11 Estimating Workplace Exposure and Industrial Releases Using ChemSTEER 11.1 What Does ChemSTEER Do?	
11.2 How Does ChemSTEER Work?	11-1
11.2.1 The General Tab	
11.2.2 The Chemical Tab 11.2.3 The Operations Tab	
11.2.4 Releases Tab - Calculations	11-4
11.2.5 Releases Tab - Calculation Results	
11.2.6 Exposures (Worker) Tab - Calculations 11.2.7 Loading Solid Materials	
11.3 Features of ChemSTEER	11-7
11.3.1 User-Friendly Design	
11.3.2 Creating Summary Reports and Saving Assessments	
11.3.3 Next Version Expected Is Soon 11.4 Running the Sample Chemical, Isodecyl Acrylate, in ChemSTEER	11-8 11-8
11.5 Entering Results from ChemSTEER in the Sustainable Futures Worksheet	11-11

11 Estimating Workplace Exposure and Industrial Releases Using ChemSTEER

The current version of ChemSTEER (<u>Chem</u>ical <u>S</u>creening <u>T</u>ool for <u>E</u>xposures and <u>E</u>nvironmental <u>R</u>eleases) and additional exposure-related information and resources are available at <u>http://www.epa.gov/oppt/exposure/pubs/chemsteer.htm</u>. This chapter will provide a brief summary of ChemSTEER. Please refer to the online resources for additional information.

11.1 What Does ChemSTEER Do?

ChemSTEER estimates workplace exposures and environmental releases of a chemical when specific measured values or monitoring data are not available. It provides screening-level estimates using worst case scenarios and input from other EPA methods and models.

11.2 How Does ChemSTEER Work?

As you enter the necessary information on your chemical and scenario(s) you "build" your assessment in ChemSTEER by entering these values:

- Data on the chemical to be assessed, including:
 - Production volume (or assessed volume) (kilograms per year)
 - o Physical/ chemical properties (known or estimated)
- Select at least one operation (or work place scenario); options include:
 - o Pre-defined industry-specific / use-specific operation
 - or
 - User-defined operation.

Then you select at least one release source/ exposure activity within each operation. Each source or activity is associated with default models for calculating releases and worker inhalation and dermal exposures.

Next you enter mass balance and container-related data, review the models selected and the model input data, then run ChemSTEER.

This chapter will summarize the entry screens or "tabs" in ChemSTEER, which are:

- General,
- Chemical,
- Operations,
- Operation Parameters,
- Releases,
- Exposures, and
- Optional Information.

11.2.1 The General Tab

This tab allows you to view and/or enter general information related to the ChemSTEER assessment, including:

- Assessment name,
- Date of completion,
- Assessor information,
- Contact information for the assessment,
- Report(s) summarizing information received from a contact, and
- General comments related to the assessment.

General Assessm	ent Type: Status:	PMN Pre-review draft	Date: 10/21/2002 Revision: ENG	CBI: No Are there comments: No
Assessors:	dentifier:	P02-9998		Number of Contact Reports: 0
Name: Sco Affiliation: U.S Phone: (202 Email: prot	. EPA/OPF 2)555-7890		Leslie Crawford ERG, Inc. (703)555-1234 [crawfor@erg.com	
Ci		Mockingbird Lane	Contact Information: Mrt O. Kenobi (555)555-1212	<u>م</u>

Pie Edit Reports Heb General Dismical Operation Parameters Releases Exposures Optional Information Chemical Category Trade Name(): Demical Categor	
Chemical Demical Name. [Guerre Ommical Category. Track Name. [Guerre Track Name. [Gold Status Name. [Critical Status Name. Track Name. [Gold Status Name. [Critical Status Name. Total Assessed Production Volume (PV). [1200 [Ag/y Imported Production Volume (PV). [1200 [Ag/y Dometic Conduction Volume (PV). [1200 [Ag/y Vapor Pessae. [Gold Status Name. [Note: Name. Vapor Pessae. [Gold Status Name. [Status Name. Molecular Weight (MW). [Status Name. [Status Name.	
Oremical Category. Trade Name(); Trade Name(); Trade Name(); Oremical Category. Trade Name(); Total Accessed Production Volume (PV); [1020] Imported Production Volume (PV); [1200] Domesice Production Volume (PV); [1200] Vapor Pressure (VPchene; [0029] Vapor Pressure (VPchene; [0029] Molecular Weight (MW); [s2: g/mol % < 500;	
Chemical Category Trade Name(1): Dhemical CAS Number: [106:58:3] Molecular Formula: [27)+8 Total Assessed Production Volume (PV): [1200 kg/yr Imported Production Volume (PV): [1200 kg/yr Dometric Production Volume (PV): [1200 kg/yr Vapor Pressure (VPchene): [0029 tor at: [20 C Molecular Weight (MVV): [52 g/mol III 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
Trade Name11: Molecular Formulas C7/18 Dremoid CAS Number: [108:88-3] Molecular Formulas [C7/18] Total Assessed Production Volume (PVI) [11200] kg/y Type of Notice: Imported Production Volume (PVI) [1200] kg/y Type of Notice: Dometic Production Volume (PVI) [1000] kg/y Type of Notice: Vacor Pressure (VPChem) [0029] for at [20] C Molecular Weight (MVI) [52] g/mol % < 500;	
Opened CAS Number T05:36:3 Molecular Formula: C7/H3 Total Assessed Production Volume (PV) T1200 kg/yr Type of Notice: Imported Production Volume (PVi) T1200 kg/yr Type of Notice: Imported Production Volume (PVi) T1200 kg/yr Type of Notice: Vapor Pressure (VPCham); [0:029 forr at 20 C Molecular Weight (MW); [52 g/mol % < 500;	1
Total Assessed Production Volume (PV) T1200 kp/yr Type of Notice: Incorted Production Volume (PV0) T200 kp/yr Domestic Production Volume (PV0) T0000 Domestic Production Volume (PV0) T0000 kp/yr Vapor Pressure (VPChan); T0029 for at 20 C Molecular Weight (MV0); Siz g/mol % < 500;	
Imported Production Volume (PVI) 1200 Hg/yr Domestic Production Volume (PVI) (0000 kg/yr Vapor Pressure (VPChem) (0029 forr at 20 C Molecular Weight (MW) (52 g/mol % < 500	
Domesic Productori Volame (PVd) 10000 kg/yr Vapor Pressure (MPchane) (0.029) tori at 20 C Molecular Weight (MW) (52) g/mol 3 < 1000.	
Vacco Pressure (VPchem); [0.029] tor at (20) C Molecular Weight (MW); [92] g/mol \$\$< \$500;	
Molecular Weight (MW): [92 g/mol % < 500. % < 1000. [
Density (Dohem) (1) 67 g/cm3 at C	
Solubility in Water (WSchem) 53 g/L at C	
General Description of End Usefst: solvent used in coalings	
View/Update Exposure Limits Update Chemical Information View/Update Regulatory Limits	
Parameters with red labeling are often important defaults used in mass balance, container, and model calculations.	

11.2.2 The Chemical Tab

This tab allows you to view and/or enter information related to the chemical to be assessed. The Production Volume (PV) (amount of chemical to be assessed) is an important input parameter because it is used in many mass balance, container-related, release, and exposure calculations.

The physical-chemical property parameters (e.g., vapor pressure, molecular weight) are needed by some release and/ or exposure models.

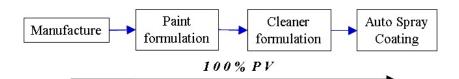
11.2.3 The Operations Tab

An operation in ChemSTEER is a work place or a set of "homogeneous" work places with essentially the same processes, equipment, chemical throughputs, procedures, and worker populations. Each work place within an operation is assumed to have the same chemical releases and worker exposures resulting from the chemical being assessed as the other work places within that operation. As you build the chemical assessment you select one or more operations in which the chemical is manufactured, processed, and/or used. Some examples of operations are:

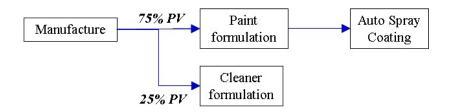
- Manufacture,
- Formulation of paint (User-defined Processing),
- Formulation of cleaner, and
- Automobile spray coating.

Operation Relationships Subtab

The relationships between multiple operations can be defined in ChemSTEER. A straight-series lifecycle of more than one operation (shown below) is the default relationship configuration.



ChemSTEER allows you to re-define the operation relationships. For example, the series above can be rearranged into a more complex, branched lifecycle of operations shown below.



Sources/Activities Subtab

For each operation at least one release source or exposure activity (shown to the right) must be selected. This selection is critical, as it will determine which default release/exposure models are used for the calculations. A source/activity is a source of chemical release to the environment and/or an activity that results in a worker exposure to the chemical within an operation.

	on below to see its Description; the Physical State(s) of the chem lelease and Exposures; and Site Information.	nical, Relations	hips to other operations, Sor	aces and Activities
Manufacture Formulation of pa	ant product			
Formulation of cl Automobile DEM				
	Update Operatio			
	- update Querano	ine in the second se		
in the	ationships Physical States Sources/Activities Site Informati	- 1		
rescription Hes	anonamps Physical States Sources/Activities Site Infomat	ion		
Sources and A	Activities associated with releases and exposures within the oper	nabon		
Activity	, ,	Release	Exposure	
			Yes	
	guid Raw Material from Drums	Yes		
Unloading Li	quid Raw Material from Drums uid Residuals from Drums Used to Transport the Raw Material	Yes Yes	Yes	
Unloading Li Cleaning Lig				
Unloading Li Cleaning Lig Equipment C	uid Residuals from Drums Used to Transport the Raw Material	Yes	Yes	
Unloading Li Cleaning Lig Equipment C	uid Residuals from Drums Used to Transport the Raw Material learning Losses of Liquids from a Single, Large Vessel	Yes Yes	Yes No	
Unloading Li Cleaning Lig Equipment C	uid Residuals from Drums Used to Transport the Raw Material learning Losses of Liquids from a Single, Large Vessel	Yes Yes	Yes No	

	Value 10
	10
	11,1111
	100
	5
Delast/Derived	160
User Specified	0.9
User Specified	0.1
User Specified	24
User Specified	365
Delault/Derived	1.0
Default/Derived	1
Delault/Derived	168
Delault/Derived	1
	User Specified User Specified User Specified User Specified Delault/Derived Delault/Derived Delault/Derived

Mass Balance Parameters Subtab

Mass balance parameters (left) are the set of input values that define each operation and associated chemical throughputs. ChemSTEER allows you to enter the information that is known and will calculate remaining unknown parameters based upon a mass balance of the chemical around the operation. Consult the Help System to learn more about the logic by which ChemSTEER makes mass balance calculations.

Container Parameters Subtab

Container parameters (right) are the set of input values that define the number of containers that are filled with the chemical, emptied, and/or cleaned during each operation. As with the mass balance parameters, ChemSTEER allows you to enter information about the containers that is known and will calculate remaining unknown parameters based upon a mass balance.

fanufacture omulation of paint product		_					
Formulation of cleaner Nutomobile OEM Spray Coating							
and the second property second							
ass Balance Parameters Container	r Parameters						
			Acres and shakes the	and halon De	while all all one new	courses condition in t	
Sources/Activities that are associa	ated with containers are	shown	i in two of the fou	FIGDS DEIOW, LFC	Oble click on any	tow to update it.	
Sources/Activities that are associa	ated with containers are	shown	in two of the fou	r tabs below. Do	uble click on any	Tow to update it.	
					oble click on any	row to update it.	
Sources/Activities that are associa For Raw Material For Product F					uble click on any	row to update it.	
					uble click on any	row to update it.	- 1
For Raw Material For Product F					uble click on any	row to update it.	
					uble click on any	row to update it.	
For Raw Material For Product F					oble click on any	Tow to update it.	
For Raw Material For Product F	For Other Material Co	tainer I		nivity			
For Row Material For Product F	For Other Material Co	tainer I	Parameters by Ac	Nod (containers /	r (containers /	OHa (hours /	
For Raw Material For Product F	For Other Material Co	tainer tainer ear)	Parameters by Ac	tivity Nod (containers / site-day)	r (containers / hour)	OHa (hours /	
For Raw Material For Product F OD = 168 Source/Activity Nam Uriloading Local Raw Material	For Other Material Co	tainer tainer ear) 30668	Parameters by Ac <u>DD-a (days/yr)</u> 168	Ncd (containets / site:day) 6.134931E-02	r (containers / hour) 20	0Ha (hours / day) 3.067466E-03	
For Raw Material For Product F	For Other Material Co Ncy (cor / step from Drums 10 Tomuns Used 10	tainer tainer ear)	OD a (days/yr) 168	Ncd (containers / alte-day) 6.134931E-02 6.134931E-02	r (containers / hour)	0Ha (hours / day) 3.067466E-03 3.067466E-03	I

Edit Reports He	qle					
neral Chemical Op	perations Operation	Parameters Rel	eases Exposure	Optional Inform	ation	
timating Chemical	Releases					
ctivity is selected, on	e or more release mo	dels will be shown	in the Release Mi	odel(s) list Select	each model in the F	ed with it. When a release Release Model(s) for Selected iations and to change
Operation: F	omulation of paint p	roduci				-
Release Activity:	oading Liquid Produ	ct into Bottles				-
	alacted Activity					
telease Model(s) for S EPA/OAQPS AP-42 L Release Input Param	Loading Model	eleaces				
EPA/OAQPS AP-421	Loading Model	eleases	Value Calc	Value	Units	m l
EPA/DAQPS AP-421	Loading Model		Value Calc Model Parm		Units dmensionless	
EPA/OAQPS AP-421 Belease Input Param	Loading Model	Туре		1	dmensionless days/yr	Add or Remove a Release model
EPA/DAQPS AP-421 Belease Input Param Parameter 1. Saturation Factor	Loading Model	Type Delault	Model Parm	1	dmensionless days/yr	Release model
EPA/OAQPS AP-421 Belease Input Param Parameter 1. Saturation Factor Freq: Frequency to	Loading Model	Type Delaul Delault	Model Parm OD a	1 168 9.059116E-06 92	dmensionless days/yr g/1 daltons	Release model
EPA/OAQPS AP-421 Belease Input Param Parameter 1. Saturation Factor Freq. Frequency to G: Vapor Generatio	Loading Model Interes Estimated R Use In Rate Inght	Type Delault Default Model Output	Model Parm OD a Model Parm	1 168 9.058116E-06 92 5	dmensionless days/yr g/1 daltons skes	Release model
EPA/DAQPS AP-421 Release Input Param Parameter 1: Saturation Factor Freq: Frequency to G: Vapor Generatio MW: Molecular We	Loading Model Interes Estimated R Use xn Rate sight st	Type Delault Default Model Output Delault	Model Parm OD a Model Parm Chem Parm	1 168 9.059116E-06 92	dmensionless days/yr g/1 daltons skes	Release model View/Update Mod Information
EPA/DAQPS AP-421 Release Input Param Parameter 1. Saturation Factor Freq. Frequency to G: Vapor Generatio Mut: Molecular We NS: Number of Site Dha: Operating Hos e. Container Rate	Loading Model Interest Estimated R Use with Rate sight si uns for the Activity	Type Default Default Model Output Default Default	Model Parm OD a Model Parm Chem Parm Mass Parm Cont Parm Cont Parm	1 168 9.058116E-06 92 5 0.5061318	dmensionless days/yr g/1 daltons skes	Release model View/Update Mode Information Modily Media of
Parameter I. Saturation Factor Freq Frequency to G: Vapor Generatio MW: Molecular We NS: Number of Site Oha. Operating Hor	Loading Model Interest Estimated R Use with Rate sight si uns for the Activity	Type Default Default Model Output Default Default Default Default Default Constant	Model Parm OD a Model Parm Chem Parm Mass Parm Cont Parm Cont Parm Model Parm	1 168 9.058116E-06 92 5 0.5061318 60 82.05	dmensionless dags/yr g/s datons sites hours/day containers/hr atm.cm3/gmol K	Release model View/Update Mode Information
Parameter I. Saluadion Factor Freq Frequency to Gi Vapor Generatio MV: Molecular Vie NS: Number of Sile No: Number of Sile No: Derivative Rath R: Universal Gas C T: Temperature	Loading Model Interes Estimated R Use in Flate sight is use for the Activity constant	Type Default Default Model Output Default Default Default Constant Default	Model Parm ODa Model Parm Chem Parm Chem Parm Cont Parm Cont Parm Model Parm Model Parm	1 168 9.058116E-06 92 5 0.5061318 60 82.05 298	dmensionless days/yr g/s datons sites hours/day containers/tw atm cm3/gmol K K	View/Update Mode Information Modily Media of Release
Parameter E Salva alson Factor Forg Frequency In G: Vapor Generatio MW: Molecular We MS: Number of Ste Dha: Operating Hon r Container Rate R: Universal Gas C.	Loading Model Interes Estimated R Use in Flate sight is use for the Activity constant	Type Default Default Model Output Default Default Default Default Default Constant	Model Parm OD a Model Parm Chem Parm Mass Parm Cont Parm Cont Parm Model Parm	1 168 9.058116E-06 92 5 0.5061318 60 82.05 298	dmensionless dags/yr g/s datons sites hours/day containers/hr atm.cm3/gmol K	Release model
Parameter I. Saluadion Factor Freq Frequency to Gi Vapor Generatio MV: Molecular Vie NS: Number of Sile No: Number of Sile No: Derivative Rath R: Universal Gas C T: Temperature	Loading Model Loading Model Use Use In Rate split us for the Activity on stant ty of container s	Type Default Default Model Output Default Default Default Constant Default	Model Parm ODa Model Parm Chem Parm Chem Parm Cont Parm Cont Parm Model Parm Model Parm	1 168 9.058116E-06 92 5 0.5061318 60 82.05 298 1 0.029	dimensionless days/yr g/s datons sites hours/day containers/hr atm.cm3/gmol K K gal/container	Release model View/Update Mode Information Modily Media of Release

11.2.4 Releases Tab - Calculations

At least one default release model is associated with each source/ activity within each operation. The release models are used for calculating the chemical releases to the environment that occur during the activity. In the screen shown to the left, the default model for calculating releases from the 'Loading Liquid Product into Bottles' source within the 'Formulation of Paint Product' operation is the EPA/OAQPS AP-42 Loading Model.

View/Update

Click on the "View / Update Combinations" button (shown in the previous image) and you can review the input parameters (shown on the right). Each release model contains the input parameter values that are necessary to perform the calculation by default. Some values are obtained via previous input or calculations (e.g., mass balance or container parameters) or are pre-programmed defaults. You may modify any of the model input parameters provided they are not determined through calculations performed in another input screen.

lead-only and updatable information ab- liput parameters are listed below. Becau e possible parameters that may be use- slease, some of these parameters will no hat parameter under the Type column. ¹ ipe in your own value.	use the release ca d are listed in the ot be required. To	an be calculated usin Input Parameters grid view options or cha	ng several valid e d. Depending on inge a parameter	quations for this mode the data values for the value, click on the la	el, all of his bel for
Activity: Loading Liquid Product in					
Model: EPA/0AQPS AP-42 Loa	ding Model				
Model DR (kg/site-day) = (G × 3 DR occurs over [Freq] d		00			^ ~
Mechanism: Displacement of air conta	aining chemical va	apor			
2		100			
Basis: EPA/OAQPS AP-42 Loading M	odel.				~
	lodel.	Value Calc	Value	Units	
Parameter			Value 0.5061318		
Parameter Dha: Operating Hours for the Activity	Туре	Value Calc	0.5061318		
Parameter Dha: Operating Hours for the Activity : Container Rate	Type Default	Value Calc	0.5061318	hours/day	
Parameter Oha: Operating Hours for the Activity Container Rate R: Universal Gas Constant	Type Default Default	Value Calc Cont Parm Cont Parm	0.5061318	hours/day containers/hr atm.cm3/gmol K	
Basis: EPA/UAQPS AP-42 Loading M Parameter Dha: Operating Hours for the Activity r Container Rate R: Universal Gas Constant T: Temperature (V: Volume Capacity of container	Type Default Default Constant	Value Calc Cont Parm Cont Parm Model Parm	0.5061318 60 82.05	hours/day containers/hr atm.cm3/gmol K	

In the screen shown above you can also view the defaults and assumptions associated with the release model. The default assumptions are conservative and often represent "worst case".

🍃 View/Update the	e Value Calculation of the selected Model Parameter	
As appropriate, view o	r update the Origin for this model parameter.	
Model Parameter:	LF: Loss Fraction	
Туре	Origin	Value
 Default 	Conservative for pumping	0.01
C Non-default	High End to Bounding for gravity drain	0.002
C Non-default	Central Tendency for gravity drain	0.0007
	Ok Cancel	

11.2.5 Releases Tab - Calculation Results

Environmental release results provided by ChemSTEER include:

- Media of release (I.e., air, water, incineration, and/or landfill),
- Number of sites releasing the chemical,
- Daily release rate (kg chemical per siteday),
- Days of release (days per site-year), and
- Annual release rate (kg chemical per year, all sites combined).



e Edit Reports Help							
eneral Chemical Opera	stions Operation Para	meters Releas	es Exposures	Optional Information	on		
Estimating Chemical E	sposures						
All activities that have a c exposure activity is select Parameters tab below to change parameter values	led, one or more exposi- view parameters for the	ure models will be	e shown in the Exp	posure Model(s) is	t Click on e	other the	e Demal or Inhalation Inpu
Operation: Fo	mulation of paint produ	st				٠	
Exposure Activity:	ading Liquid Product in	to Bottles				-	
Demal Exposure Mod	et. EPA/OPPT 2-Hand	d Demal Contact	t with Liquid Mode	6			Liquid
Inhalation Exposure Mod	et EPA/OPPT Mass 8	Ialance Model del Input Parame	Hers Activity Exp	osure Estimates			Liquid Vapor
Inhalation Exposure Mod Dermal Model Input Parat	et EPA/OPPT Mass 8	Ialance Model del Input Parame Type	ren: Activity Exp Value Calc	iosure Estimates	Units	~	
Inhalation Exposure Mod Dermal Model Input Parat Parameter Is Inhalation Rate	et EPA/OPPT Mass 8	Ialance Model del Input Parame Type Default	Her: Activity Exp	osure Estimates Value 1.25	m3/9#	-	
Inhalation Exposure Mod Dermal Model Input Parat Parameter Distribution Rate BW: Body Weight	et EPA/OPPT Mass B meters Inhalation Mor	Ialance Model del Input Parame Type Default Default	Herz Activity Exp	osure Estimates Value 1.25 70	m3/9# kg		Vapor
Inhalation Exposure Mod Dermal Model Input Parar D. Inhalation Rate BW: Body Weight Cris: Mars Concern	et EPA/OPPT Mass B meters Inhalation Mos ration of Chemical in A	Salance Model del Input Parame Type Default Default Model Output	Herz Activity Exp Value Calc Model Parm Model Parm Model Parm	Value Value 1.25 70 0.3754	m3/hr kg mg/m3		Vapor
Inhalation Exposure Mod Dermal Model Input Para Parameter b: Inhalation Rute BW: Body-Weight Cm: Wast Concent Cv: Votame Concent	et EPA/OPPT Mass B meters Inhabation Mos ration of Chemical in A nitration of Chemical in A	Ialance Model del Input Parame Type Default Default Model Output Model Output	Hers Activity Exp Value Colc Model Parm Model Parm Model Parm Model Parm	Volue Estimates Volue 1.25 70 0.3754 0.1	m3/hr kg mg/m3 ppm		Vapor
Inhalation Exposure Mod Dermal Model Input Parat Dramater Dr. Inhalation Rate SW. Body Weight Dr. Mass Concent CV. Volume Conce ED: Exposure Day	et EPA/OPPT Mass B meters Inhalation Mor auton of Chemical in A s	Ialance Model del Input Parame Default Default Model Output Model Output Default	Value Calc Model Parm Model Parm Model Parm Model Parm DDa	Value Estimates Value 1.25 20 0.3754 0.1 160	m3/hr kg mg/m3 ppm days/yr		Vapor
Inhelation Exposure Mod Demail Model Input Para Distribution Rate BW-Body Weight Cris Marc Concert Cr. Volume Concert ED: Exposure Official EY: Years of Occu	et EPA/OPPT Mass B meters Inhabation Moo nation of Chemical in A spation Expensive	Ialance Model del Input Parame Type Default Default Model Output Model Output Default Default	Kees Activity Exp Value Calc Model Parm Model Parm Model Parm ODa Model Parm	osure Estimates Value 1.25 20 0.3754 0.1 160 40	m3/hr kg mg/m3 ppm days/yr years		Vapor Add or Remove an Exposure model Verw/Update
Inhelation Exposure Mod Dermal Model Input Paran Parameter b. Inhelation Rate BW. Body Weight Cr. Mare Concert E.D. Exposure Day E.Y. Years of Doou G. Vagor Generatio	et EPA/OPPT Mass 8 meters Inhalation Mo nation of Chemical in A nitration of Chemical in a pation Exposure in Roln	Ialance Model del Input Parame Default Default Model Output Model Output Default Default Default Model Output	Here: Activity Exp Model Parm Model Parm Model Parm Model Parm Model Parm Model Parm Model Parm	Interestinates Value 1.25 70 0.3754 0.1 160 40 9.0581E.06	m3/hr kg mg/m3 ppm days/yr years g/s		Vapor Add or Remove ar Exposure model View/Update Model (Information
Inhelation Exposure Mod Demail Model Input Para Demail Model Input Para Di Inhabation Rate BW: Body Weight Cris Marc Concert CV: Volume Concert ED: Exposure Day EY: Years of Occur G: Vapor Germetid R: Exposure Durals	et EPA/OPPT Mass 8 meters Inhalation Mo nation of Chemical in A nitration of Chemical in a pation Exposure in Roln	Ialance Model del Input Parame Default Default Model Output Model Output Default Model Output Default Model Output Default	tter: Activity Exp Value Calc Model Parm Model Parm Model Parm ODa Model Parm Model Parm Model Parm	Coure Estimates 1.25 20 0.3754 0.3754 0.3754 0.3754 0.5754 8 8	m3/hr kg mg/m3 ppm days/yr years g/s hrs/day		Vapor Ádd or Remove ar Exposure model View/Update Wodel Information
Inhelation Exposure Mod Dermal Model Input Paran Dermal Model Input Paran Di Inhelation Rate SW Body Weight Cr. Mars Concert Cr. Volume Conce ED: Exposure Day EY: Years of Occu G: Vapor Einnetatio	et EPA/OPPT Moss 8 meters Inhibition Mos nation of Chemical in A nation of Chemical in A nation of Chemical in a soliton Exposure on Rate on	Ialance Model del Input Parame Default Default Model Output Model Output Default Default Default Model Output	Here: Activity Exp Model Parm Model Parm Model Parm Model Parm Model Parm Model Parm Model Parm	Value Value 1.25 20 0.3754 0.1 160 40 9.0581E.06 8 0.1	m3/hr kg mg/m3 ppm days/yr years g/s		Vapor Add or Remove ar Exposure model View/Update Model (Information

11.2.6 Exposures (Worker) Tab -Calculations

The exposure models in ChemSTEER are used to calculate the worker inhalation and dermal exposures to the chemical during the activity. As with the release sources, each activity resulting in a worker exposure will have associated default inhalation and/or dermal exposure model(s). In the screen shown to the left, the default inhalation model for worker exposure to the chemical vapor during the 'Loading Liquid Product into Bottles' activity within the 'Formulation of Paint Product' operation is the EPA/OPPT Mass Balance Model.

Each exposure model contains the input parameter values that are necessary to perform the calculation by default. Some values are obtained via previous input or calculations (e.g., container parameters, associated release model calculations) or are preprogrammed defaults. You may modify any of the model input parameters (provided they are not determined through calculations performed in another input screen).

ead-only and updatable information about			r		
d input paramèters are listed below. Bec of the possible parameters that may be u posure, some of these parameters will no at parameter under the Type column. Wi pe in your own value.	ause the exposi sed are listed in t be required. T	ure can be calculate the Input Parameter o view options or ch	d using several va s grid. Depending ange a parameter	ilid equations for the on the data value value, click on the	nis mode es for thi e label fi
Activity: Loading Liquid Product into B	ottles				
Model: EPA/OPPT Mass Balance M	odel				
Model I = Cm x b x h					
Equation: LADD = [I x ED x Y] / (BW/ x	ATc x 365 days	:/yr]			
					~
echanism: Inhalation of chemical vapors					
hemical State: Wapor	•				
lasis: EPA/OPPT Mass Balance Model.					< >
asis: EPA/OPPT Mass Balance Model.	Туре	Value Calc	Value	Units	
asis: EPA/DPPT Mass Balance Model. Parameter MW: Molecular Weight	Type Default	Chem Parm	92	daltons	
asis: EPA/OPPT Mass Balance Model. Parameter MW: Molecular Weight Nwexy: Number of Workers Exposed	Type Default Default	Chem Parm Model Parm	92	daltons workers/site	
asis: EPA/DPPT Mass Balance Model. Parameter MW: Molecular Weight	Type Default	Chem Parm	92	daltons	S S
Aasis: EPA/OPPT Mass Balance Model. Parameter MW: Molecular Weight Number of Workers Exposed	Type Default Default	Chem Parm Model Parm	92	daltons workers/site ft3/min	
Parameter MV: Molecular Weight NWexp: Number of Workers Exposed Q: Vertilation Rate	Type Default Default Default	Chem Parm Model Parm Model Parm	92 3 500 298	daltons workers/site ft3/min	
Aasis: EPA/OPPT Mass Balance Model. Parameter MW: Molecular Weight NWexp: Number of Workers Exposed Q: Vertilation Rate T: Temperature	Type Default Default Default Default	Chem Parm Model Parm Model Parm Model Parm	92 3 500 298	daltons workers/site ft3/min K L/mol	

e Edit Reports H	elp				
eneral Chemical 0	perations Operation Parame	eters Releases E	opsures Optional Informa	tion	
stimating Chemica	l Exposures				
exposure activity is se	e a chemical exposure are list elected, one or more exposure to view parameters for the m lues.	models will be show	n in the Exposure Model(s)	list. Click on either ti	he Dermal or Inhalation Inpu
Operation	Formulation of paint product				
Exposure Activity.	Loading Liquid Product into	Bottles			
Demai Exposure N	Indel: EPA/DPPT 2-Hand D	Iermal Contact with L	inuid Model		Linud
Inhalation Exposure #	Aodet EPA/OPPT 2-Hand E Aodet EPA/OPPT Mass Bal	ance Model		r.	Liquid Vapor
Inhalation Exposure M		ance Model Ilinput Parameters 4	Activity Exposure Estimates	1	
Inhalation Exposure M Dermal Model Input P Exposure	fodel: EPA/OPPT Mass Bal tarameters Inhalation Model	ance Model IInput Parameters 4	Activity Exposure Estimates	1	
Inhalation Exposure M Dermal Model Input F Exposure Inhalation Pote	Aodel: EPA/OPPT Mass Bal tarameters Inhalation Model	Input Parameters A Estimate 3.7537	Activity Exposure Estimates	1	
Inhalation Exposure M Dermal Model Input P Exposure Inhalation Pote Inhalation Lifet	Addet: EPA/OPPT Mass Bal arameters Inhalation Model ntial Dose Rate me Average Dally Dose	Input Parameters A Estimate 3.7537 0.014	Activity Exposure Estimates Units / mg/day i mg/kg/day	1	Vapor
Inhalation Exposure M Dermal Model Input P Exposure Inhalation Pote Inhalation Aver	Acdel: EPA/OPPT Mass Bal arameters: Inhalation Model nilol Doon Rate me Average Dally Dose age Dally Dose	ance Model Input Parameters A Estimate 3.7537 0.014 0.025	Activity Exposure Estimates Units mg/kg/day mg/kg/day img/kg/day]	Vapor
Inhalation Exposure N Dermal Model Input P Exposure Inhalation Lite Inhalation Acut Inhalation Acut	Addet: EPA/OPPT Mass Bal tarameters: Inhalation Model ntial Dose Rate me Average Dally Dose age Dally Dose E Atemád Dose	ance Model I Input Parameters A Estimate 3.7537 0.014 0.025 0.054	Activity Exposure Estimates I Units I mg/day i mg/kg/day i mg/kg/day i mg/kg/day	1	Vapor Add or Remove ar Exposure model
Inhalation Exposure M Dermal Model Input P Exposure Inhalation Pote Inhalation Acut Dermal Exposu	Addel: EPA/OPPT Mass Bal anameters Inhalation Model nilal Dose Rate the Average Dally Dose age Dally Dose e Potential Dose te Dose Rate	ance Model Input Parameters A Estimate 3.7537 0.014 0.025 0.054 176.4	Activity Exposure Estimates ing/day ing/ng/day ing/ng/day ing/ng/day ing/ng/day	1	Vapor Add or Remove ar Exposure model
Inhalation Exposure N Dermal Model Input P Exposure Inhalation Pote Inhalation Aver Inhalation Aver Inhalation Aver Dermal Exposu Dermal Lifetime	Kodel: EPA/OPPT Mass Bal arametes: Inhalation Model nikil Dose Rate me Average Daly Dose app Daly Dose e Potential Dose e Dosential Dose te Dose Rate Average Daly Dose	ance Model Imput Parameters A Estimate 3.7537 0.014 0.025 0.054 1.76.4 0.6528	Activity Exposure Estimates mg/day mg/bg/day mg/bg/day mg/bg/day mg/bg/day mg/bg/day	1	Vapor Add or Remove ar Exposure model
Inhalation Exposure M Dermal Model Input P Exposure Inhalation Pote Inhalation Acut Dermal Exposu	Addet: EPA/OPPT Mass Bal arameters: Inhalation Model misil Doos Rate me Average Daly Doos e Potential Doos e Potential Doos e Doos Rate e Doos Rate e Doos Rate a Average Daly Doos e Daly Doos	ance Model Input Parameters 4 Estimate 0.025 0.054 175.6 0.652 1.1593	Activity Exposure Estimates ing/day ing/ng/day ing/ng/day ing/ng/day ing/ng/day	j.	Vapor Add or Remove an Exposure model

Exposures Tab - Calculation Results

Worker exposure results include the following estimates for both inhalation and dermal exposure:

- PDR Potential Dose Rate (mg/day)
- LADD Lifetime Average Daily Dose (mg/kg-day)
- ADD Average Daily Dose (mg/kg-day)
- APD Acute Potential Dose (mg/kg-day)

11.2.7 Loading Solid Materials

The activity "Loading Solid Materials" is evaluated using the model OSHA PNOR (Particles Not Otherwise Regulated) PEL (Permissible Exposure Limit).

Read-only and updatable information a value. When the Type is User-defined. Updrut 1 option and the Model Parame parameters are used to calculate the D the model equation(s) Activity: Loading Solid Product it	, you enter yo eters for Outp	ur value directly in th ut 2 option below. N	e Value column. To ote that Output 1 p	a calculate two sets of arameters are used to	model results, enable the Mod calculate the Output 1 model n	el Parameters for esuits and Output 2
	into Transmort	Containers				
Model: OSHA Total PNDR PEL						
Model I = Cm x b x h Equation: Cm = KCk x Ys						
	/Particulate o	non-volatile portion	of mist, aerosols, e	te.		
Form(s) of Exposure:						
Chemical State: Particulate	-	I Uncert	ainty lestimate base	d on model regulator	v limit, or data not specific to in	tustru?l
	and a second	i. curren	any feature ton	a an model, regarded	y mile, or obsorbly operate to an	mand of
Enable Model Parameters for Dutps	of 1		F Er	able Model Paramete	ns for Output 2	
Upper Bound	-		Uppe	r Bound	•	
			1.000			
Basis: OSHA PNOR PEL Limiti	ing Model					
^D arameters:						
	ype 2	Origin 2	Value 2	Units		A
EY. Years of Occupation Exposure D		Model Parm		years		
	Constant	Model Parm		hts/day		
KCk: Mass concentration of total c Co NS: Number of Sites D		Model Parm Mass Parm		mg/m3		
	efault	User Specified		sites workers/site		
Made and March of March and Taxas De						
NW/exp: Number of Workers Expo D Ys: Weight Fraction of Dhemical in D		Yi Yi		dmensionles		1

11.3 Features of ChemSTEER

f paint product				
g Basis Selection Specify Mass B	alance Input Parameters	Specily Other Batch Parame	kers	
ChemSTEER will calculate the other	er two parameters for you. I	you only need a smaller sub	oset of these param	arameter from the leters for use in a
ation; Using Effluent				
NS: Number of Siles	Pair 1 -	5		Deloitote
Nbv: Total batches per vear			â	2
	Pair 2 -	P.0		-
				Defaults
SMUprod: Batch Mass Output of Pr	oduct kg/ste batch	[10	0	Calculate
BMDchem: Batch Mass Dutput of 0	hemical kg/site-batch	10	1	
Calculate remainin	ng two parameters	Bestore Defaults		
ent Parameters Calculation				
With Weight Fraction of Chemical in Baw Material (uniters)			0.9	Becak
BMIm: Batch Mass Input of Raw Material kg/site-batch			11.1111	Becald
P BMIchem Batch Mass Input of Chemical kg/site-batch			10	Brunk
	Çalculate dela	ults		
	executivitiere of the first two parame Chemis TELFs will calculate the dwill calculate the dwill be parameters strice; U sing Effluent 45: Number of Sites Up; E dal Latchen per sea (prod. Weight Fraction of Chemical BMOpod Bach Mass Dutput of D Calculate remain and Parameters: Calculate remain in Parameters: Calculate rescalation. Once social and of the rescalation. Once social calculate Million: Bach Mass Tiput of Raw M	executivities of the list two parameters, including al load to Chemic TEER will calculate the other two parameters for you. I double, methor of Mone parameters and Denoi TEER will not do string; Using Effluent Pain 1 - Structure of Stes Hig. Total batchen par pear prod. Weight Fraction of Demoisal in Product (unless) BMOpend Batch Mans Durput of Product kg/steb batch 	exocity there of the first two parameters, including at least one parameter from the first "para Chem"s TELFs will calculate the other two parameters for you. If you only meet a matter will define a strain of the parameters and Chem"s TELFs will not derive a complete set of definitions. If you only meet a strain of the telephone in the telephone and the set of the strain of the set of telephone and	Pair 1 Standber of Stes 5 Bits Number of Stes 166 Tpud Weight Fraction of Chemical in Product (unlines) 0.1 MDQroot Batch Mass Dutput of Product light/ab batch 100 Statuster of Stes 10 MDQroot Batch Mass Dutput of Product light/ab batch 10 Calculate remaining two parameters Elestore Defaults mt Parameters Calculation Calculate remaining two parameters and press the Thecalt batton for the parameter recalculation Inv Weight Reaction O Chemical Ray Alter batch 10 Or Weight Reaction O Chemical Ray Alter batch 10 Inv Weight Reaction O Chemical Ray Alter batch 10 Inv Weight Reaction O Chemical Ray Alter batch 10 Inv Weight Reaction O Chemical Ray Alter batch 10 Multime Batch Mass Input of New Material kgr/Alter batch 10 Mitcher Datch Mass Input of Chemical Ray Alter batch 10

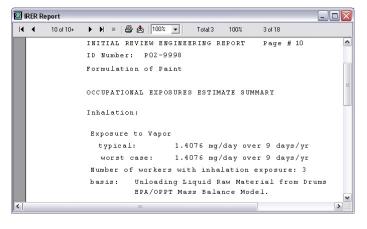
11.3.1 User-Friendly Design

ChemSTEER is designed such that new as well as experienced users can use the software to perform screening-level estimates. ChemSTEER walks you through the process of creating an assessment scenario.

Every screen has instructions that tell you what information must be entered before you proceed to the next screen. All default models are designed to be transparent and all assumptions and values are documented. ChemSTEER contains an extensive Help System that documents the bases for every model and every default value. The Help System also contains a library of background documentation.

11.3.2 Creating Summary Reports and Saving Assessments

You can view and print an EPA-formatted summary report (shown at the right). You can also export the report into various types of file formats (e.g., rich text format (.rtf)) to a choice of destinations on your hard drive or external disk. Assessments may be saved as individual records in a database file containing multiple assessments. Maintaining a database of multiple assessments allows you greater flexibility in organizing collections of assessments.



Sustainable Futures / P2 Framework Manual 2012 EPA-748-B12-001

11. Estimating Workplace Exposure and Industrial Releases Using ChemSTEER

11.3.3 Next Version Expected Is Soon

The new version will have numerous enhancements from the current version. These enhancements include:

- A new release model (solid emission during dust handling),
- Improved Initial Review Exposure Report (IRER) generator,
- More flexible mass balance (don't have to enter all parameters),
- Several new inhalation models (roll coating mist, Auto Spray Coating (polyisocyanates)),
- Cooling tower water additive use operation and three associated models,
- Capability of opening and modifying assessments that were originally created and last saved using previous versions (after July 2003) of ChemSTEER,
- Revised number of worker calculation,
- Re-ordering the assessment sources/activities,
- Revised container parameters restore defaults, and
- Dual model output capabilities (including typical and worst-case for vapor models and small volume solids inhalation).

11.4 Running the Sample Chemical, Isodecyl Acrylate, in ChemSTEER

The following information about isodecyl acrylate will be entered in ChemSTEER

The sample chemical, isodecyl acrylate (CAS No. 1330-61-6), is a liquid that will be imported into the United States. Pure isodecyl acrylate will be used as a reactive diluent and processed to a 30% formulation for use in radiation curable coatings and adhesives, and related materials.

Pure isodecyl acrylate will be imported in transport containers at 11,200 kg/year, and delivered directly to the facility where it will be processed. For each batch (10 batches/year), isodecyl acrylate will be transferred directly into a single reactor and processed to a 30% formulation. Worker exposure will be prevented during transfer of pure isodecyl acrylate into the reactor via automated transfer equipment. Furthermore, a fugitive emissions capture device will be utilized to prevent release of isodecyl acrylate into the reactor. After formulation of each batch, the processed material will be transferred into the 55 gallon drums in which it will be transported to buyers. A single worker will be exposed by dermal contact and by inhalation during drumming. The reactor is cleaned once per year; occupational exposure will not occur during cleaning of the reactor. Releases to the environment will occur during drumming (fugitive releases to air) and cleaning of the reactor (fugitive releases to air and releases to surface water).

Screen captures showing the steps in entering isodecyl acrylate in ChemSTEER are not provided here. Readers can review Appendix G of this document which goes step-by-step through running ChemSTEER with another chemical.

Here are the results from running the sample chemical, isodecyl acrylate (CAS No. 1330-61-6) in ChemSTEER

3/15/2005 INITIAL REVIEW ENGINEERING REPORT ID Number: Case Study ENGINEER: Thomas Webb 🔪 PV (kg/yr): 11,200.00 Import CBI: No SUBMITTER: The Green chemical corporation USE: Reactive diluent in UV/EB curable coatings and adhesives. OTHER USES: MSDS: No Label: No Gen Eqpt: gloves/goggles/glasses/local exhaust ventilation/general mechanical ventilation/other (please specify): Respirator: air purifying/organic vapor/dust/paint mist/supplied air/other (please specify): Health Effects: corrosive/flammable/other (please specify): TLV/PEL: CRSS: Chemical Name: Isodecyl acrylate Chemical category: Acrylate S-H20: 0.00303 g/L @ 25.00 0.0227000010 torr@ 25.00 VP: MW: 212.34 %<500 %<1000 Phys state NEAT: out of user-defined Processing: solution consumer use: No SAT (concerns): Related cases: Migration to groundwater: PBT rating: PBT Health: Eco: OCCUPATIONAL EXPOSURE RATING: NOTES & KEY ASSUMPTIONS: POLLUTION PREVENTION CONSIDERATIONS EXPOSURE-BASED REVIEW: No (0 criteria met) 1) # of workers exposed: >1000? No 2)>100 workers with >10 mg/day inhalation exposure: No 3) (a)>100 workers w/1-10 mg/day inh. exp. & >100 days/yr: No (b)Routine Dermal cant: >250 workers & >100 days/yr: No

3/15/2005 INITIAL REVIEW ENGINEERING REPORT CBI: NO ID Number: case Study user-defined Processing Number of sites: 1 days/yr: 10 Basis: Process Description: ENVIRONMENTAL RELEASES ESTIMATE SUMMARY Air 4.3040E-03 kg/site-day over 1 days/yr from: Equipment cleaning Losses of Liquids from a single, Large vessel; Loading Liquid Product into Drums basis: EPA/OPPT Mass Transfer coefficient Model.; EPA/OAQPS AP-42 Loading Model. Air 9.6848E-04 kg/site-day over 9 days/yr from: Loading Liquid Product into Drums basis: EPA/OAQPS AP-42 Loading Model. Water 11.2 kg/site-day over 1 days/yr from: Equipment cleaning Losses of Liquids from a single, Large vessel basis: EPA/OPPT sin le vessel Residual Model, CEB standard 1% resldual. OCCUPATIONAL EXPOSURES ESTIMATE SUMMARY Tot. # of workers: 1 Inhalation: Exposure to vapor 13.9353 mg/day over 10 days/yr Number of workers (all sites) with inhalation basis: Loading Liquid Product into Drums; EPA/OPPT Mass Balance Model. Dermal: Exposure to Liquid at 30.00% concentration 529.20 mg/day over 10 days/yr

Number of workers (all sites) with dermal expo basis: Loading Liquid Product into Drums; EPA/OPPT 2-Hand Dermal contact with Liquids Model.

11.5 Entering Results from ChemSTEER in the Sustainable Futures Worksheet

	EXPOSURE	MODELS:		
INDU	STRIAL RELEASE AND EXI	POSURE VALUES: CHEMSTEE	ER	
Process	User-defined Processing	Number of Release Days	10	
SIC Code / NPDES #	Code / NPDES #		1	
Occupational Exposure Value	es	<u>.</u>		
	Cancer LADD	Chronic ADD	Acute APDR	
Dermal	0.118 mg/kg-day	0.207 mg/kg-day	7.56 mg/kg-day	
Inhalation	3.12 x 10 ⁻³ mg/kg-day	5.45 x 10 ⁻³ mg/kg-day	0.199 mg/kg-day	
Environmental Release Value	S		·	
Release to Water		11 kg/year (*	11 kg/site-day over 1 day/yr)	
Release to Air (Fugitive) [drumming]		0.0097 kg/year (9.7 x 10 ⁻⁴ kg/site-day over 10 days/yr)		
Release to Air (Fugitive) [read	ctor cleaning]	0.0033 kg/year (3.3 x 10 ⁻³ kg/site-day over 1 day/yr)		
Release to Landfill				
Release from Incineration				
Other Release Activities				

	EXPOSURE	MODELS:		
INDU	STRIAL RELEASE AND EXP	OSURE VALUES: CHEMSTI	EER	
Process	User-defined Processing	ng Number of Release Days		
SIC Code / NPDES #	PDES # Number		1	
	Occupational Ex	posure Values		
	Cancer LADD	Chronic ADD	Acute APDR	
Dermal	0.118 mg/kg-day	0.207 mg/kg-day	7.56 mg/kg-day	
Inhalation	3.12 x 10 ⁻³ mg/kg-day	5.45 x 10 ⁻³ mg/kg-day	0.199 mg/kg-day	
	Environmental 1	Release Values		
Release to Water		11 kg/year (11	kg/site-day over 1 day/yr)	
Release to Air (Fugitive) [drumming]		0.0097 kg/year (9.7 x 10 ⁻⁴ kg/site-day over 10 days/yr)		
Release to Air (Fugitive) [reactor cleaning]		0.0033 kg/year (3.3 x 10 ⁻³ kg/site-day over 1 day/yr)		
Release to Landfill			· · · · · · · · · · · · · · · · · · ·	
Release from Incineration				
Other Release Activities				