction of compartment
ρ (rho)	density
φ (alternate phi)	fraction sorbed to solids
γ(gamma)	gradient of soil concentration change
δ (delta)	boundary layer thickness
Θ (Theta)	temperature correction factor
λ (lamda)	dimensionless viscous sublayer thickness
λ_i	removal rate constant for soil compartment *I*
μ (mu)	viscosity
ν (nu)	velocity
υ (upsilon)	volumetric flow rate
ω (omega)	volume fraction occupied by a fluid (where fluid = air or water)

Roman

A	area
AE	assimilation efficiency
BW	body weight
C	concentration
d	depth
D	diffusion coefficient
DSP	dispersion coefficient (between surface water compartments)
E	elimination (wildlife)
f	fraction
FIR	free-living inhalation rate (not normalized to body weight)
g	conductance
H	Henry's law constant
I	interception fraction

IN	ingestion, inhalation, or intake (normalized to body weight)
IR	inhalation rate (not normalized to body weight)
k	rate constant
k	transfer coefficient (Chapter 3)
K	partition coefficient
L	characteristic mixing length
m	mass of an organism
M	mass of chemical
M_W	molecular weight
n	number
na_S	number of stomata in leaf multiplied by the area of a single stomata divided by the area of the leaf
N	chemical inventory (mass)
p	proportion
P	permeance
P	pressure (P_{vapor})
Q	flux
R	universal gas constant
$R_{[sub]}$	resistance [subscript]
rh	relative humidity
f_{ML}	fraction mass disolved/volume fraction liquid
f_{MS}	fraction mass solid particle-phase/volume fraction solid particles
f_{MV}	fraction mass vapor-phase/volume fraction gas
S	rate of sediment deposition (or resuspension)
T	transfer factor or
T	temperature
U	mass transfer coefficient
V	volume
v	velocity
ve	effective velocity
WI	water ingestion (not normalized to body weight)
Z	fugacity capacity

ABBREVIATIONS USED IN VARIABLE SUBSCRIPTS

acc	accumulation
adv	advection
Al	Algae
Arth	Arthropod
ASF	Allometric Scaling Factor
avail	available
B	Boundary layer
BI	Benthic Invertebrates
C	Conductance
d	drag
D	Diet
dep	depuration (fish)
dep	deposition (abiotic media)
dif	diffusion
e	effective
ef	excretion via urine/feces
eg	excretion from gills
ET	total elimination
f	unspecified fish
ff	fur, feathers (or hair)
Fbo	Fish, benthic omnivore
Fh	Fish, herbivore
Fwch	Fish, water column herbivore
Fwco	Fish, water column omnivore
G	Growth (fish algorithms)
G	Gas (air algorithms)
L	load (e.g., D_L = Dust load)
L	liquid (e.g., R_L = liquid phase resistance)
lact	lactation
m	melting; or
m	mesophyl
met	metabolism
Mp	Macrophyte
N	normalized
oc	organic carbon
ow	octanol water
P	Particle
Ph	Phloem
r	ratio
rV	ratio for Vapor
R	Root
Rcv	Receiving
res	resuspension/resuspend
S	Soil (*e.g.*, A_S = soil area); or
S	Stomatal (*e.g.*, g_S = total stomatal conductance)
Sed	Sediment
SSed	Suspended sediments
Send	Sending
Snk	Sink
Sr	root-zone Soil
Ss	surface Soil
Sv	vadose-zone Soil
St	Stem
SWD	dissolved in surface water
t	time
T	Temperature
Tprey	Terrestrial prey
Twl	Terrestrial wildlife
uf	urine/feces
U	Uptake
fuSs	eliminated to surface soil
fuSW	eliminated to surface water
W	Water
WD	dissolved in water
v	volatilization
VAF	vegetation attenuation factor
Worm	Earthworm
WV	Wet Vapor
Xy	Xylem

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