



October 15, 2014

AIHA EASC Dermal Project Team Overview to Beryllium Health and Safety Committee Fall Meeting 2014

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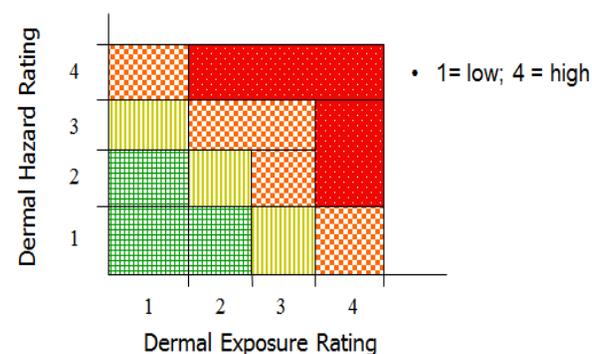
Agenda

- AIHA EASC Dermal Project Team History
- Mission & Membership
- Recent accomplishments
 - IH SkinPerm example
- Future plans

Dermal Project Team History

- **Volunteer group formed around 2001**
- **Founder Jennifer Sahmel** Senior Managing Health Scientist Cardno ChemRisk
- **Exposure Assessment Strategies Committee Sub-teams:**
 - Dermal Project Team
 - Math Modeling Team
 - Professional Judgment Team
 - 5 yr Strategic Planning Team
 - Data Quality Team

Dermal Risk Assessment:
Qualitative Judgment Matrix

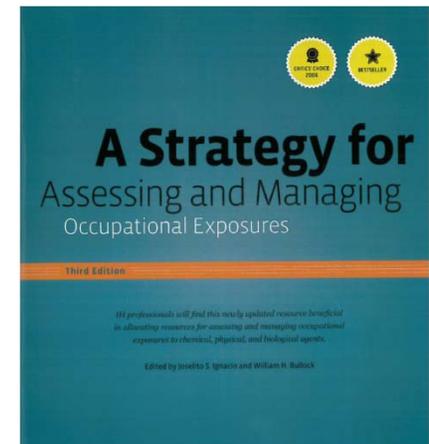


Derma Project Team - Mission & Membership

- **Mission:**
To create a broader understanding of dermal risks. Collaborate to build more effective dermal exposure assessment tools and risk management strategies.
- **Chairs:** Rosalie Tibaldi; Aleks Stefaniak
- **Membership:** Twenty Occupational Health professionals with affiliations to academia, government, consulting and private industries.
- **Biannual meetings**

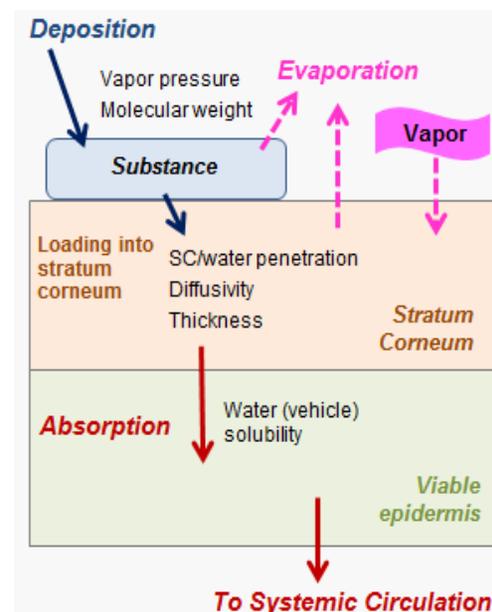
Recent Accomplishments

- **Support Professional Development**
 - PDCs covering Dermal Exposure Assessment
 - AIHCe 2014 Dermal Science Symposium
 - Dermal Webinar to W Michigan local section
- **4th Edition Exposure Assessment Strategy Manual**
 - Dermal Chapter Updates
- **Qualitative Exposure Risk Assessment**
 - Monte Carlo feature added
- **Quantitative Assessment Model**
 - IH SkinPerm model estimates dermal absorption



Dermal Project Team - IH SkinPerm Model

- Estimates skin absorption
 - built up from Skin Perm model (ten Berge 1995)
 - incorporates QSARs and algorithms *
 - runs in Microsoft Excel
- Models three types of skin exposures
 - instantaneous deposition
 - deposition over time
 - vapor to skin absorption
- Minimum data input requirements
 - 5 common physical chemical properties
- Accounts for evaporation and absorption simultaneously



* Tibaldi, R.S.; ten Berge, W.; Drolet, D. Dermal Absorption of Chemicals: Estimation by IH SkinPerm, *Journal of Occupational and Environmental Hygiene*, 11: 19–31 (2014)

Example Instantaneous deposition scenario *

- An operator forgets to put on his glove when unloading furfural (95wt%).

A bad connection results in skin exposure to one hand.

- About how much is absorbed before driver can wash it off in 15 minutes?



* hypothetical for demonstration purposes only

Example: Data Inputs

- volume: 2 ml
 - convert ml to mg (2204 mg)
- skin surface area
 - 1 bare hand (420cm²)
 - thickness of stagnant skin air (1 cm)
- exposure duration
 - 15 minutes (0.25 hr)

IH SkinPerm Data input

1 Substance selection

Database: SkinPerm User's

Choose: Furfural ▼

LogKow at skin pH 5.5: 0.41

2 Scenario parameters

Instantaneous deposition
 Deposition over time
 Vapor to skin scenario

Instantaneous deposition dose	2204 mg
Affected skin area	420 cm ²
Maximum skin adherence solids	-1 mg/cm ²
Dermal deposition rate	0.25 mg/cm ² /hr
Air concentration	15.97 mg/m ³
Thickness of stagnant air	1 cm

3 Timing parameters

Start deposition	0 hr
Duration of deposition	8 hr
End time observation	0.25 hr

4 Report parameters

Calculation intervals/hour	10000
Report intervals/hour	100

5

Example: Numerical Outputs

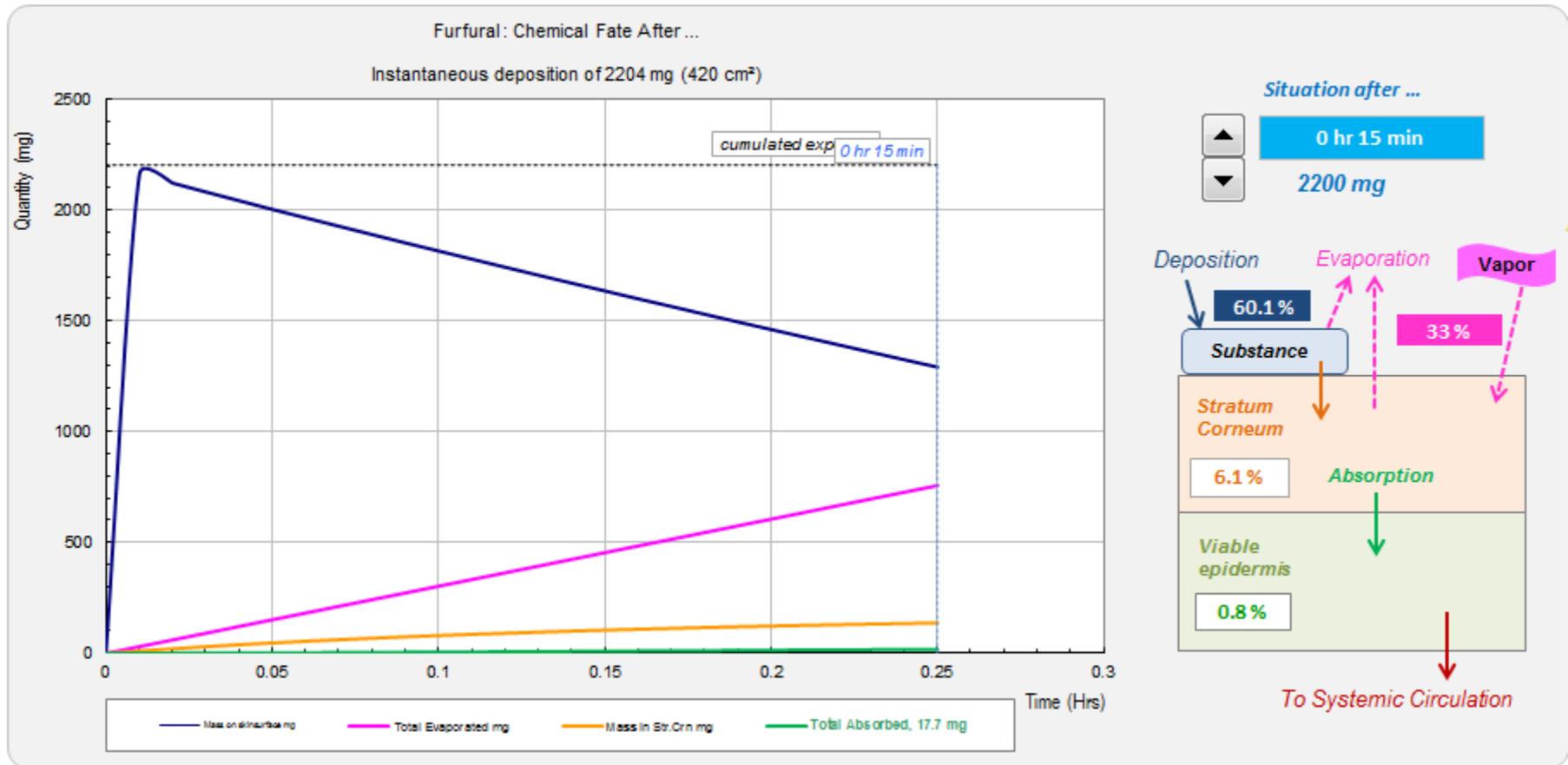
IH SkinPerm

Substance Furfural		
Deposition	Instantaneous	
Duration		
Tot. Deposition	2204 mg	
Fraction absorbed	0.8%	
Amount absorbed	17.719 mg	
	WATER	AIR
Kp-lipids (vehicle water)	1.13E-3 cm/hr	1.15E+1 cm/h
Kp-keratins (vehicle water)	8.61E-5 cm/hr	8.73E-1 cm/h
Lag time stratum corneum	17.755 min	
Diffusivity of Stratum corneum	2.30E-6 cm ² /hr	3.20E+2 cm/h
Skin/Water partition ratio	1.0805	10958
	WATER	AIR
Permeation coefficient water	1.22E-3 cm/hr	1.19E+1 cm/h
5th percentile water	8.49E-4 cm/hr	8.38E+0 cm/h
95th percentile water	1.75E-3 cm/hr	1.68E+1 cm/h
Max. derm. abs.	1.01E-1 mg/cm ² /hr	

Example considerations:

- 17 mg furfural dermally absorbed at fifteen minutes compared to OEL equivalent inhalation dose 78 mg.
- Compare furfural lag time for maximum absorption to exposure duration.

Example: IH SkinPerm Graphical Outputs



Question: What happens to the 6.1% in the stratum corneum?

Future plans

- Continue supporting professional development activities
 - Dermal Roundtable 2015 AIHce planned
- Enhance IH SkinPerm model
 - Continue translation into other languages
 - Work with AIHA Biological Committee to further validate
- Explore Dermal Assessment Strategy for Mixtures

Appendix

Example: Further analysis for stratum corneum residual

Further analyze splash scenario.

1. Model the 6.1 % (134mg) as an exposure
 - extend observation time e.g. 3 hrs
2. Use spinner graph. Takes 2 hr 51 mins before Furfural diffuses out of stratum corneum.
3. Results: 87.1% evaporates, 12.9% (17.258 mg) permeates from SC into viable epidermis
4. Compare OEL equivalent to total dose
Total dose: $17.719 + 17.258 = 35\text{mg}$
 $78\text{ mg OEL} > 35\text{ mg exposure dose}$

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