

Dermal Exposure Assessments Workshop: Instructions

1. Form six groups.

2. Focus on three tasks:
 - a. Refurbish rolls/solvent wipe
 - b. Refill pretreat solution
 - c. Coater setup

3. Complete exercise #1 to determine the dermal hazard rating and dermal exposure rating:
 - a. Before any group discussion, take a few minutes to write down your individual thoughts on the qualitative rankings and put them on the form for Exercise #1A (page 5). If you would like to have your answers anonymously included in a study to validate the consistency of the screening method, please tear this sheet out and pass your answers to the front.
 - b. Use the second copy of the form for Exercise #1B (page 6) to make notes and develop your group's rating determinations.
 - c. Answer the discussion questions (page 7).

4. Complete exercise #2:
 - a. Use the AIHA dermal exposure model and the information collected in exercise #1 to calculate a rough estimate of the total exposure to:
 - 1) toluene
 - 2) MEK
 - b. Use the EPA values provided (page 9) to estimate the amount retained on the skin (Q). Use the EPA values provided for the skin area (page 8).
 - c. Compare your estimates to OEL equivalents where possible.
 - d. Utilize the form for Exercise #2 (page 10).

Exercise #1

Dermal Hazard Rating

Rating	Description
1	Reversible or very low skin or systemic toxicity
2	Moderate but reversible skin or systemic toxicity
3	Irreversible/chronic skin or systemic toxicity or sensitization
4	Life threatening skin or systemic toxicity or sensitization

Dermal Contact Area (CA)*

Rating	Description
1	Unexpected/unlikely
2	Very small area of skin contact
3	Contact possible to hands and forearms
4	Contact possible to significant area of skin

Assume the absence of PPE for contact rating

Dermal Concentration or Loading (DC)*

Rating	Description
1	Negligible concentration of agent likely to contact the skin
2	Low concentration of agent likely to contact the skin
3	Moderate concentration of agent likely to contact the skin
4	High concentration of agent likely to contact the skin

Assume absence of PPE for concentration rating

Dermal Contact Frequency (CF)

Rating	Description
1	Minimal contact with skin; one or two incidental contacts; contact during less than 5% of workshift
2	Up to 10 incidental contacts with skin; contact during less than 10% of workshift
3	Up to 50 incidental contacts with skin; contact during less than 50% of workshift
4	Routine incidental contact with skin throughout shift; contact during 50-100% of workshift

Dermal Retention Time (RT)

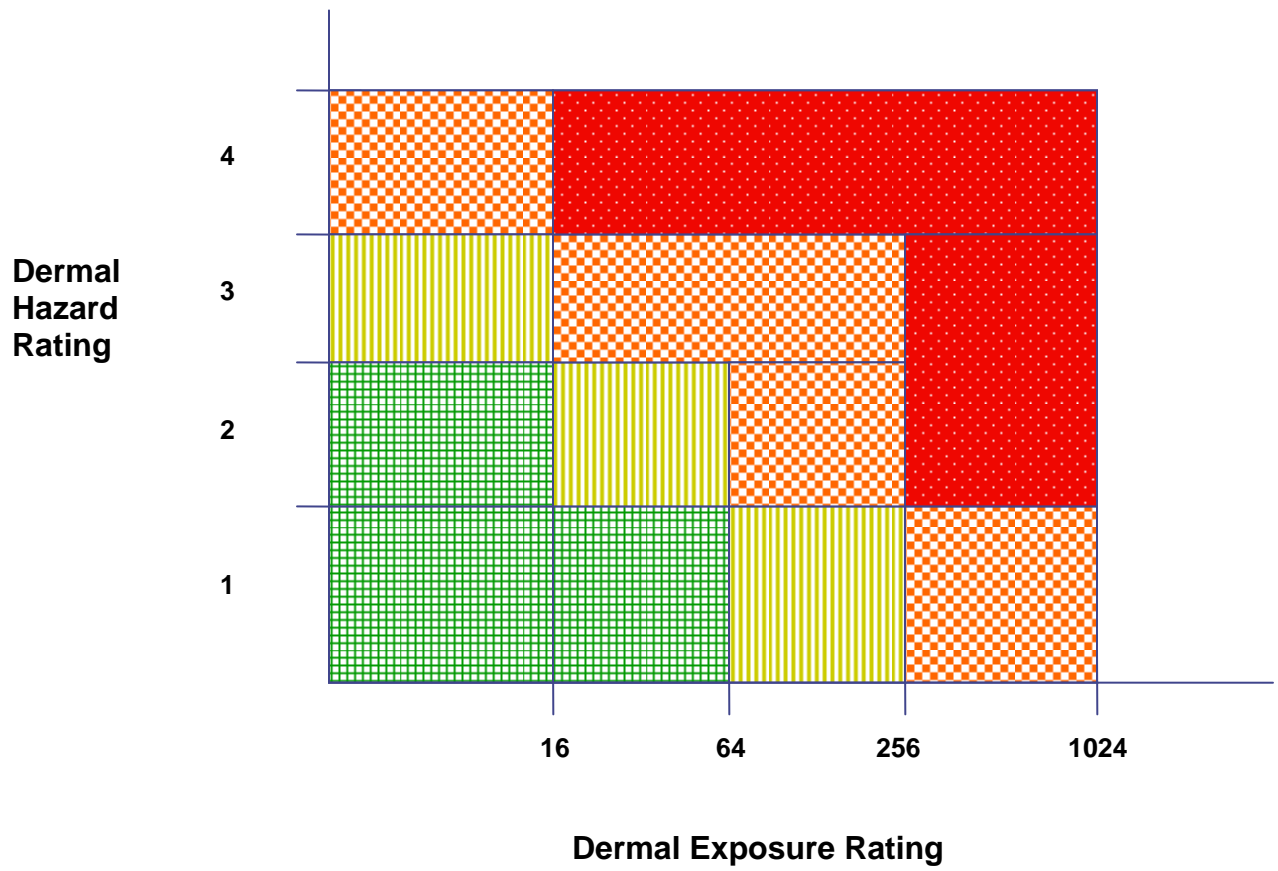
Rating	Description
1	Amount transferred unlikely to remain on skin for any period of time (i.e., high volatility, dry and powdery)
2	Amount transferred may remain on skin for some time (i.e., some volatility or adherence to skin)
3	Amount transferred likely to remain on skin for a significant period of time (i.e., low volatility, high MW, sticky or consolidated on skin even if not visible)
4	Amount transferred very likely to remain on skin (i.e., substance not volatile, MW > 100, substance very likely to stick to skin)

Dermal Penetration Potential (PP)

Rating	Description
1	Rare (large, insoluble particles)
2	Less likely (small insoluble particles >1 µm in size or both poor lipid solubility and poor water solubility)
3	Possible or slow (very small insoluble particles <1 µm in size or some lipid solubility and some water solubility, or marginal skin health)
4	Probable or likely (good lipid solubility and good water solubility, or poor skin health)

Exposure Rating = CA * DC * CF * RT * PP

Qualitative Assessment of Dermal Exposures



**Exercise #1A: Dermal Exposure Assessment Summary Form
Individual Responses**

Job Title	Task	Agent	Hazard Rating	CA	DC	CF	RT	PP	Exposure Rating	Risk Rating
Maintenance Tech	Refurbish rolls	Omni 90 (MEK)								
Sr Lab Tech	Refill pretreat	Permatreat 1500								
Coater Operator	Coater setup	Omni 90 (Toluene)								

CA – dermal contact area
 DC – dermal concentration/loading
 CF – dermal contact frequency
 RT – dermal retention time
 PP – dermal penetration potential
 RR-Use the Qualitative Assessment of Dermal Hazards chart to determine value

Other Information:

Assume DC = 35% or 0.35
 MEK- MW=72.1
 VP=78 mm Hg
 Chromic Acid- MW= 100.0
 VP= Very Low
 Toluene- MW= 92.1
 VP= 21 mm Hg

Exposure Rating = CA * DC * CF * RT * PP

Maintenance Tech: Exposure Rating = * * * * =

Sr Lab Tech: Exposure Rating = * * * * =

Coater Operator: Exposure Rating = * * * * =

**Exercise #1B: Dermal Exposure Assessment Summary Form
Group Responses**

Job Title	Task	Agent	Hazard Rating	CA	DC	CF	RT	PP	Exposure Rating	Risk Rating
Maintenance Tech	Refurbish rolls	Omni 90 (MEK)								
Sr Lab Tech	Refill pretreat	Permatreat 1500								
Coater Operator	Coater setup	Omni 90 (Toluene)								

CA – dermal contact area
 DC – dermal concentration/loading
 CF – dermal contact frequency
 RT – dermal retention time
 PP – dermal penetration potential
 RR-Use the Qualitative Assessment of Dermal Hazards chart to determine value

Other Information:

Assume DC = 35% or 0.35
 MEK- MW=72.1
 VP=78 mm Hg
 Chromic Acid- MW= 100.0
 VP= Very Low
 Toluene- MW= 92.1
 VP= 21 mm Hg

Exposure Rating = CA * DC * CF * RT * PP

Maintenance Tech: Exposure Rating = * * * * =

Sr Lab Tech: Exposure Rating = * * * * =

Coater Operator: Exposure Rating = * * * * =

Exercise #1 Discussion

1. Which chemical substances are of highest concern for dermal exposure? For systemic absorption?

2. Why?

3. What are the top tasks/chemicals for which additional assessment should be conducted for systemic exposure concern?

4. Why?

5. Which substances/tasks do not have a dermal exposure concern?

Exercise #2

AIHA Dermal Exposure Model

D = S * Q * WF * FQ * ABS

D – potential dose (mg/day)

S – surface area of contact (cm²)

Q – amount retained on the skin (mg/cm²)

WF = DC – dermal concentration or loading of chemical (can estimate using percent by weight)

FQ – number of contact events per day

ABS – absorption (assume 100% absorption into skin)

Skin Surface Area

Body Part	Mean (men) (cm²)	5th to 95th Percentile (cm²)
Head	1180	900 – 1610
Arms	2280	1090 – 2920
Forearms	1140	945 – 1360
Hands	840	596 – 1130
Palms	150	
Thumb	~24	

Taken from U.S. EPA's Exposure Factors Handbook, Volume I, Chapter 6: Dermal, Table 6-4, Surface Area by Body Part for Adults, m²

Factors for Screening-Level Assessment of Dermal Exposure to the Hands

Type of Contact ^a	Typical Examples	S ^b (cm ²)	Q ^c (mg/cm ²)	Resulting Dermal Contact (mg)
Routine, direct handling of solids – 2 hands	Filling/dumping containers of powders, flakes, granules Weighing powder/scooping/mixing (i.e., dye weighing) Handling wet or dried material in a filtration and drying process.			up to 3100 ^d
Routine contact with surfaces – 2 hands	Handling bags of solid materials (closed or empty).			up to 1100 ^d
Routine immersion – 2 hands, liquids	Handling wet surfaces. Spray painting	840	1.3 – 10.3	up to 8700
Routine contact – 2 hands, liquids	Maintenance Manual cleaning of equipment Filling drum with liquid	840	0.7 – 2.1	up to 1800
Incidental contact – 2 hands, liquids	Connecting transfer line	840	0.7 – 2.1	up to 1800
Incidental contact – 1 hand, liquids	Sampling Ladling liquid/bench scale liquid transfer	420	0.7 – 2.1	up to 900

^aThe terms “routine” and “incidental” reflect typical CEB judgments on likelihood of contact for the example activities

^bValues of the skin surface area of the hands taken from: EPA Exposure Factors Handbook, 1997 and are the mean values for men

^cSelected ranges of “Q” values for liquid handling activities taken from: EPA, 199s. A Laboratory Method to Determine Retention of Liquids on the Surface of Hands, Exposure Evaluation Division, Office of Pollution Prevention and Toxic, USEPA, EPA 747-R-92-003, September 1992

^dValues for dermal contact for solids handling activities were taken from: Lansink 1996. Calcium Carbonate in the Paint Industry. Preliminary Modeling of Skin Exposure Levels to Powders Based on Field Data (TNO Report V 96.064). Rijswijk, The Netherlands: TNO Nutrition and Food Research Institute, 1996

Further details on the derivation of this table can be found in: U.S. EPA, 2000. Options for Revising CEB’s Method for Screening-Level Estimates of Dermal Exposure. Final Report. 06/01/00. To obtain a copy of this document, contact Jennifer Sahmel at jsahmel@yahoo.com or Nhan Nguyen at Nguyen.Nhan@epa.gov. U.S. Environmental Protection Agency/Economics, Exposure, and Technology Division/Chemical Engineering Branch.

Exercise #2: Dermal Exposure Assessment Summary Form

Job Title	Task	Agent	D	S	Q	WF	FQ	ABS
Maintenance Tech	Refurbish rolls	Omni 90 (toluene)						
Maintenance Tech	Refurbish rolls	Omni 90 (MEK)						
Coater Operator	Coater setup	Omni 90 (toluene)						
Coater Operator	Coater setup	Omni 90 (MEK)						

D – potential dose
 S – surface area of contact
 Q – amount retained on the skin
 WF is also known as DC – dermal concentration or loading of chemical
 FQ – number of contact events per day
 ABS – absorption

Other information:
 C= 35% or 0.35
 ABS= the default value is 100% or 1.0
 MEK PEL=590 mg/m³
 Toluene REL STEL=560 mg/m³

$$D = S * Q * WF * FQ * ABS$$

Maintenance Tech/Refurbish Rolls/toluene: Exposure Dose (D) = * * * * =

Maintenance Tech/Refurbish Rolls/MEK: Exposure Dose (D) = * * * * =

Coater Operator/Coater Setup/toluene: Exposure Dose (D) = * * * * =

Coater Operator/Coater Setup/MEK: Exposure Dose (D) = * * * * =

Answers to Exercises: Workshop 3

Possible Answers to Exercise #1: Dermal Exposure Assessment Summary Form 4

Job Title	Task	Agent	Hazard Rating	CA	C	CF	RT	PP	Exposure Rating	Risk Rating
Maintenance Tech	Refurbish rolls	Omni 90 (MEK)	2 or 3	3	3	3	2 or 3	3 or 4	162	3
Sr Lab Tech	Refill pretreat	Permatreat 1500	4	3	2	1	4	2	96	4
Coater Operator	Coater setup	Omni 90 (Toluene)	2	2	3 or 4	2	2 or 3	3 or 4	72	3

CA – dermal contact area

C – dermal concentration

CF – dermal contact frequency

RT – dermal retention time

PP – dermal penetration potential

RR-Use the Qualitative Assessment of Dermal Exposure Chart to determine value

Other Information:

Assume C= 35% or 0.35

MEK- MW=72.1
VP=78 mm Hg

Chromic Acid- MW= 100.0
VP= Very Low

Toluene- MW= 92.1
VP= 21 mm Hg

$$\text{Exposure Rating} = \text{CA} * \text{C} * \text{CF} * \text{RT} * \text{PP}$$

Possible Answers to Exercise #2: Dermal Exposure Assessment Summary Form 5

Job Title	Task	Agent	D	S	Q	WF	FQ	ABS
Maintenance Tech	Refurbish rolls	Omni 90 (toluene)						
Maintenance Tech	Refurbish rolls	Omni 90 (MEK)	6585.6	840 cm ²	1.4	35%	16	100%
Coater Operator	Coater setup	Omni 90 (toluene)	7761.6	1980 cm ²	1.4	35%	8	100%
Coater Operator	Coater setup	Omni 90 (MEK)						

D – potential dose

S – surface area of contact

Q – amount retained on the skin

WF is also known as C – concentration of chemical

FQ – number of contact events per day

ABS – absorption

Other information:

C= 35% or 0.35

ABS= the default value is 100% or 1.0

MEK PEL=590 mg/m³

Toluene REL STEL=560 mg/m³

$$D = S * Q * WF * FQ * ABS$$