EXPOSURE ASSESSMENT TOOLS FROM THE AMERICAN INDUSTRIAL HYGIENE ASSOCIATION: A REVIEW WITH EXAMPLES OF THEIR USE

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INTRODUCTION

SOFTWARE TOOLS DEVELOPED IN THE AIHA EXPOSURE ASSESSMENT STRATEGIES COMMITTEE PROVIDE WAYS TO STATISTICALLY EVALUATE DATA AND EVALUATE OCCUPATIONAL/CONSUMER EXPOSURE SCENARIOS. THE TOOLS ARE FREE AND ARE REGULARLY UPDATED. SEVERAL (1 TO 3 BELOW) ARE AVAILABLE IN MULTIPLE LANGUAGES. FIVE OF THE MAIN TOOLS WILL BE DISCUSSED WITH EXAMPLES OF THEIR USE.

OUTLINE OF THE TOOLS TO DISCUSS

- IH EXPOSURE SCENARIO TOOL
  - GUIDES EVALUATION OF THE WORKPLACE, SPE
    TYPE OF ENGINEERING CONTROLS.
- QUALITATIVE EXPOSURE ASSESSMENT CH
  - REQUIRES: AN OEL; THE VAPOR PRESSURE OF T
    WORKPLACE CONTROLS AND THE REQUIRED LI
    READILY AVAILABLE INFORMATION AND HAS BE
    JUDGMENTS. I
- IH STAT
  - AN EXCEL APPLICATION THAT CALCULATES A VARIETY OF EXPOSURE STATISTICS, PERFORMS GOODNESS OF FIT TESTS, AND GRAPHS EXPOSURE DATA.
- IH MOD
  - A MATHEMATICAL MODELING EXCEL SPREADSHEET SUITE OF 11 ALGORITHMS USED FOR ESTIMATING AIR CONCENTRATION EXPOSURES. A NEW VERSION IH MOD 2.0 ADDITIONALLY PROVIDES NATIVE IN MS EXCEL MONTE CARLO SIMULATION.
- IH SKINPERM
  - AN EXCEL APPLICATION FOR ESTIMATING THE DERMAL UPTAKE OR EVAPORATION OF DERMALLY DEPOSITED AGENTS. FOUR DERMAL ABSORPTION SCENARIOS CAN BE SIMULATED INCLUDING ESTIMATES OF DERMAL UPTAKE FROM AIR.

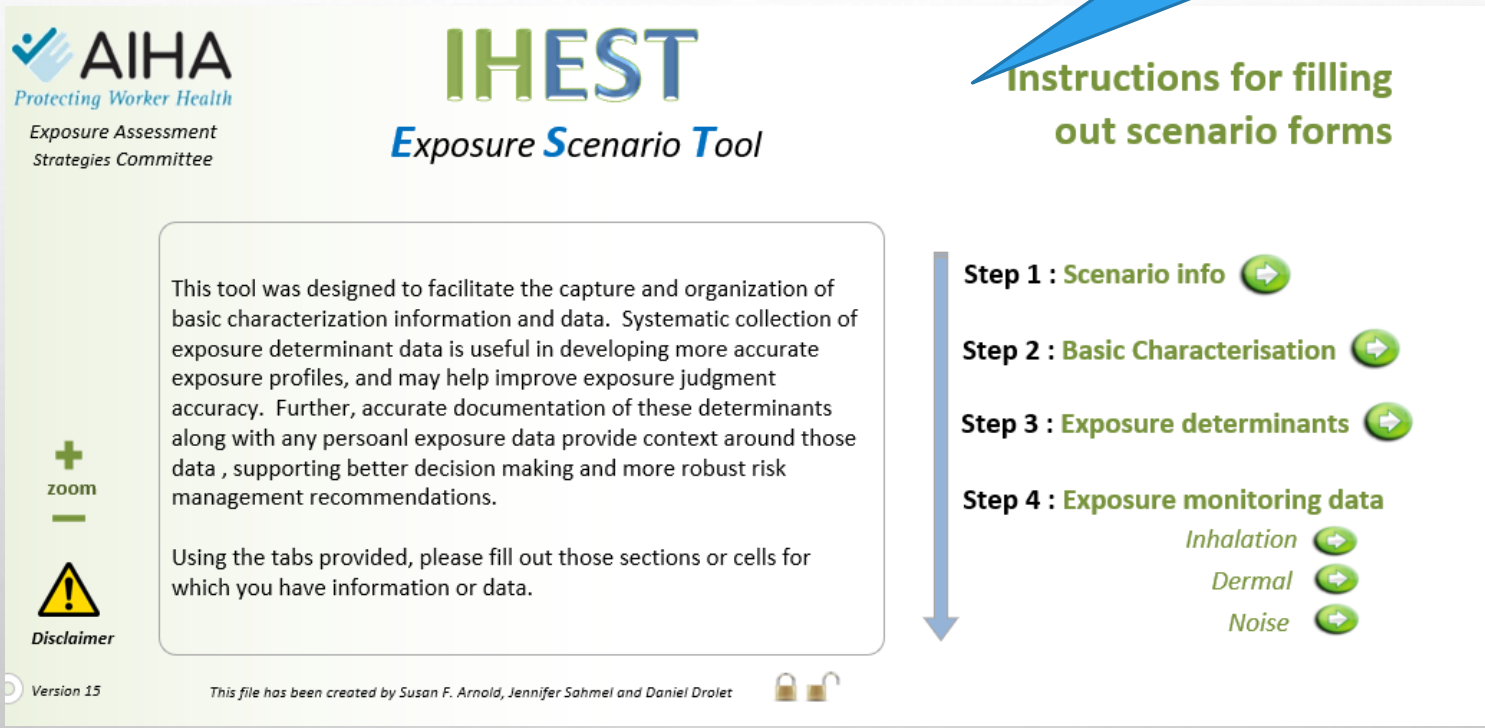
Given the five tools and limited time expect just quick overviews of functionality. If you are interested, further details on any of these tools are available with the tools themselves.

SCENARIO EVALUATED. USE OF 1-BROMOPROPANE IN A DRY CLEANING OPERATION

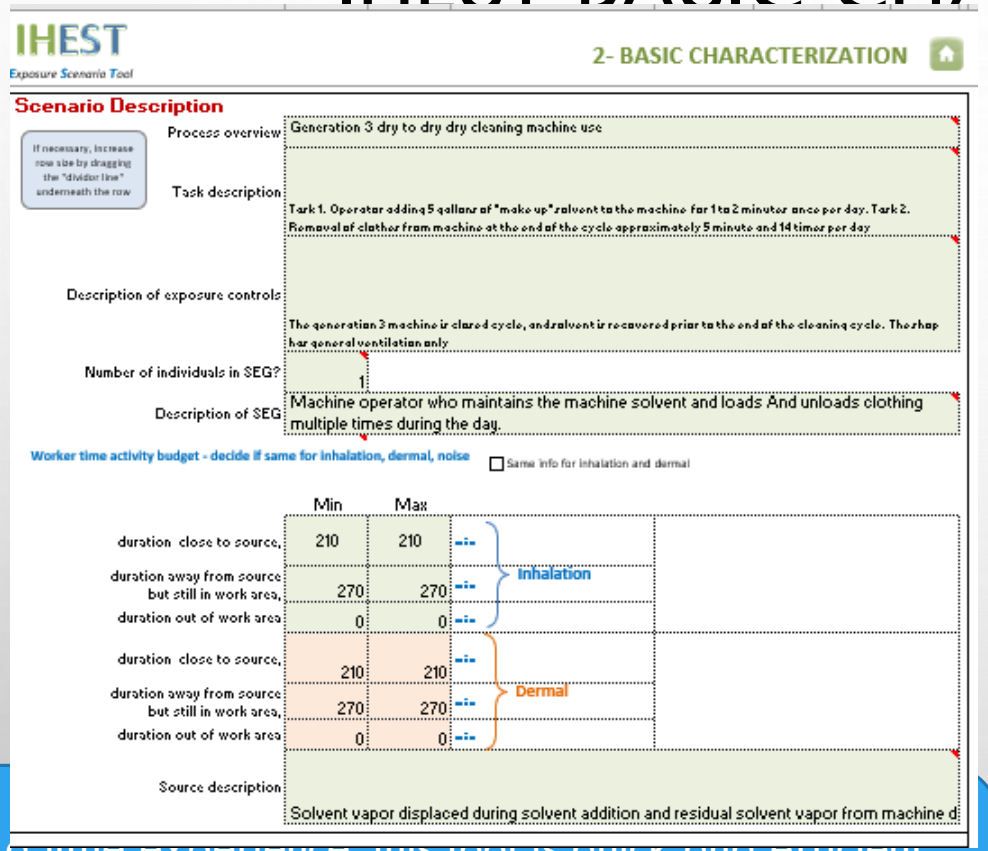
- DESCRIBED BY BLANDO 2010 (J. AIR & WASTE MANAGE. ASSOC. 60:1049–1056)
- SPECIFIC TASKS
  - ADDITION OF 5 GALLONS OF 1 BP THROUGH THE FRONT DOOR OF THE DRY CLEANING SHOP
  - REMOVAL OF CLOTHES AT END OF DRY CLEANING CYCLE AND EXPOSURE TO RESIDUAL 1-BP FROM THE WASHER
- SHOP VOLUME 280 CUBIC METERS TOTALS
- VENTILATION RATE NOT SPECIFIED IN BLANDO REPORT
  - ASSUME ACH FROM US EPA EPA DOCUMENT# 740-R1-5001 FEBRUARY 2016
  - OTHER DETERMINANTS DERIVED FROM SAME EPA DOCUMENT
- EVALUATE NEAR FIELD OPERATOR EXPOSURES
- EVALUATE DERMAL EXPOSURE VIA 1-BP CONTACT WITH HANDS AND ALSO WHOLE BODY DERMAL VAPOR UPTAKE FROM A NEAR FIELD AIR CONCENTRATION

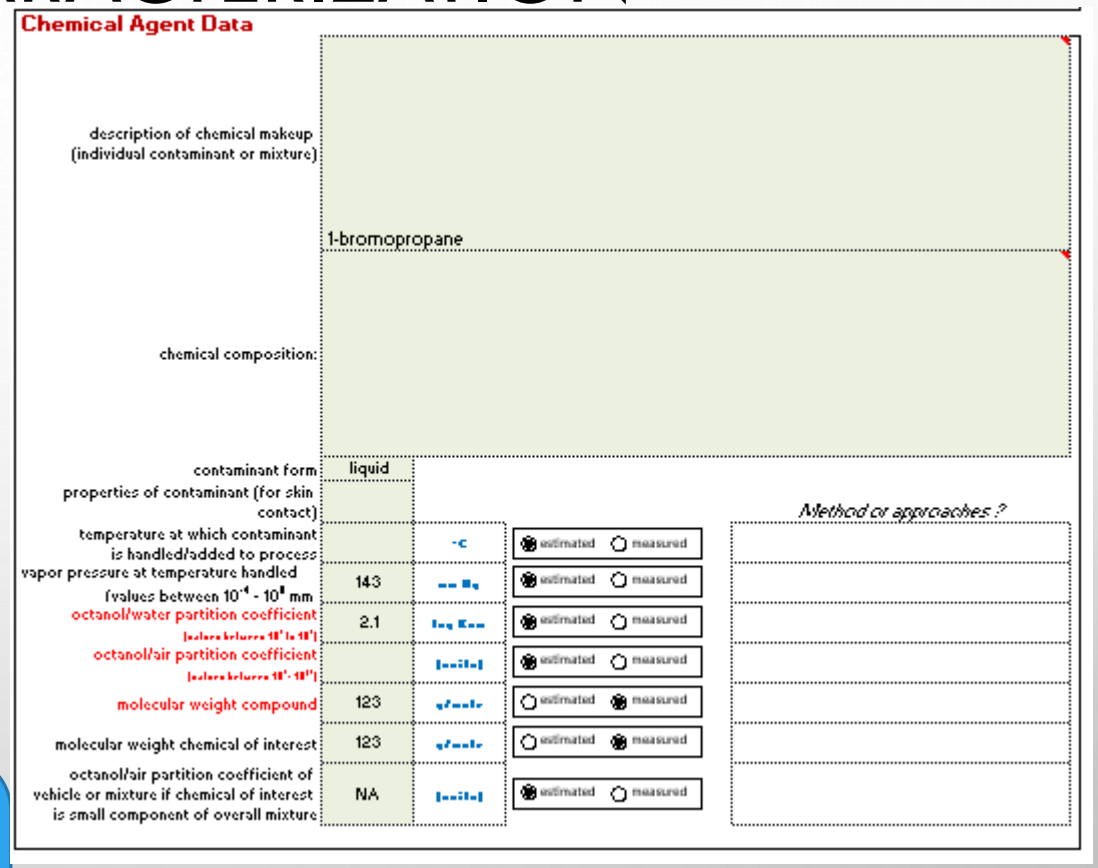
IHEST OPENING SCRE

This tool helps structure and document the basic characterization of an exposure scenario.



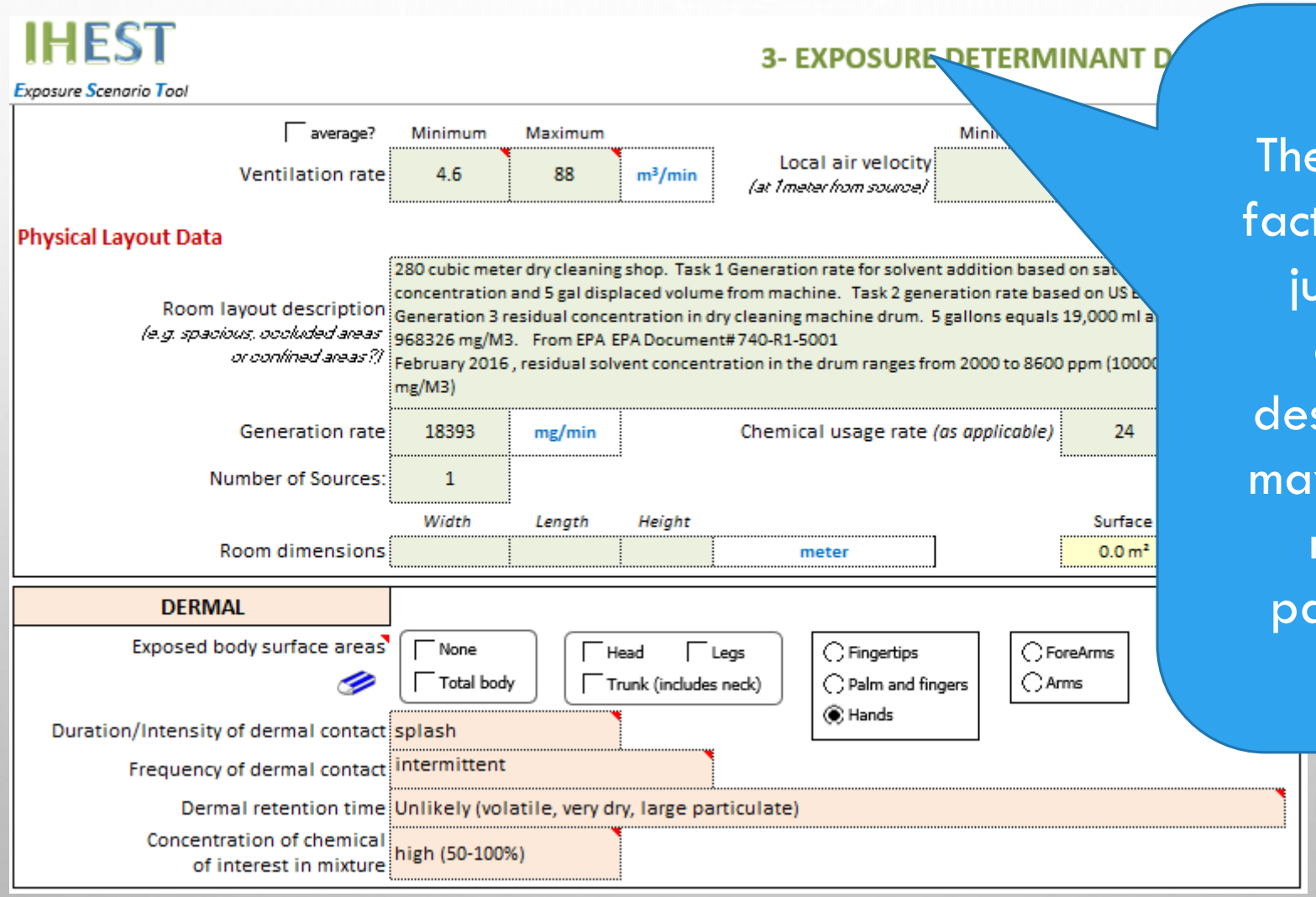
IHEST BASIC CHARACTERIZATION





After a little experience, this tool is quick and efficient and the information is very useful for designing a survey or other estimation technique such as mathematical modeling

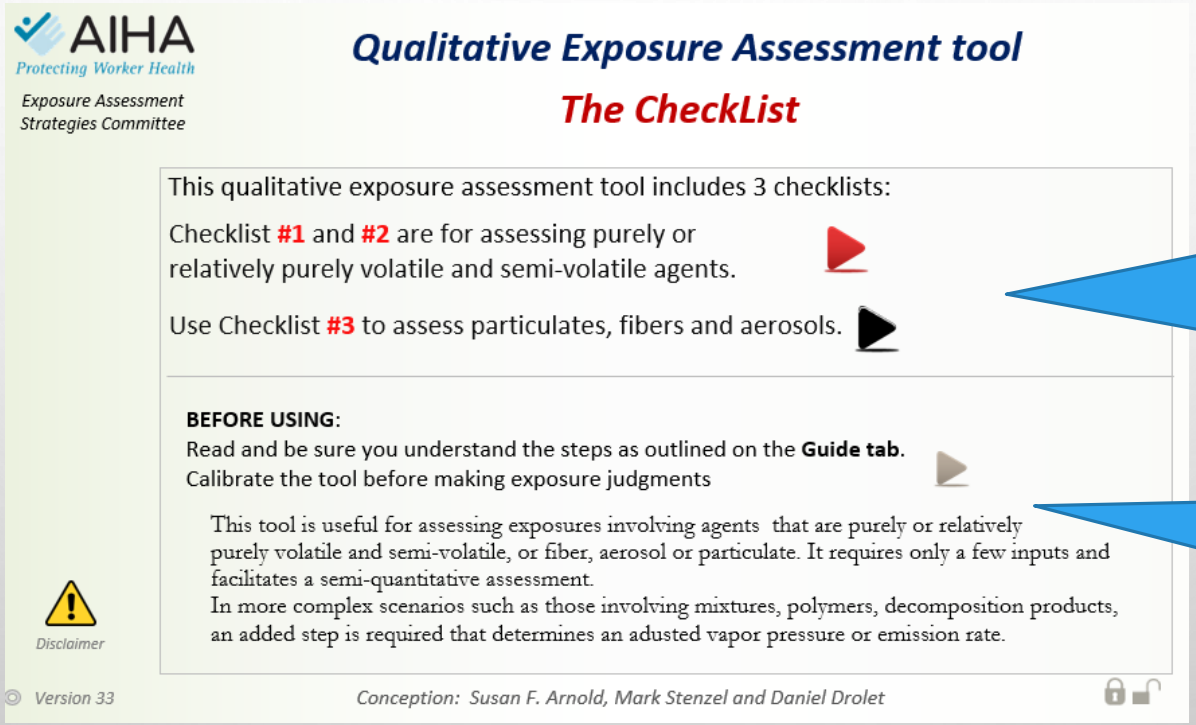
IHEST EXPOSURE DETERMINANT DATA



These may all be key factors in a qualitative judgement guided assessment or in designing a survey or may be used to guide model and input parameter selection

QUALITATIV

This tool employs decision heuristics that have been found useful and that improve the general accuracy of qualitative decisions on exposure

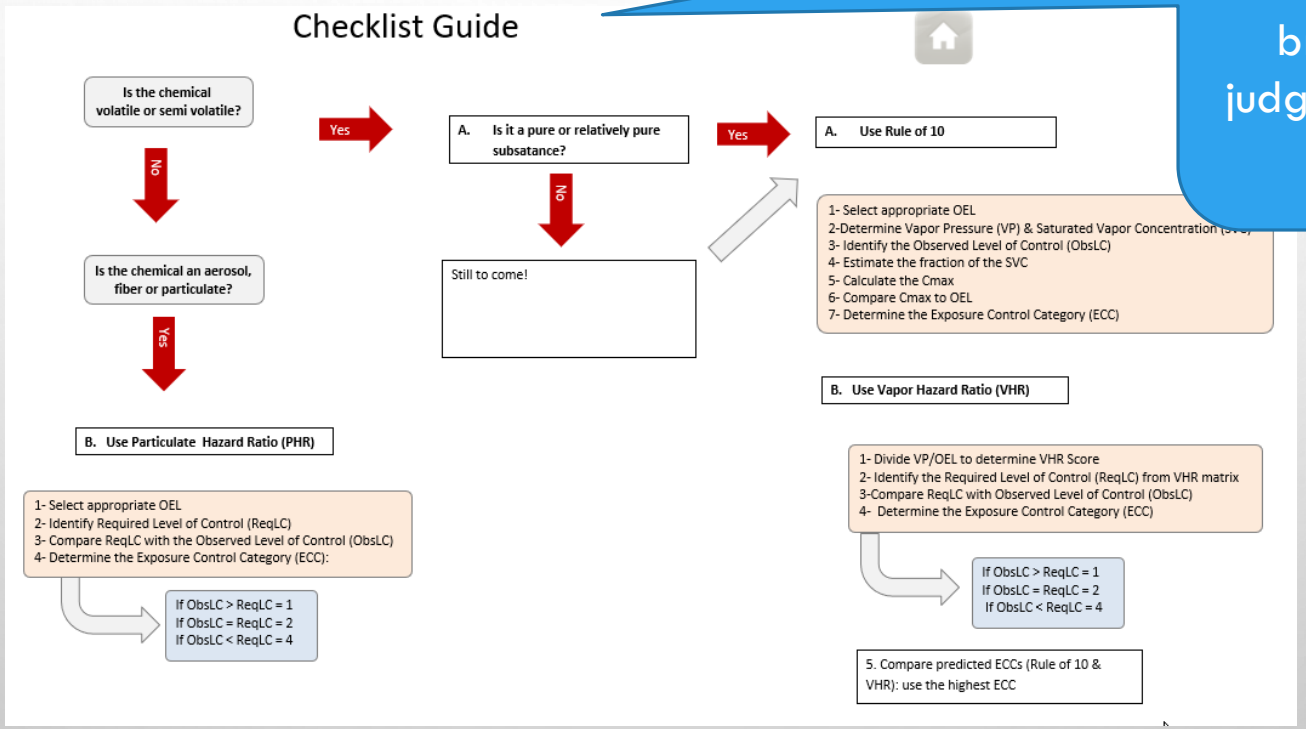


The user can assess volatile or semi-volatile agents or particulates, fibers or aerosols

It is always important to understand a tool before using it!

QUALITATIVE EXPOSURE ASSESSMENT TOOL CHECKLIST GUIDE

This guide outlines the model's content and branching logic of judgement and decision heuristics

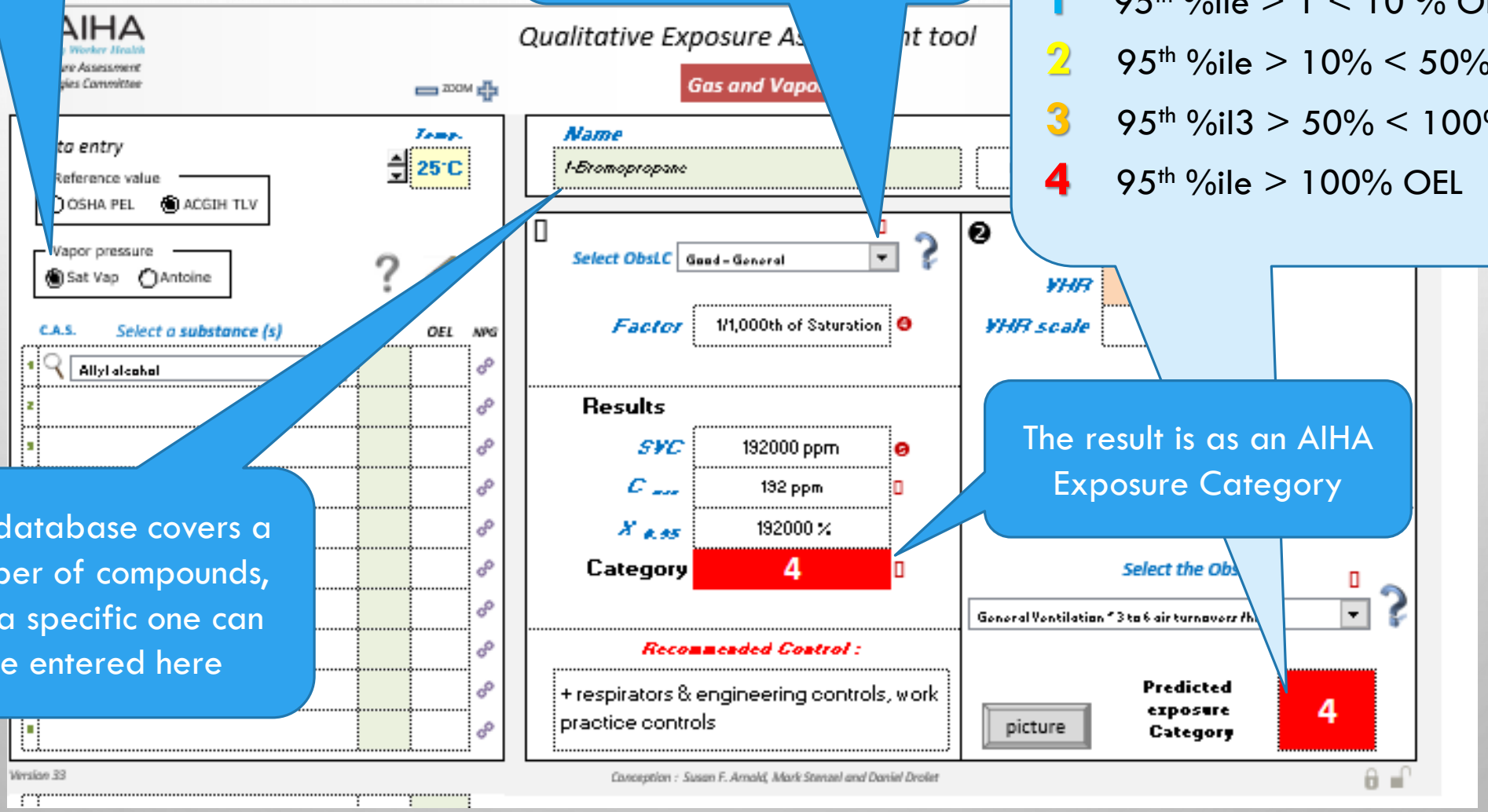


QUALITATIVE EX… GASES …SMENT TOOL

Vapor pressure is a key determinant

A key piece is the expected or observed level of control

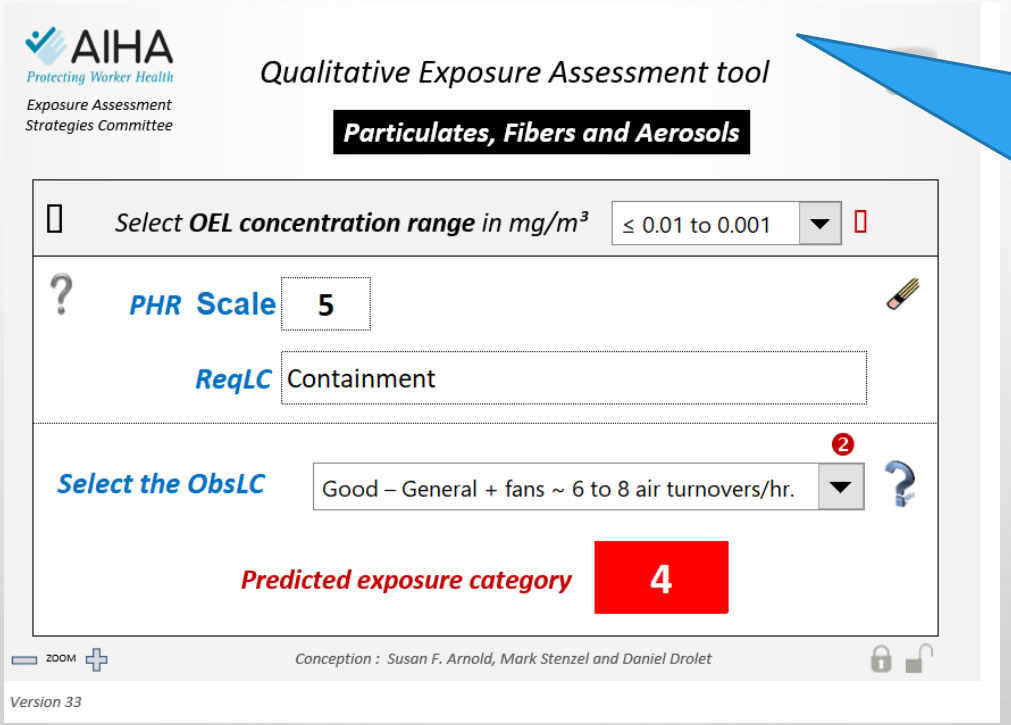
- 0 — 95th %ile < 1% OEL
- 1 — 95th %ile > 1 < 10 % OEL
- 2 — 95th %ile > 10% < 50% OEL
- 3 — 95th %il3 > 50% < 100% OEL
- 4 — 95th %ile > 100% OEL



The database covers a number of compounds, but a specific one can be entered here

The result is as an AIHA Exposure Category

QUALITATIVE EXPOSURE ASSESSMENT TOOL PARTICULATES, FIBERS AND AEROSOLS



These tools must not be used without a good understanding of the strengths and limitations of the heuristics and of the terminology

IH STAT – THE OPENING SCREEN

AIHA
Protecting Worker Health

Multilingual IHSTAT+

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This file was originaly created by John Mulhausen and then modified in its multilingual version by Daniel Drolet et al.

If this file doesn't work....
Enable macros when opening this file.
Activer les macros à l'ouverture du fichier.
Attivare le macro all'apertura del file
Ativar macros quando abrir este arquivo.
इस फ़ाइल खोलने जब स्थूल सक्षम है.
이 파일을 열 때 매크로를 활성화함.
Aktiver makroer når du åpner denne filen
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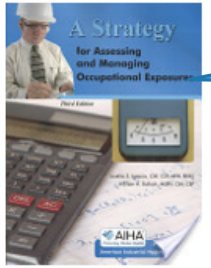
Dosyayı açarken makroları etkinleştirin
Запускайте работу макросов при открывании документа

This file requires that macro security level of Microsoft Excel must be set in order to enable MACROS .
For more information, refer to the Microsoft Web site:

2000 / 2003 | 2007 | 2010 | 2013

Languages

English	Español
Français	Deutsch
Italiano	Chinese
Portuguese	Česky
Hindi	Dutch
Korean	Norwegian
Turkish	Russian
Japanese	



A full discussion on how to analyze and interpret exposure data can

Ignacio, J. and, Bullock, B. (editors) A Strategy for Assessing and Managing Occupational Exposures, 3rd Edition. Fairfax, VA: AIHA Press, 2006

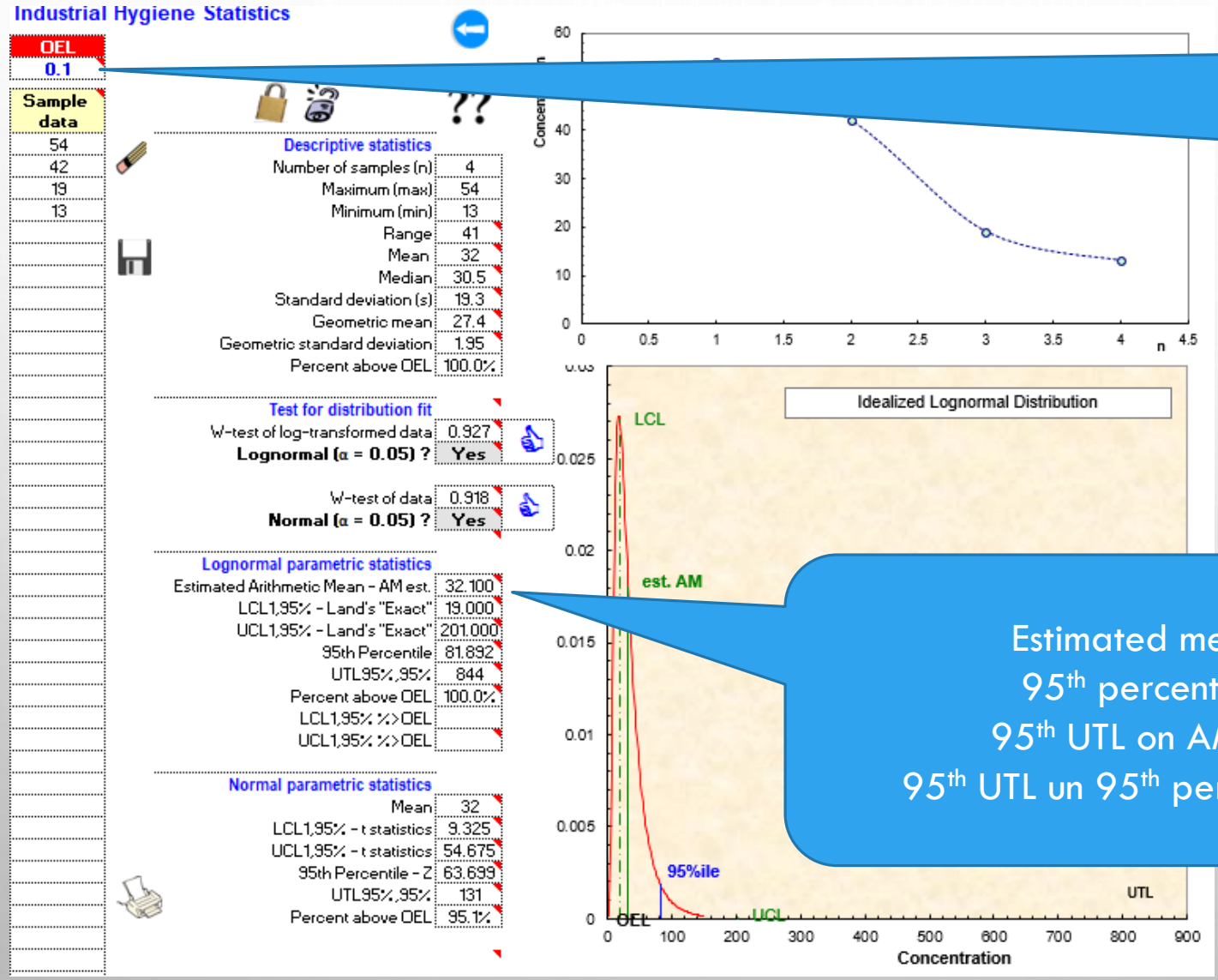
IHSTAT+ : v. 235, Dec 2013

Now with 15 choices of language

The program uses MACROS which must be enabled

This book gives more information on the statistical techniques and more.

IH STAT ANALYSIS – DATA FROM BLANDO 2010 SH R TWA



The user sets the OEL and enters the data (up to n=200)

Various parameters are calculated and shown graphically

Estimated mean 32 ppm (161 mg/M3)
95th percentile 82 ppm (412 mg/M3)
95th UTL on AM 201 ppm (1011 mg/M3)
95th UTL un 95th percentile 844 ppm (4245 mg/M3)

IH MOD 2.0 MATHEMATICAL MODELS TO ESTIMATE AIR CONCENTRATIONS

- IH MOD 2.0 INCLUDES MONTE CARLO SIMULATION TO EVALUATE PARAMETER UNCERTAINTY AND VARIABILITY IN THE DETERMINISTIC MODELS GIVEN IN IH MOD 1.0, STILL ***ALL IN EXCEL***, WITH NO OTHER SOFTWARE NEEDED!
  - THE CALCULATIONS ARE SET TO GIVE THE 5^{TH}, 25^{TH}, MEDIAN, 75^{TH} AND 95^{TH} PERCENTILES OF THE RESULTS DISTRIBUTION AND THIS IS NOT USER CONFIGURABLE.
  - MCS CALCULATIONS CAN BE VERY USEFUL WHERE YOU HAVE A POSSIBLE RANGE OF VALUES FOR CERTAIN MODEL PARAMETERS, SUCH AS A MINIMUM AND MAXIMUM FOR THE VENTILATION RATE, OR A MINIMUM, MOST PROBABLE AND MAXIMUM FOR THE CONTAMINANT GENERATION RATE, OR A LOG-NORMAL DISTRIBUTION OF AIR VELOCITY.
- THE CONCENTRATION VS TIME (OR TWA VS TIME) CURVES AT THE GIVEN PERCENTILES CAN PROVIDE NEW INSIGHTS INTO TIME AND VARIABILITY PATTERNS

This is What You First See

AIHA
Protecting Worker Health
Exposure Assessment Strategies Committee

It will be available in multiple languages, given volunteers to complete translations!

English

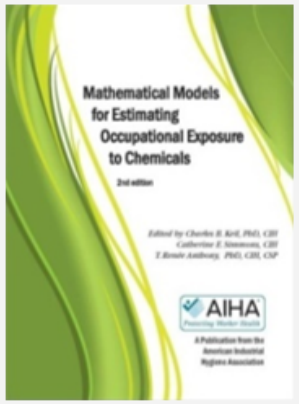
Mod 2.0

Determinist *Monte Carlo*

Click Here to Start

Start

This Excel spreadsheet contains several algorithms found useful for calculating airborne concentrations of chemicals. Each equation included with this spreadsheet has been described in the literature.



Refer to that source for information on the algoritms' limitations and applications. Each ponsability of reveiwing, und f any assessments completed using this

Choose a screen resolution that suits your computer (but you can zoom too)

Optimize Zoom

720p 1080p 1440p 2000p

Monte Carlo simulation process NEEDS a LOT of your system
to close any other workbooks or applications before starting the Monte Ca

IH Mod 2.0 uses a lot of system resources, but we have run it in Windows 7, Excel 2010 on a 10 year old netbook with an Atom processor and just 2 GB of ram.

Version 2,0 : June 2018

This file has been created by Daniel Drolet and Tom Armstrong with review by Michael Jayjock

THE T ONSTANT GENERATION MODEL MCS

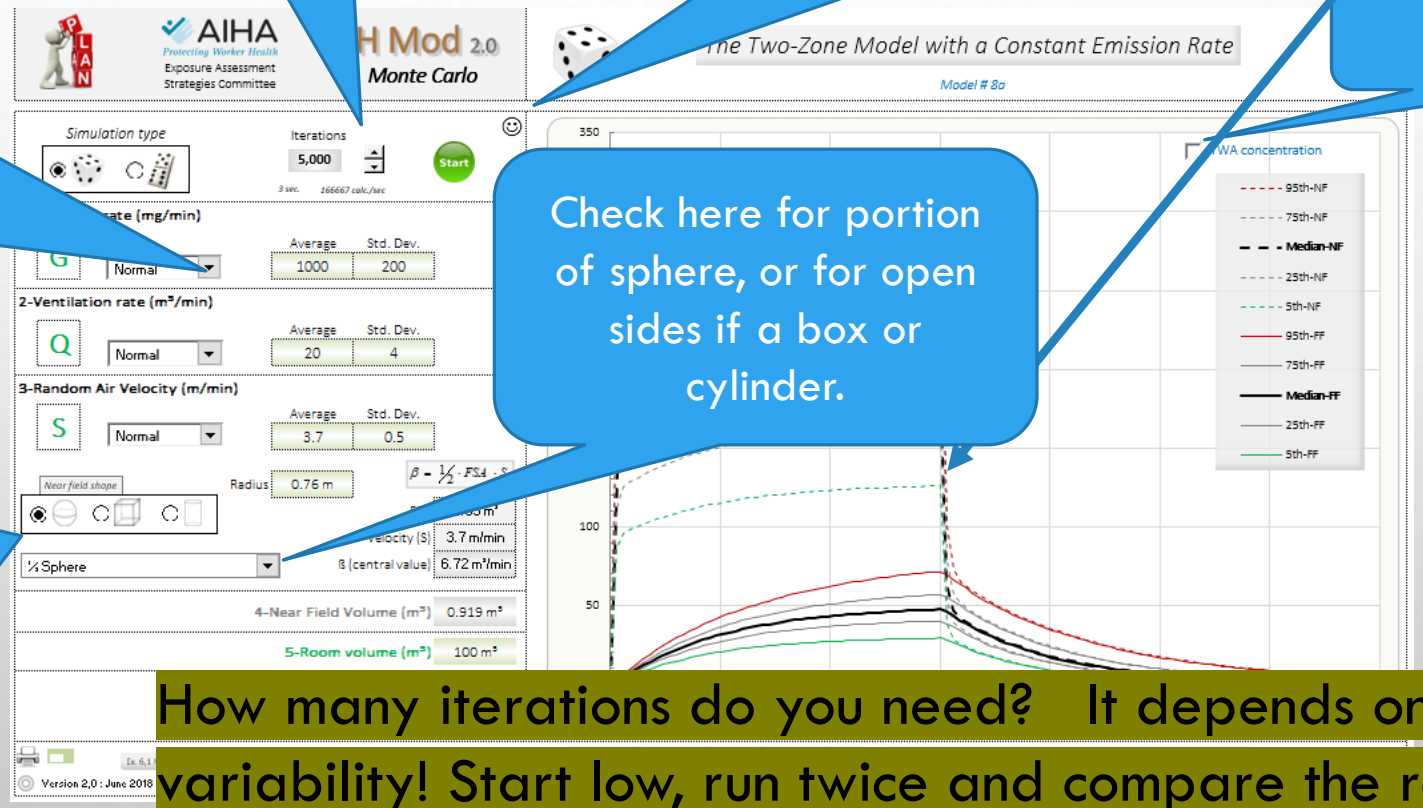
Set the number of iterations.

Choose the distribution type and set the parameters.
The normal distribution is truncated to avoid zero and negative values

Smile = good to go!
Frown = parameters, etc. not quite right!

Show graph for TWA or C vs T

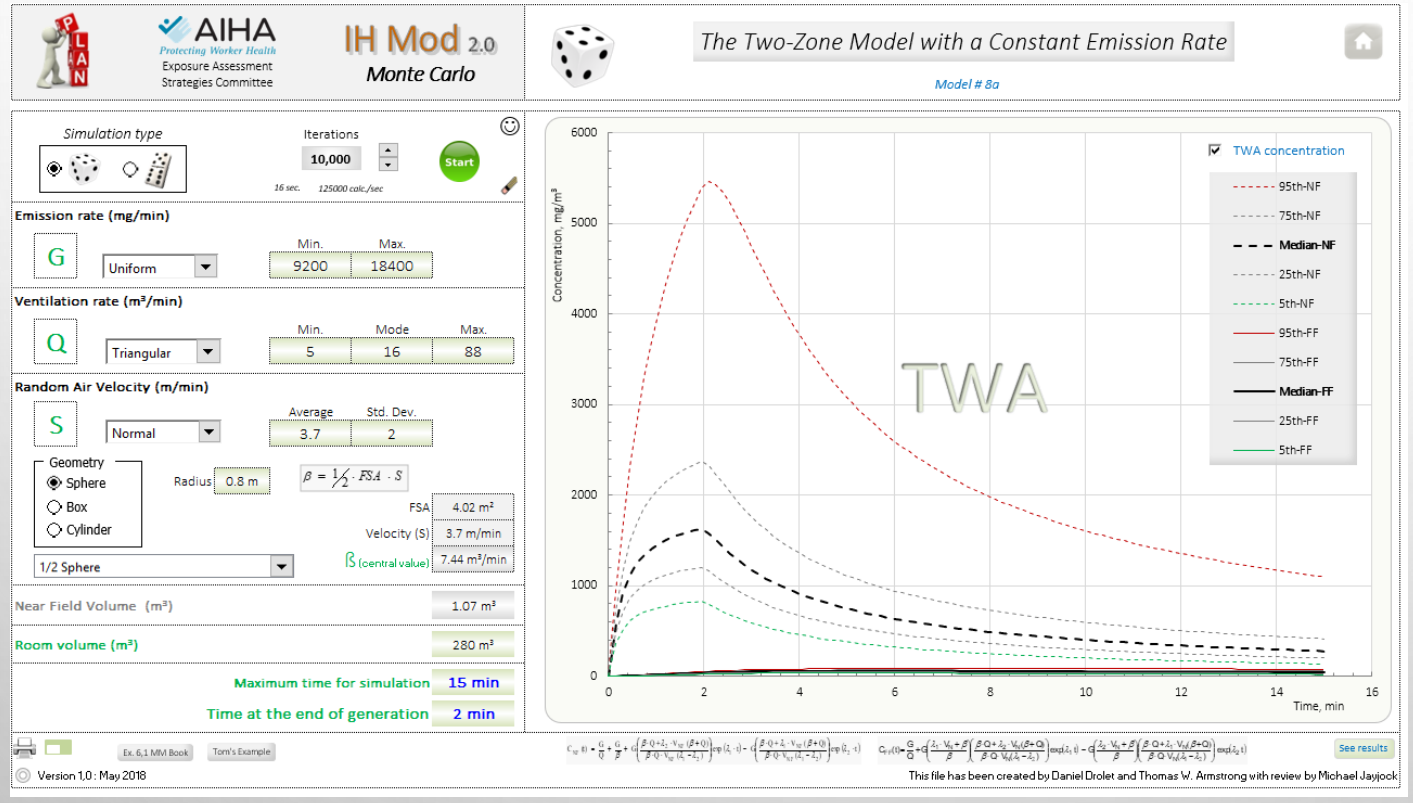
Check here for portion of sphere, or for open sides if a box or cylinder.



Here you define the Near Field shape and calculate Beta. Specify shape, S and FSA, then Beta is set up!
Room Volume adjusts too.

How many iterations do you need? It depends on parameter variability! Start low, run twice and compare the results. If quite divergent, increase the iterations until you have satisfactory "stability" from run to run.

BLANDO 2010 SHOP A 1-BP ADDITION TO MACHINE TWAS TO 15 MINUTES



NEAR FIELD

15 Min TWA mg/M3

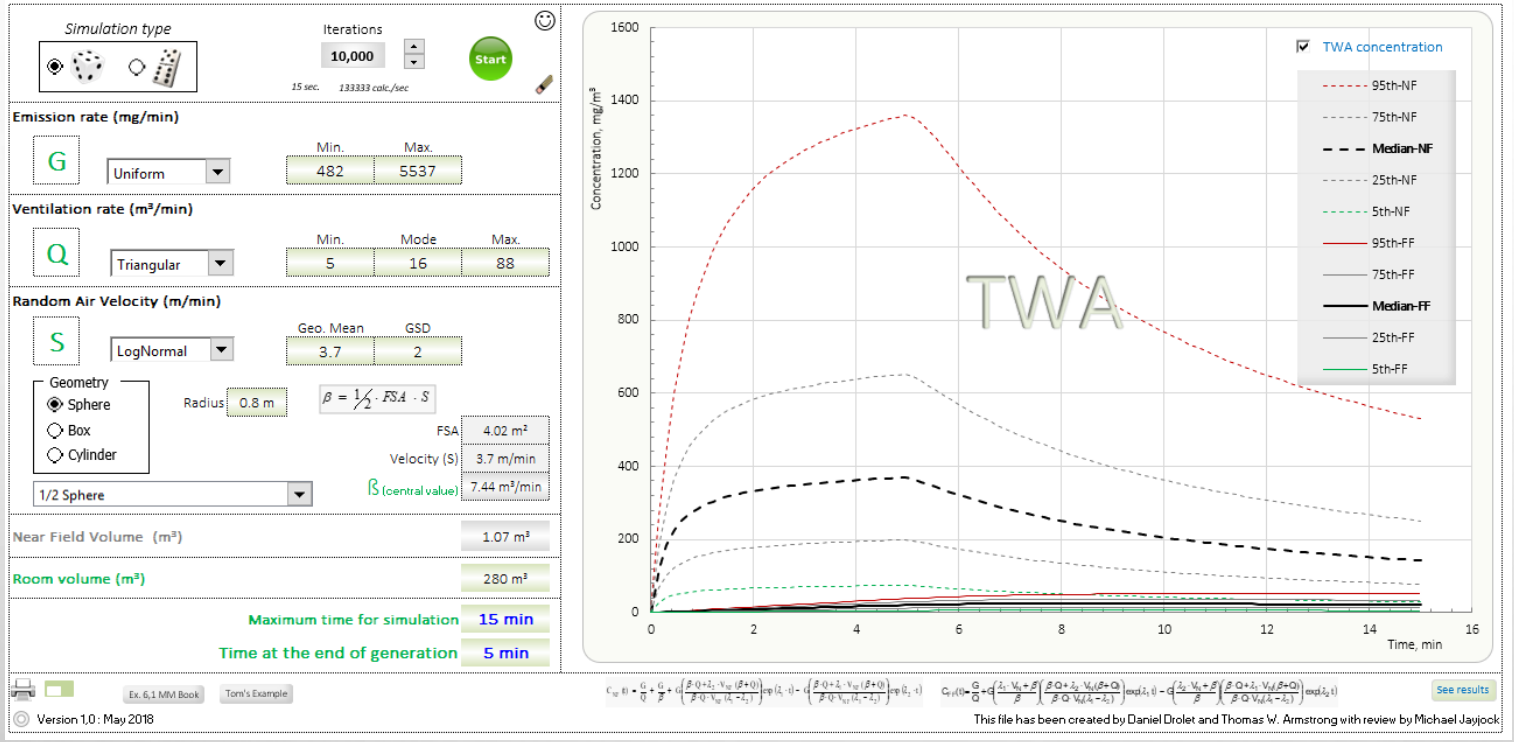
5th 138

Median 280

95th 1098

DRY CLEANING MACHINE UNLOADING TASK EXPOSURE

MODIFIED FROM APP K, EPA DOCUMENT# 740-R1-5001 FEBRUARY 2016



Near Field mg/M3

5th	35
Median	151
95th	593

Estimated 8 hr TWA solvent addition + 14 unloads

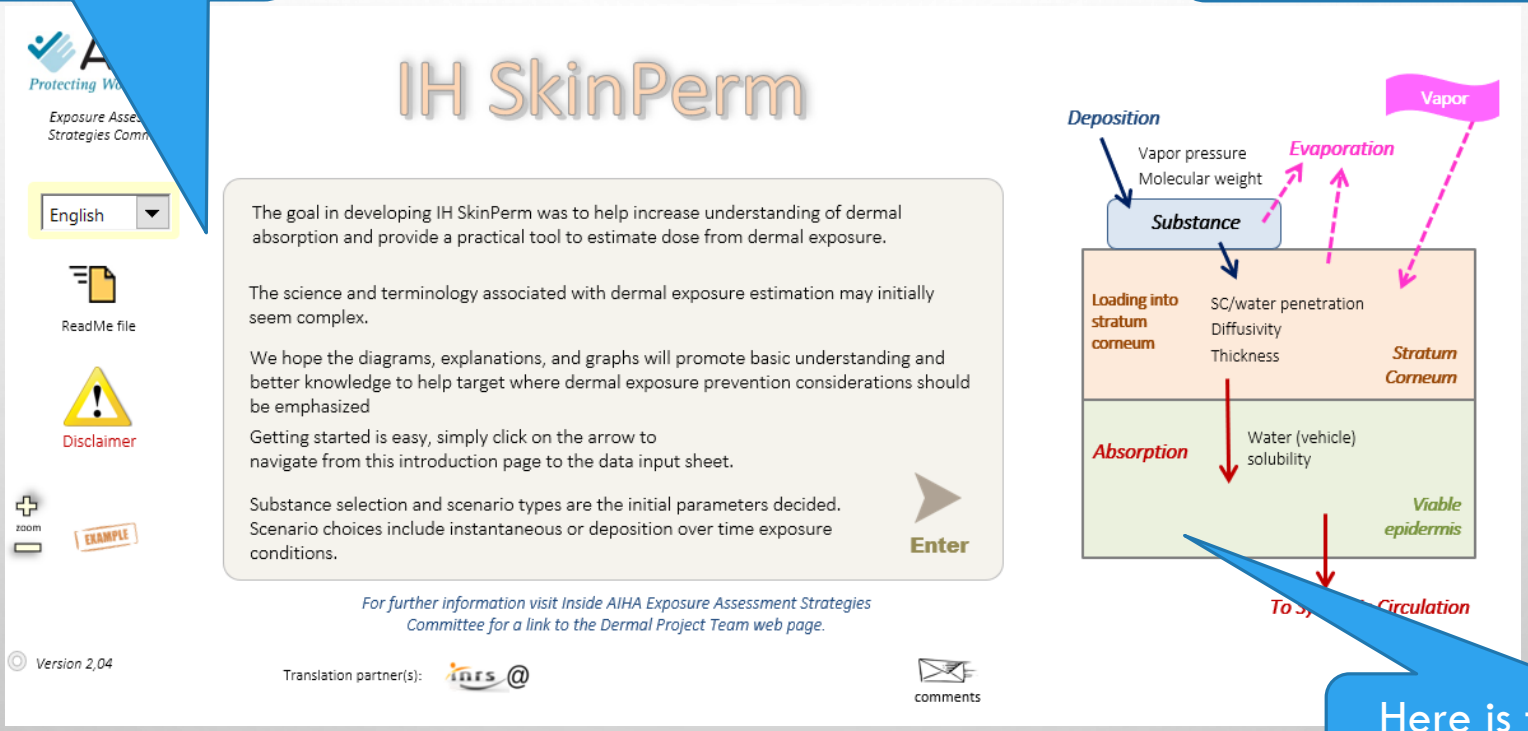
Median 86 mg/M3 (17 ppm) 95th 321 mg/M3 (64 ppm)

BLANDO measured 8 hr TWA AM 32 ppm, 95th 82 ppm

IH SKINPERM PROGRAM INTRODUCTION SCREEN

The "Read Me" file contains a lot of valuable guidance

This figure shows the major considerations modeled



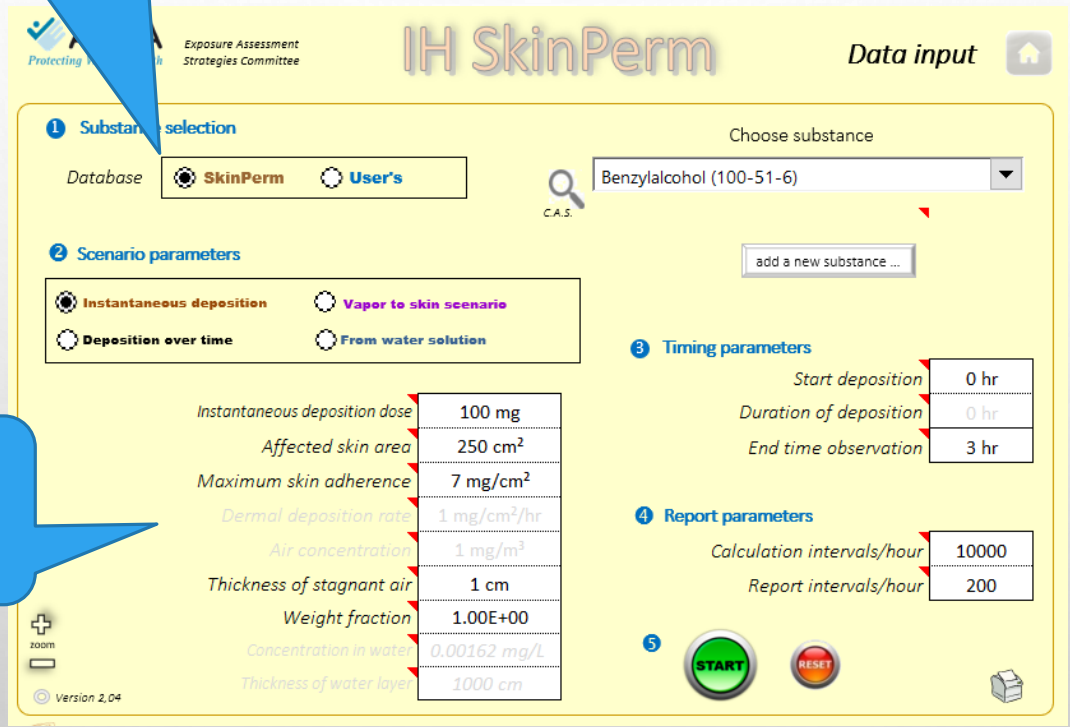
Here is the entry to the model

IH SKINPERM DATA INPUT SCREEN

Many compounds of are in the database with all required physical chemical properties

Note four scenario variants can be modeled

The user sets the loading factors and affected area here

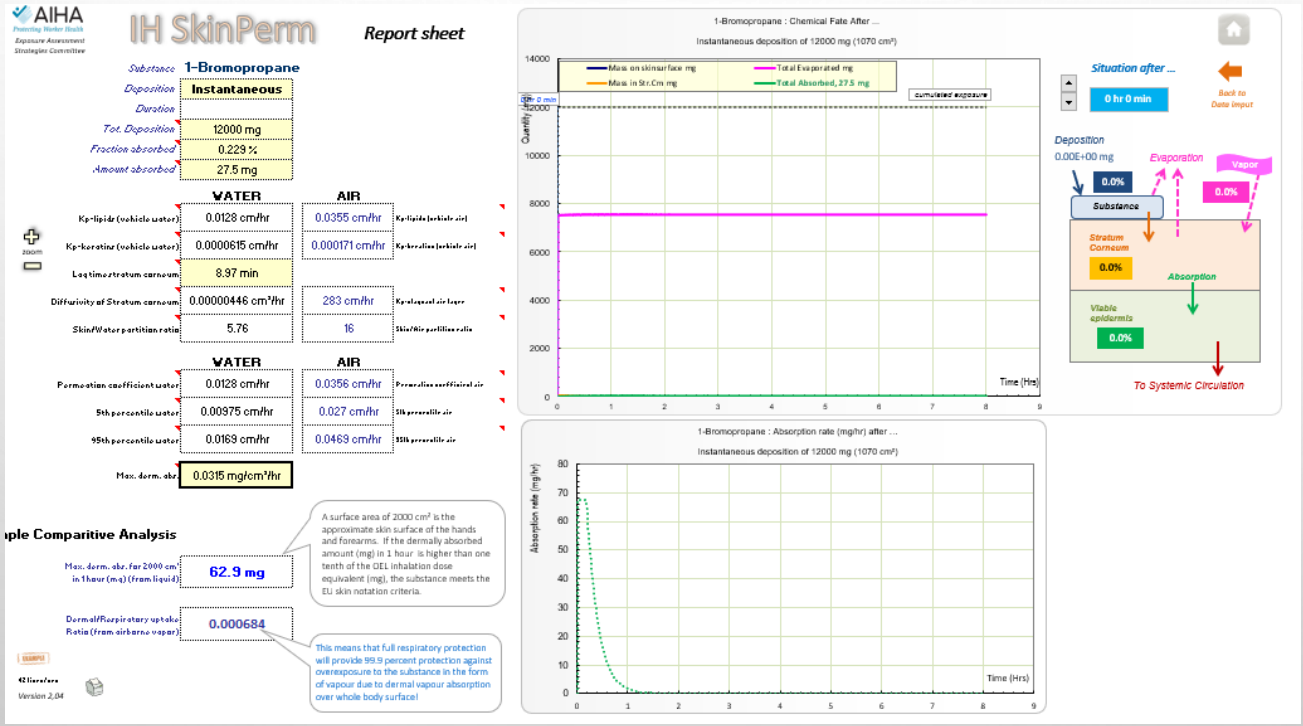


Users can enter new substances if the physical chemical properties are available

Red triangles indicate some explanation is available

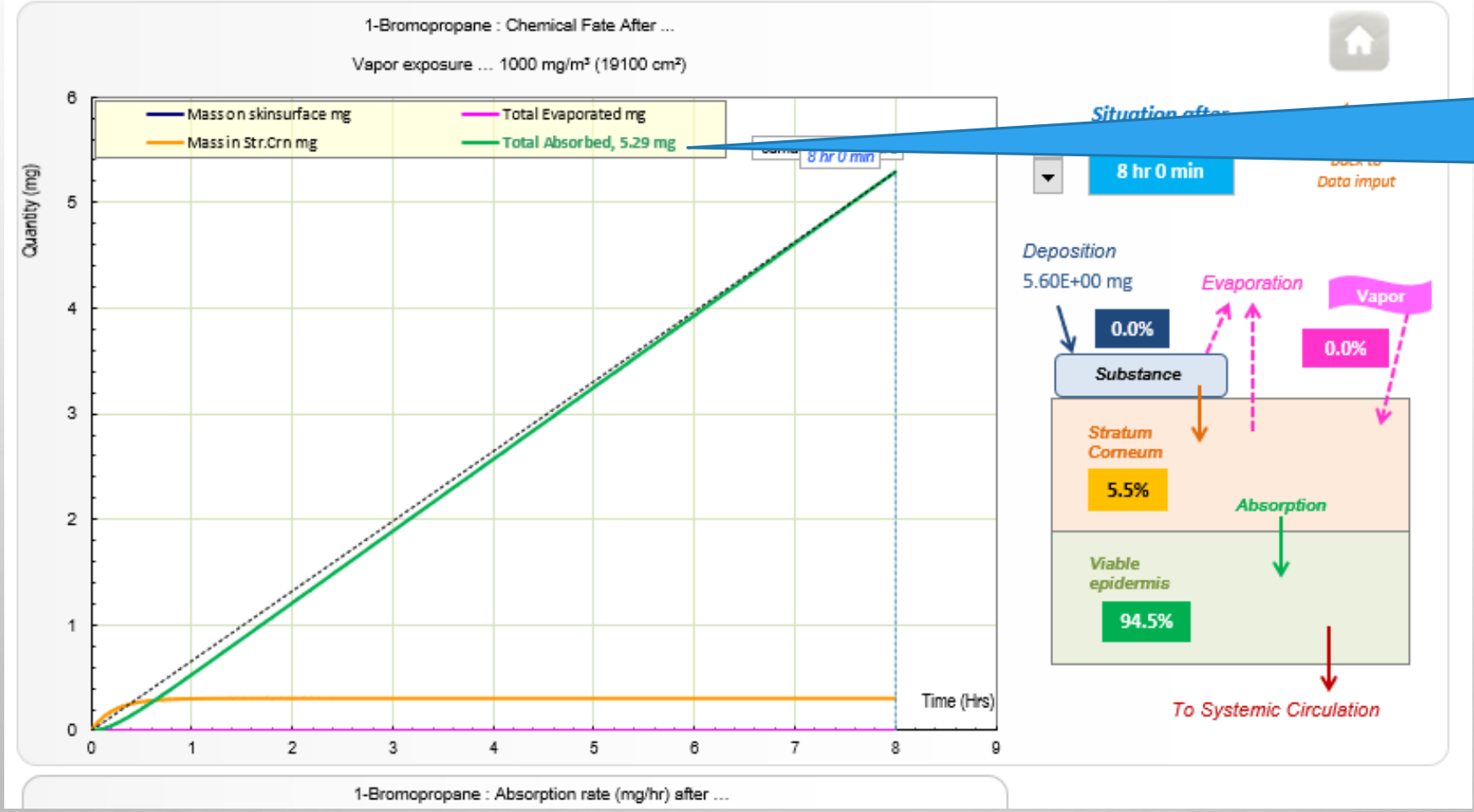
IH SKINPERM TYPICAL RESULTS SCREEN.

WHAT IS SHOWN VARIES WITH THE INITIAL SCENARIO CHOICE. THIS IS FOR 1-BP TO BOTH HANDS. BASICALLY IT ALL EVAPORATES!



IH SKINPERM 1 BROMOPROPANE AIR TO SKIN

FULL ADULT MALE SKIN SURFACE (19100 CM2) AND 1000 MG/M3 AIR CONCENTRATION (200 PPM)



5.3 mg absorbed for 8 hours

IN SUMMARY

THE TOOLS REVIEWED ARE FREEWARE, ARE OPENLY AVAILABLE AND PROVIDE EASY TO USE APPROACHES TO IMPORTANT ASPECTS OF THE EXPOSURE ASSESSMENT PROCESS

- SCENARIO DEFINITION AND DOCUMENTATION OF KEY EXPOSURE DETERMINANTS
- QUALITATIVE EVALUATION VIA JUDGEMENT HEURISTICS
- STATISTICAL EVALUATION OF SURVEY DATA
- MODELING OF DERMAL UPTAKE INCLUDING FROM AIR
- EITHER DETERMINISTIC OR MCS SIMULATION WITH MULTIPLE ALGORITHMS FOUND USEFUL FOR OCCUPATIONAL OR DOWNSTREAM USER SCENARIO EVALUATION

THE AIHA EASC TEAM INVOLVED IN DEVELOPING TOOLS WELCOMES COLLABORATION ON THEIR FURTHER DEVELOPMENT AND FOR TRANSLATIONS OF THE MULTI-LINGUAL TOOLS