

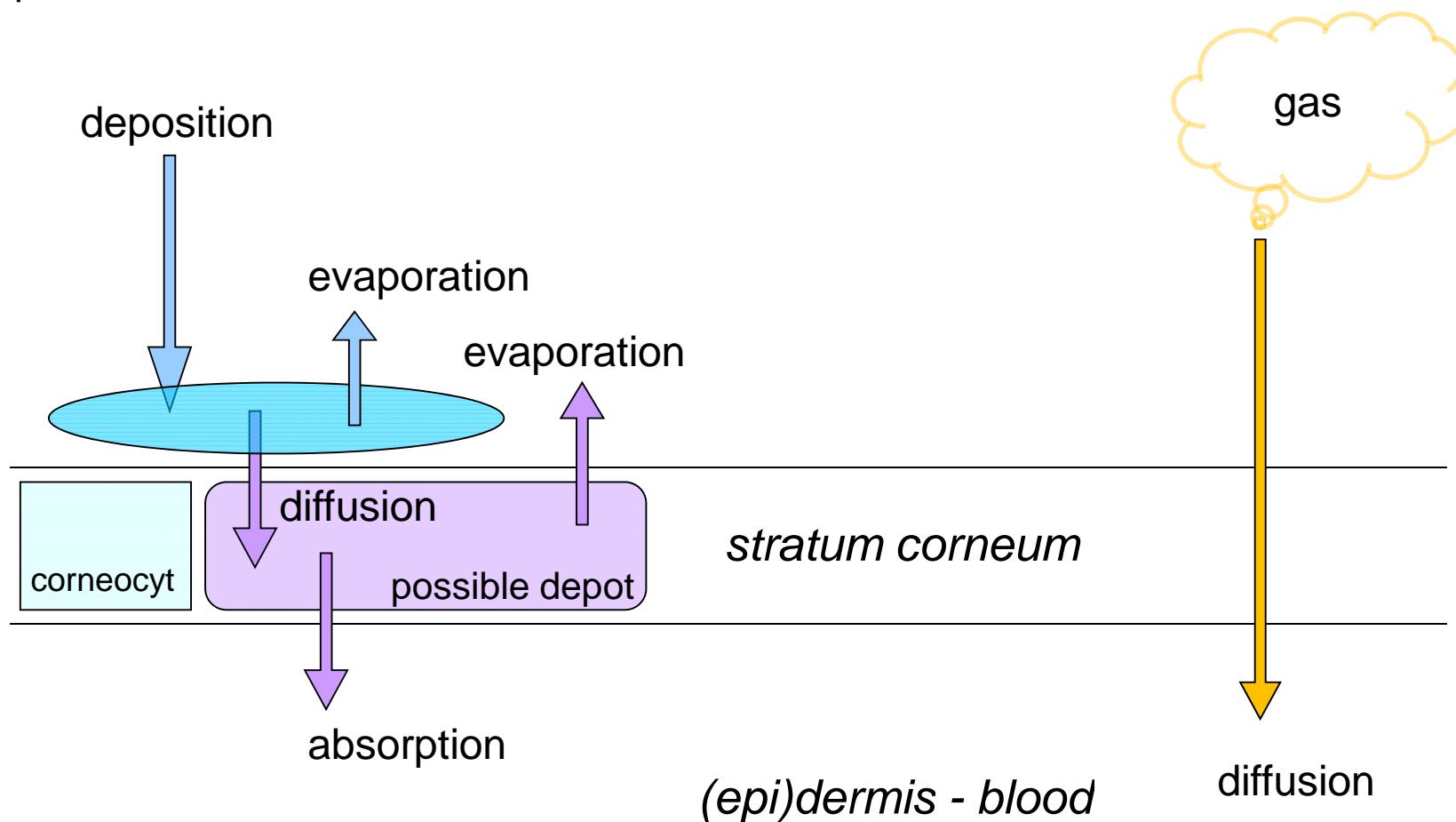
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# **Huidopname van gevaarlijke stoffen via luchtconcentratie in de werkatmosfeer**

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**Daan Huizer  
NVvA symposium  
24 maart 2010**

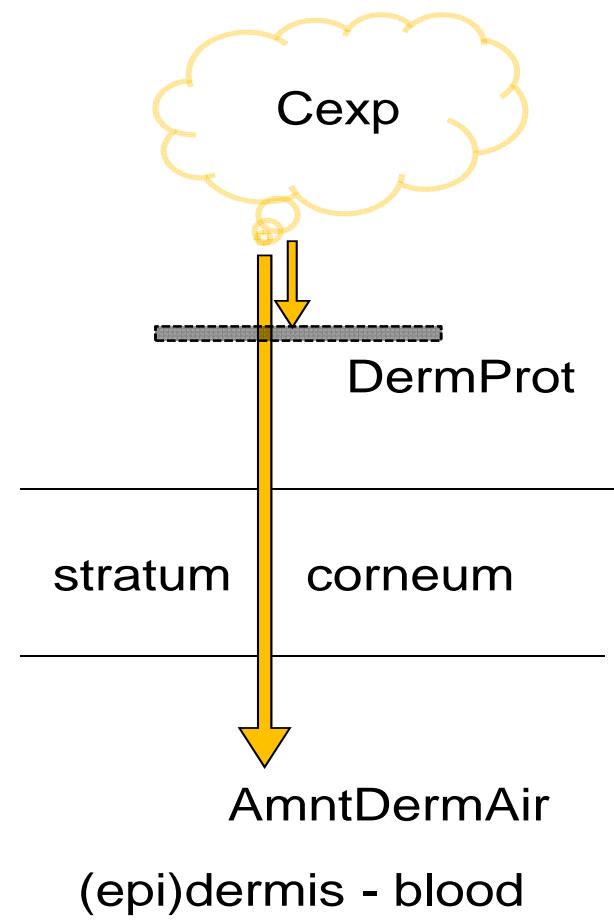
# Huidopname: direct / indirect



Dermal absorption via liquid

Dermal absorption via gas

# Huidopname in arbeidssituaties - voorbeeld



# gebruikte software

## ■ Skinperm

- versie 7.0 (juni 2008)
- website Wil ten Berge (Google op Skinperm: 1e hit )

## ■ IndusChemfate model (DRAFT)

- CEFIC-LRI project (IndusTox)

# Benodigde informatie voor gebruik Skinperm

## PhysChem data:

- molecular weight
- water solubility (mg/litre)
- vapour pressure (Pascal)
- log(octanol/water) at pH 5.5 (skin pH)
- density (mg/cm<sup>3</sup>)

> 100 stoffen opgenomen in Skinperm

## Scenario blootstelling:

- luchtconcentratie (mg/m<sup>3</sup>)
- blootstellingsduur (minuten)
- onbeschermd huidoppervlak (cm<sup>2</sup>)

# Input scherm Skinperm

Substance properties for estimating skin permeation

Debugged version 7.0 of 30 June 2008, info wtberge@planet.nl

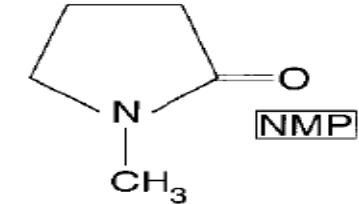
Chemical	ETHOXYDIGLYCOL
CasNum	111-90-0
Molweight	134,2
VapourPress_Pa_25cg	1.30E+01
WaterSolub_mg/l	1000000
Log(Kow)	-0,86
Concentration in water in mg/liter	<input type="text"/>
Concentration in air in mg/m <sup>3</sup>	25
Duration of exposure in minutes	480
Exposed skin surface in cm <sup>2</sup>	16000
Calculate aqueous absorption	
Calculate absorption from air	
Go to Record No	
Calculate Steady State	
View Results	

## Output Skinperm (.txt)

Skin absorption from vapours in air of ETHOXYDIGLYCOL

Concentration in air in mg/m <sup>3</sup>	2,500E+01
Duration of exposure in minutes	480
Skin surface exposed in cm <sup>2</sup>	16000
mg in SC at end of exposure	5,78E+01
mg absorbed at end of exposure	4,49E+01
mg finally absorbed from single exposure	9,31E+01
mg finally evaporated from skin	9,61E+00
minutes for disappearance after exposure	4,81E+01

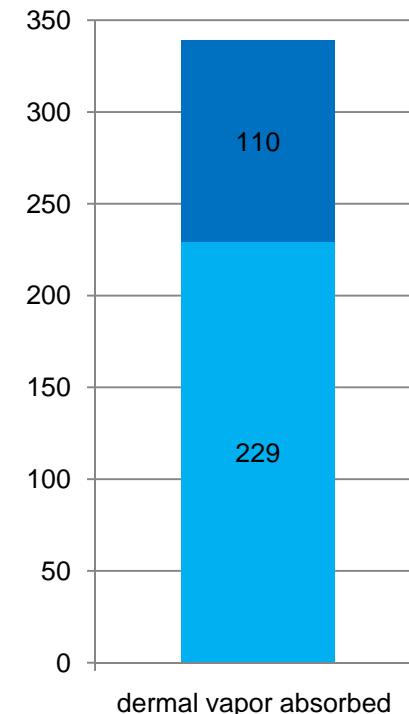
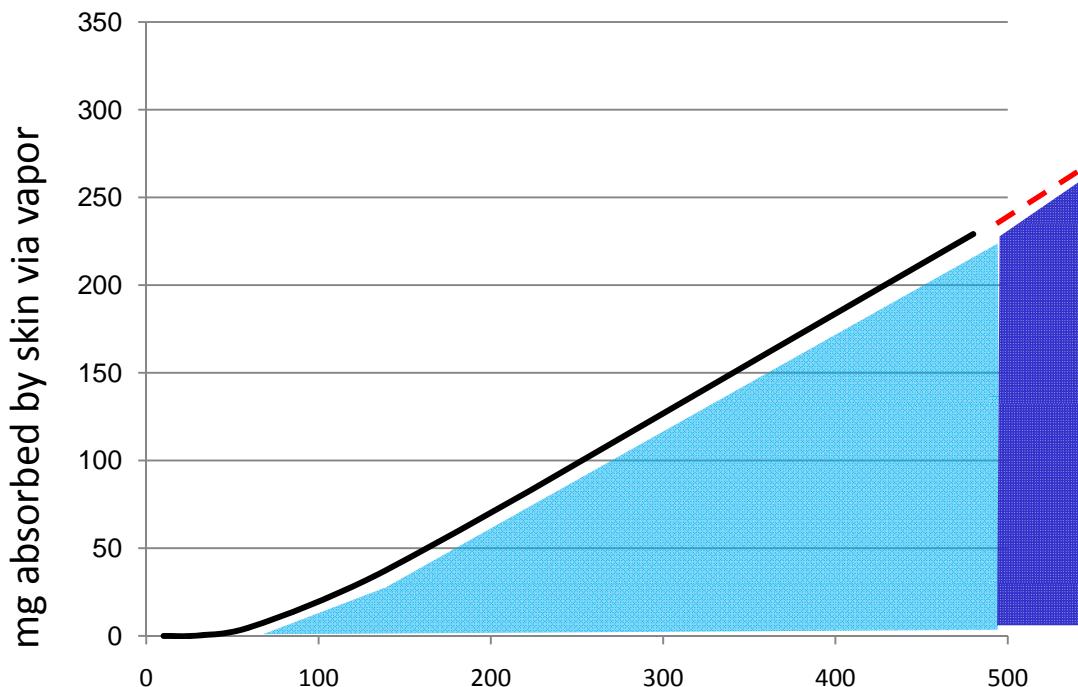
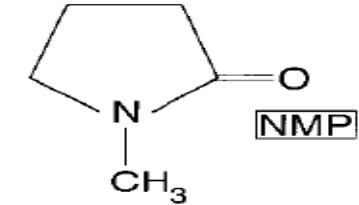
## Case 1 - NMP



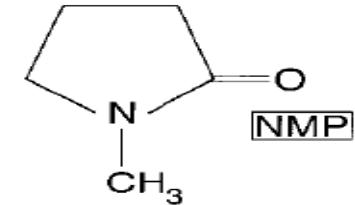
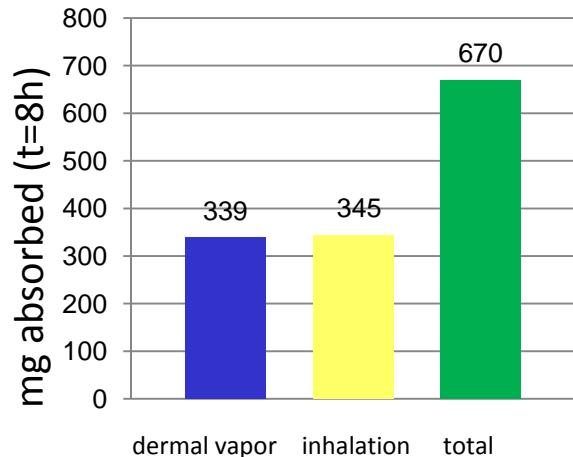
- N-methyl-2- pyrrolidone
  - breed industrieel toepasbaar (synthese, polymerisatie )
  - behoort tot 'nieuwe' solvents
  - 'skin penetration enhancer'
  - ook gebruikt in cosmetica en pharmaceutica
- 
- oude MAC-waarde: 80 mg/m<sup>3</sup> (als damp)
  - UK / D vergelijkbare grenswaarde
  - VS heeft BEI ingesteld voor 1e metaboliet 5-HNMP

## Case 1 - NMP

- luchtconcentratie op 80 mg/m<sup>3</sup> (grenswaarde 8-u)
- huidopname via damp (GEEN huidcontact met vloeistof)



## Case 1 - NMP



### ■ Skinperm

*huidopname van damp ca. 50% van totaal  
(80 mg/m<sup>3</sup>, 8 uur)*

### ■ literatuur:

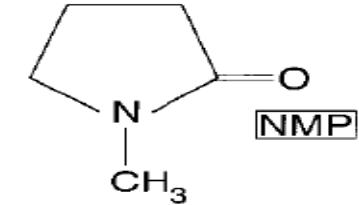
#### ■ Bader et al 2008

*dermal vapor absorption contributes for 33% - 42% of whole body exposure*

#### ■ Carnerup et al 2006

*dermal vapor absorption contributes for appr. 35% to whole body exposure*

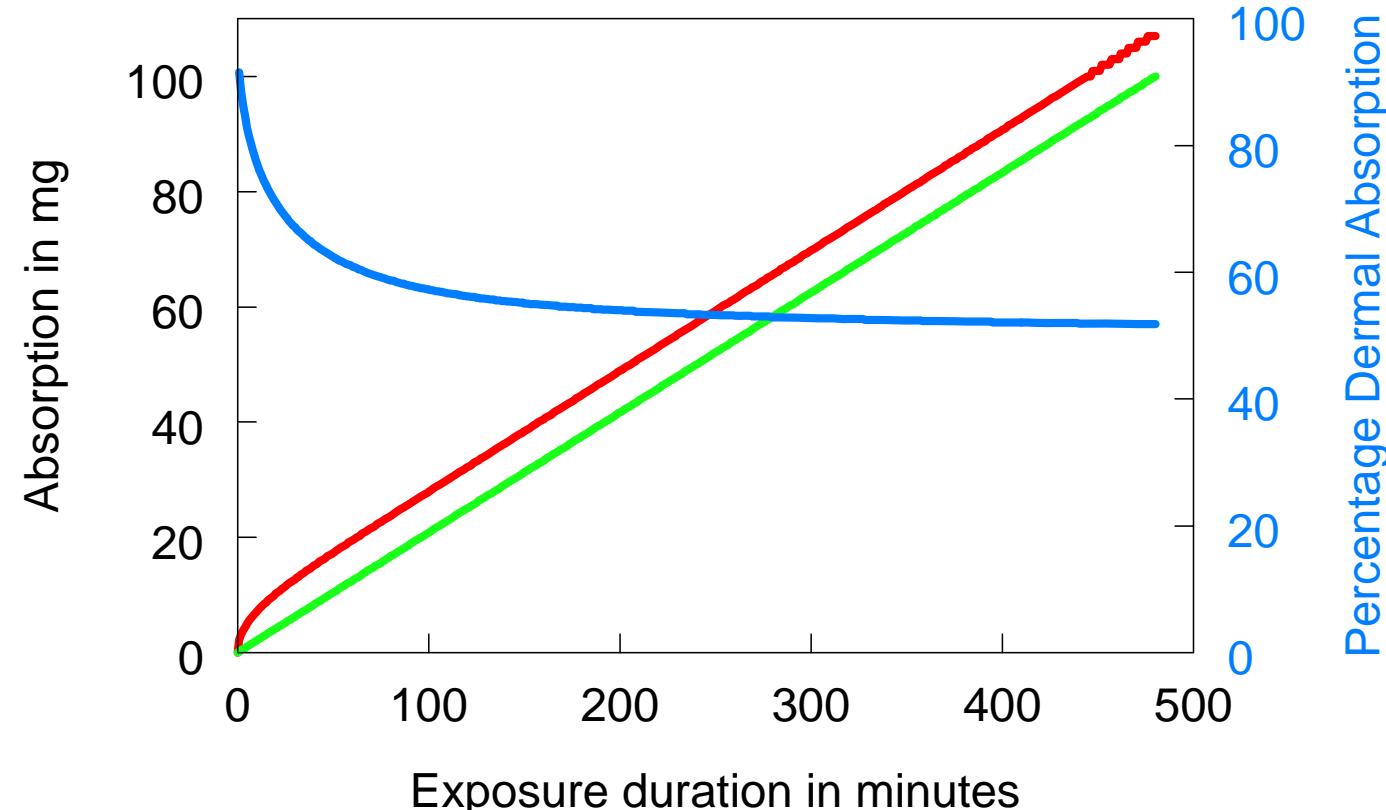
## Case 1 - NMP



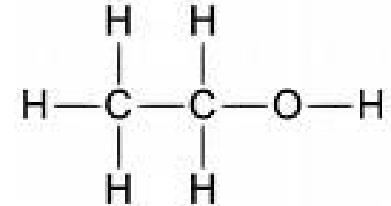
Exposure to NMP (10mg/m<sup>3</sup>)

Layer stagnant air 3 cm from skin

Skin      Inhal.      % skin



## Case 2 - Ethanol



- breed industrieel toepasbaar
- ook veel gebruikt binnen gezondheidszorg (ontsmetting)
  
- Grenswaarde NL 260 mg/m<sup>3</sup> (als damp)
- recent carcinogeen verklaard (2006)
- H-notatie

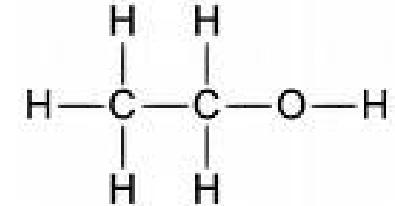
ANTIMICROBIAL AGENTS AND CHEMOTHERAPY, Mar. 2007, p. 1107–1108  
0066-4804/07/\$08.00+0 doi:10.1128/AAC.01320-06  
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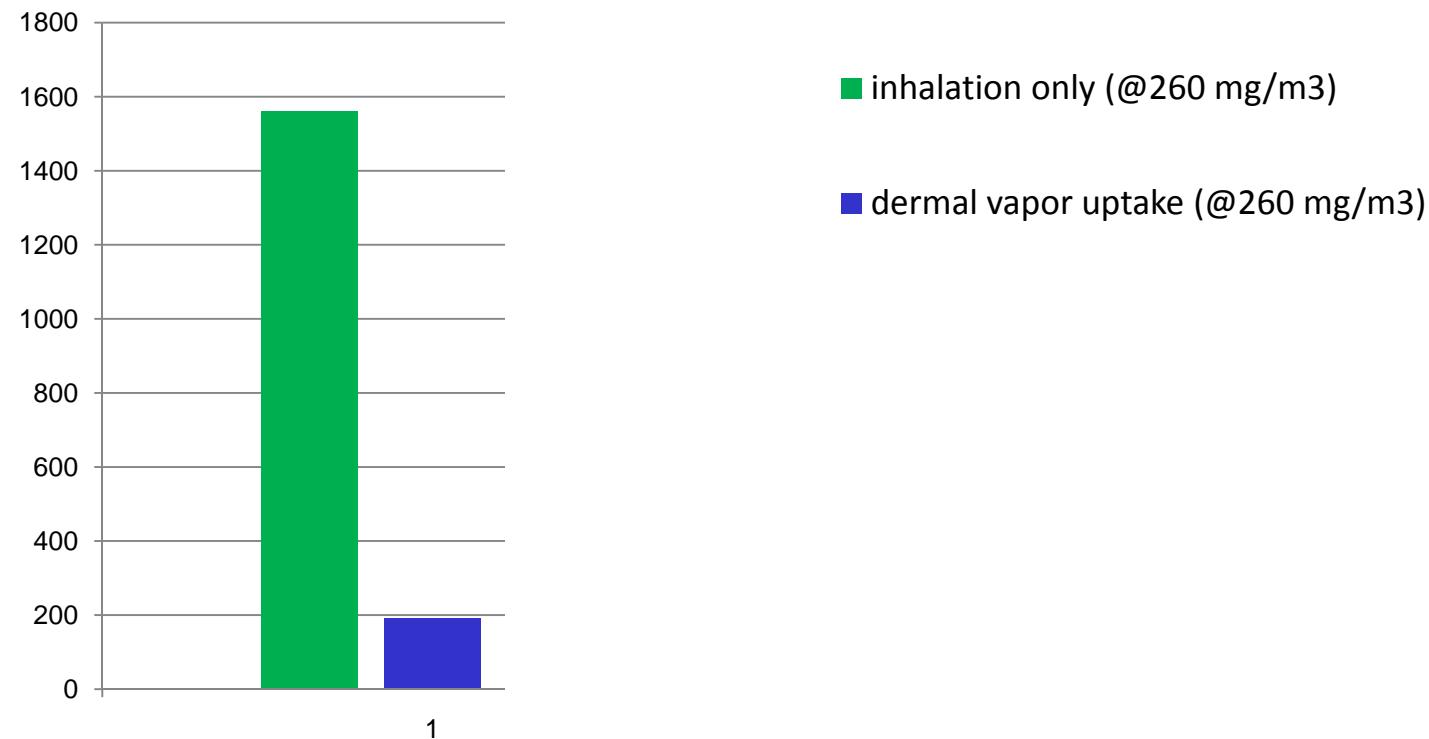
### Can Alcohol-Based Hand-Rub Solutions Cause You To Lose Your Driver's License? Comparative Cutaneous Absorption of Various Alcohols<sup>†</sup>

T. L. Brown,<sup>1</sup> S. Gamon,<sup>2</sup> P. Tester,<sup>3</sup> R. Martin,<sup>2</sup> K. Hosking,<sup>2</sup> G. C. Bowkett,<sup>3</sup> D. Gerostamoulos,<sup>4</sup> and M. L. Grayson<sup>1,5,6\*</sup>

## Case 2 - Ethanol

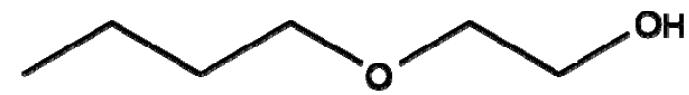


- luchtconcentratie 260 mg/m<sup>3</sup> (grenswaarde 8-u)
- GR: inhalatie (60% retentie x 10 m<sup>3</sup>/8h)



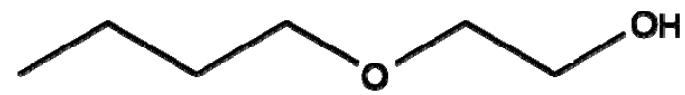
*huidopname van damp volgens Skinperm ca. 12% van inhalatie dosis*

## Case 3 - Butoxy-ethanol



- Glycoethers
  - industrieel solvent, breed toepasbaar
  - schadelijk bij inhalatie, orale inname, huidcontact
  - schadelijk voor vruchtbaarheid (?)
- 
- vervallen MAC-waarde NL: 100 mg/m<sup>3</sup>
  - SCOEL: 100 mg/m<sup>3</sup> (8h TWA)
  - VS: BEI voor butoxyazijnzuur

## Case 3 - Butoxy-ethanol



- Johansen et al 1991:

*"...dermal absorption of vapor is far more significant than respiratory uptake.... 45 - 85%..."*

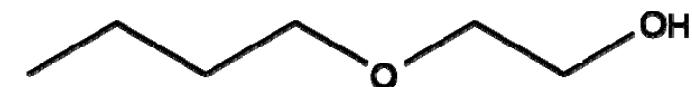
*(conc 50ppm, 2h, whole body exposure to vapor)*

- Corley et al 1997:

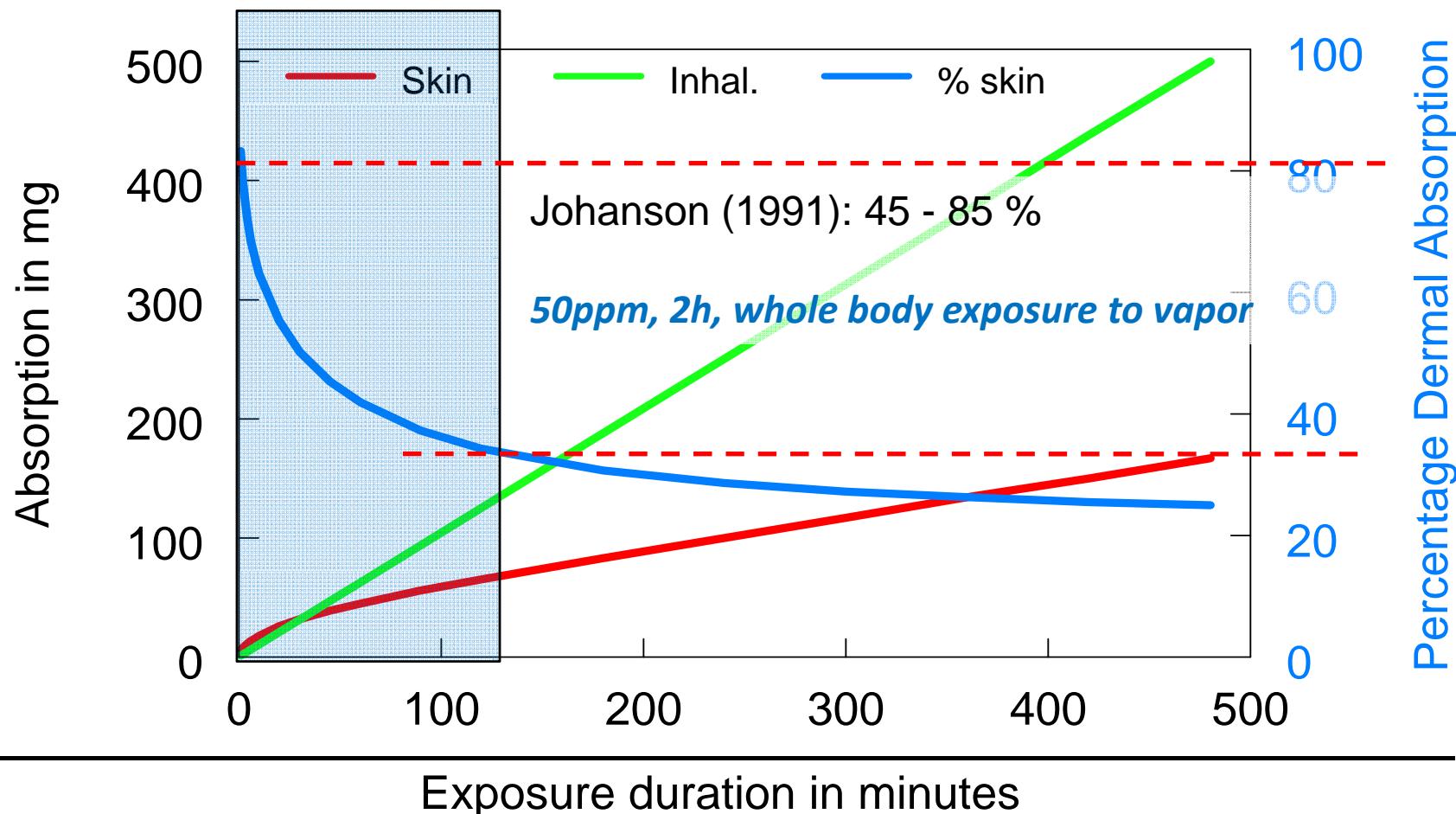
*"...dermal vapor absorption contributes for no more than 15% - 27% of total uptake..."*

*(conc 25ppm, 8h, whole body exposure to vapor)*

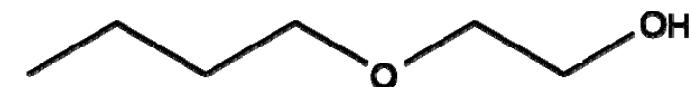
## Case 3 - Butoxy-ethanol



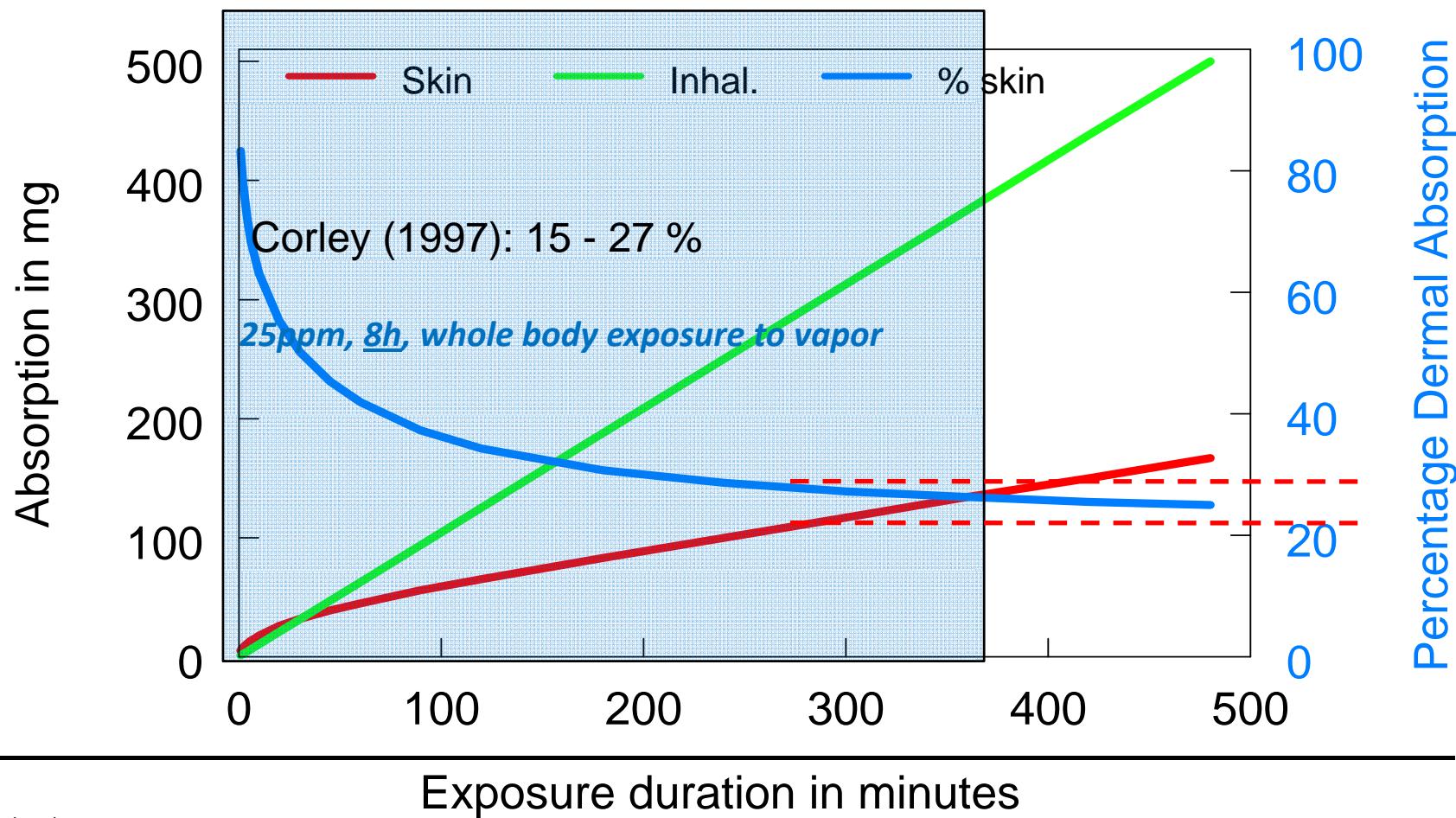
- Concentration: 50 mg/m<sup>3</sup> (= 10 ppm)



## Case 3 - Butoxy-ethanol



- Concentration: 50 mg/m<sup>3</sup> (= 10 ppm)



## Conclusie

- Huidopname uit gasfase kan substantieel bijdragen aan totale inwendige blootstelling
- Skinperm schattingen komen goed overeen met experimentele studies (NMP, ETOH, BE)

## Discussie

- Absorbed fraction is geen constante
- Huidabsorptie gaat vaak door na einde blootstelling
- Houd bij beheersing/monitoring van huidopname rekening met:
  - opname uit de gasfase
  - moment van monstername (BM)
  - type geadviseerde beheersmaatregelen

## Afsluiting

- Bedankt voor uw aandacht!

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ondersteund door CEFIC-LRI