TSCA Exposure Workshop
Proposed Draft Framework for
Dermal Exposure Assessments in TSCA Risk Evaluations

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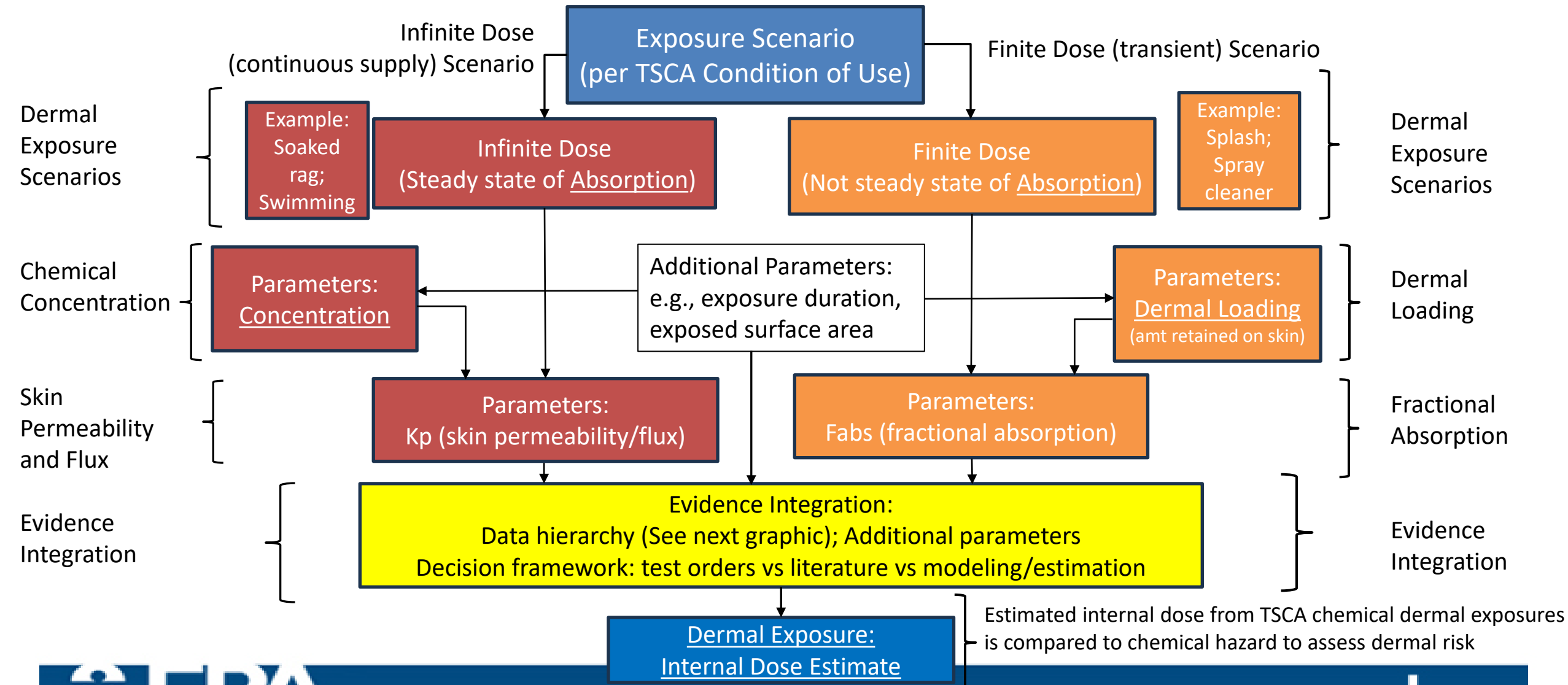
OUTLINE

- Background

- Proposed draft dermal framework/decision framework outline

- Data hierarchy

- Decision logic for dermal absorption data selection

- Dermal exposure models

Background

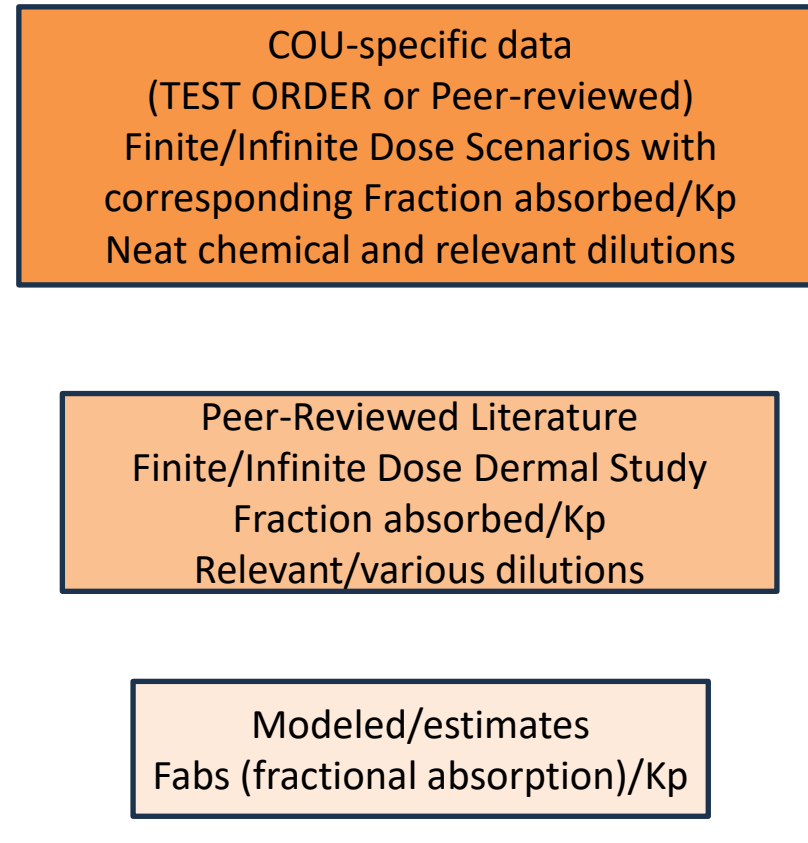- Dermal exposure to chemicals assessed in TSCA Risk Evaluations is an important route of exposure and risk estimates and risk management

- Scenarios may be different, but EPA recognized a need for aligning occupational/consumer dermal assumptions

- Group of engineers, exposure assessors, industrial hygienist and hazard assessors gathered to form a workgroup
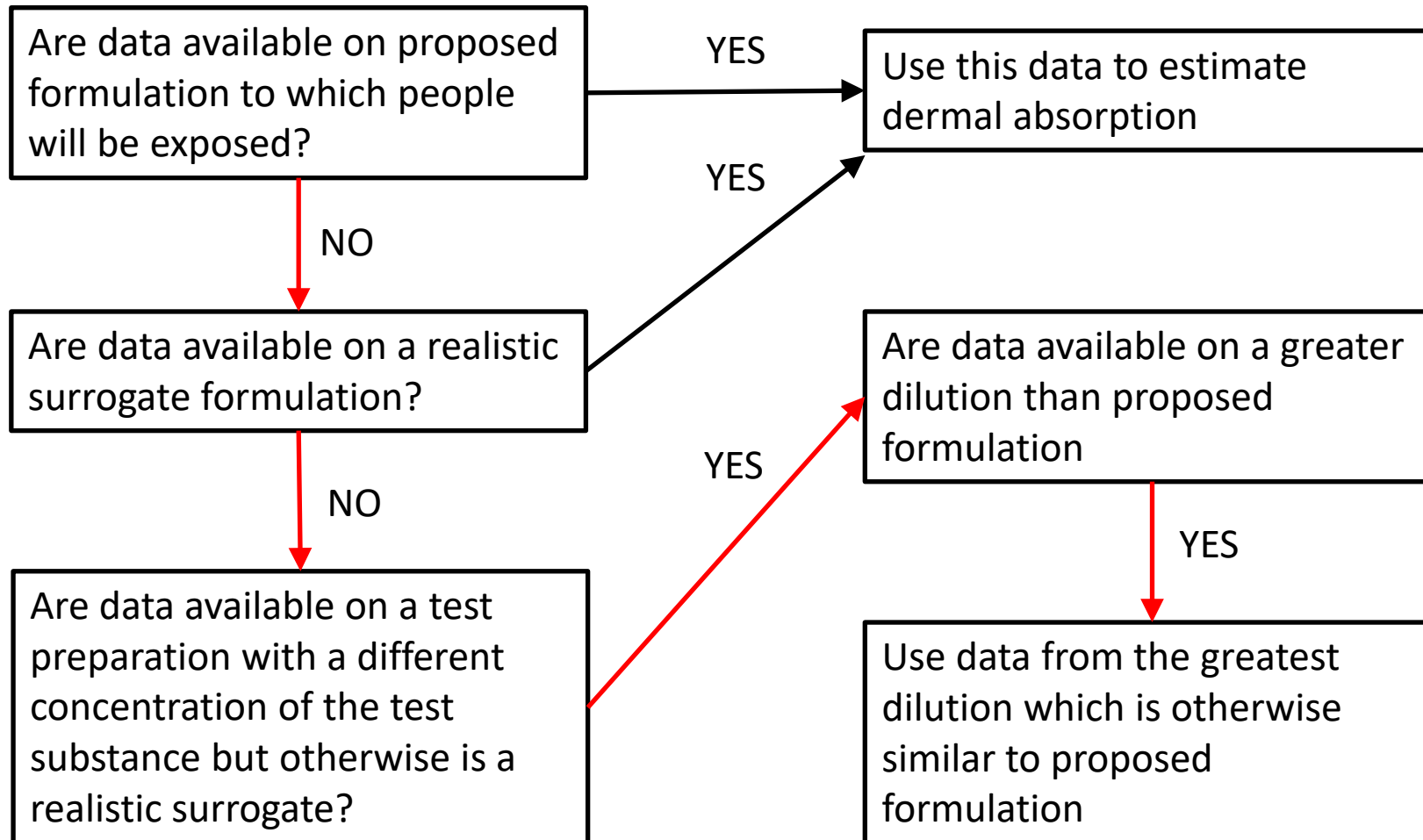
  -> Ongoing Development of a Proposed Draft Framework

Proposed Draft Framework for Dermal Exposure Assessment

Infinite Dose (continuous supply) Scenario

Exposure Scenario (per TSCA Condition of Use)

Finite Dose (transient) Scenario

Dermal Exposure Scenarios

Example: Soaked rag; Swimming

Infinite Dose (Steady state of Absorption)

Finite Dose (Not steady state of Absorption)

Example: Splash; Spray cleaner

Dermal Exposure Scenarios

Chemical Concentration

Parameters: Concentration

Additional Parameters: e.g., exposure duration, exposed surface area

Parameters: Dermal Loading (amt retained on skin)

Dermal Loading

Skin Permeability and Flux

Parameters: Kp (skin permeability/flux)

Parameters: Fabs (fractional absorption)

Fractional Absorption

Evidence Integration

Evidence Integration: Data hierarchy (See next graphic); Additional parameters Decision framework: test orders vs literature vs modeling/estimation

Evidence Integration

Dermal Exposure: Internal Dose Estimate

Estimated internal dose from TSCA chemical dermal exposures is compared to chemical hazard to assess dermal risk

EPA

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Proposed Draft Framework for Dermal Exposure Assessment Data Hierarchy

COU-specific data
(TEST ORDER or Peer-reviewed)
Finite/Infinite Dose Scenarios with
corresponding Fraction absorbed/Kp
Neat chemical and relevant dilutions

Peer-Reviewed Literature
Finite/Infinite Dose Dermal Study
Fraction absorbed/Kp
Relevant/various dilutions

Modeled/estimates
Fabs (fractional absorption)/Kp

Decision Logic for Dermal Absorption Data Selection: TCEP example

Are data available on proposed formulation to which people will be exposed?

YES → Use this data to estimate dermal absorption

NO ↓

Are data available on a realistic surrogate formulation?

YES → Use this data to estimate dermal absorption

NO ↓

Are data available on a test preparation with a different concentration of the test substance but otherwise is a realistic surrogate?

YES → Are data available on a greater dilution than proposed formulation

YES ↓

Use data from the greatest dilution which is otherwise similar to proposed formulation

Available Data:
Fractional absorption and permeability of TCEP dilution in acetone (~0.001 – 0.005 wt%)

Assumption:
Fractional absorption and permeability coefficient increase with increasing dilution

TCEP Conclusion:
Use fractional absorption and permeability data for dilute TCEP to estimate dermal exposure to higher concentration materials

*Flowchart from OECD 156 Guidance Notes on Dermal Absorption

Models for Assessing Dermal Exposure

Dermal Model for Finite Doses – Fractional Absorption

$$D_{exp} = Q_u \times f_{abs} \times SA \times FQ \times WF$$

Model Applicability

- "Splash-type" exposures
- Non-immersive and non-occluded scenarios
- Liquids: < 10 µL/cm^2, Solids: 1 – 5 mg/ cm^2
  (OECD 428 Guideline for Skin Absorption Testing)

D_{exp} = Dermal Exposure (mg/day)
Q_u = Dermal Loading (mg/cm^2-event)
f_{abs} = Fractional Absorption
SA = Area of Contact (cm^2)
FQ = Frequency of Contact (events/day)
WF = Weight Fraction of Chemical

Challenge:
Choice of model for a given scenario is not always obvious

Dermal Model for Infinite Doses – Flux-Based Permeability

Model Applicability

- Continuous supply of chemical against skin
- Immersive or occluded scenarios
  - ➤ *Example:* Material trapped under glove
- Liquids: >100 µL/cm^2, Solids >10 mg/ cm^2
  (OECD 28 Guidance Document for Absorption Studies)

$$D_{exp} = K_{p,c} \times C \times SA \times t_{exp}$$

D_{exp} = Dermal Exposure (mg/day)
$K_{p,c}$ = Skin Permeability Coefficent at Conc. C (cm/hr)
C = Chemical Concentration (mg/cm^3)
SA = Area of Contact (cm^2)
t_{exp} = Contact Time (hrs/day)

Summary/Next Steps

- Proposed Draft Framework is moving through internal EPA reviews

- Workgroup continuing to meet to revise and address comments

THANK YOU!

QUESTIONS/COMMENTS