Pesticide Registration Evaluation Model (PREM) for Surface Water Protection in California

Yuzhuo Luo, Ph.D.
Research Scientist IV
Surface Water Protection Program (SWPP)
California Department of Pesticide Regulation (CDPR)
The latest version: PREM5

The first version of PREM was released in 2012. It continues to evolve to better fit CA conditions with increasing modeling capabilities for more consistent, transparent, and efficient evaluation. A new methodology has been developed and implemented in PREM, judgment and experience. Historically, SW evaluations have been based on professional judgment and experience. The main modeling tool for surface water registration evaluation (PREM)
Model development

- Modeling framework with 2-stage evaluation process
- Evaluation of urban pesticide uses
- Evaluation of pesticide degradates
- Exposure potentials to marine/estuarine organisms
- SWPP continues to improve the model’s capabilities and specificity to California conditions: receiving water body, indoor uses and wastewater, etc.

Version 2 (2012)
Version 3 (2014)
Version 5 (2017)
Under development
Scope and limitations by pesticide use patterns:

- PREM is developed for production agriculture (both upland and flooded), aquatic application, outdoor impervious surfaces, and adulticide application. It is also developed for production agriculture (both upland and flooded), aquatic application, outdoor impervious surfaces, and residential, commercial, right-of-way, and indoor uses (POTW scenario, under development).

- But NOT for anti-fouling paint (AFP), inorganic compounds (silver), copper, and other biocidal and antimicrobial pesticides.

By pesticide use patterns:
Overview of PREM evaluation process

Model input data

- PREM
- Chemistry data
- Eco-tox data
- DPR-accepted data only

Evaluation variables

- Decision-making flowchart
- Conditionally support
- Not support
- Watch-listing, flagging etc.
- Graphical user interface (GUI)

Functional modules

- Evaluate modules
- Flowchart

Recommendations

- Registration
- Model input data
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Note: variables are presented as descriptive classification, e.g., high (H), low (L), intermediate (M)
Pesticide use pattern

- Pesticide use patterns with high-risk potentials to surface water:
  - Aquatic and rice pesticides
  - Crops with top acreages in California
  - Pre-emergent application
  - Winter rain season application
  - Crops with gravity irrigation
  - Urban/residential uses

- Other use patterns: low-risk potentials
  - Crops with top acreages in California
  - Pre-emergent application
  - Winter rain season application
  - Crops with gravity irrigation
  - Urban/residential uses
  - Aquatic and rice pesticides
Risk quotient ($RQ$) • Evaluated for high-risk use patterns only

Intermediate $RQ$: 0.1-0.5

High $RQ$: >0.5

$RQ$ is compared to the LOC (level of concern)

TOX = the toxicity value (LC50 or EC50) for the most sensitive species

EEC (Estimated Environmental Concentration) = $f$(chemical property, use, pattern, label rate)

$$\frac{TOX}{EEC} = \tilde{RQ}$$

Evaluated for high-risk use patterns only

Risk quotient ($RQ$)
EEC modeling

• Generally, based on the Rodenticide Act (Tier-2 modeling framework, Federal Insecticide, Fungicide, and Rodenticide Act) (FIFRA) (Federal Insecticide, Fungicide, and Rodenticide Act)}

Ref: EPA-HQ-OPP-2015-0424-0036
Generally, based on the FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) Tier-2 modeling framework, modeling for applications to an aquatic site (e.g., rice pesticide) is generally based on the FIFRA modeling framework.
EEC modeling: tools

- Simulation engines (USEPA models)
  - Landscape simulation: PRZM (Pesticide Root-Zone Model)
  - In-water simulation: VVWM (Varying Volume Water Model), and PFAM

- Modeling scenarios
  - DPR scenario for down-the-drain pesticides (under development)
  - USEPA/PR scenario for rice pesticides
  - DPR scenario for degrade evaluation
  - DPR scenario for urban outdoor uses
  - USEPA scenarios for agricultural uses
  - DPR scenario for degrade evaluation

- Simulation engines (USEPA models)
Decision-making flowchart

Note: L=low, M=intermediate, H=high, VH=very high
PBM Results

• Watch it for new products and label amendments

• Low-risk use pattern for the currently evaluated product: Flag the A.I. and monitor its actual use amount and post-use risk.

• Conditional registration: consider the A.I. as a candidate for surface water monitoring, and watch its actual use amount and post-use risk.

• Conditional registration (for an active ingredient):

  • Watch listing (for an active ingredient)

  • Do not support registration

  • Support conditional registration and request analytical methods

• Registration recommendations (for a product)
Graphical user interface

Chemical-specific data

Specify the parent compound here

Specify the degradates to be modeled here

Product-specific data
High-risk use patterns
Additional data by pesticide use pattern

Urban use as an example
PREM applications

- Registration evaluations for 70+ pesticide products (as of Dec 2019)
- Risk assessment for fipronil (urban) and pyrethroids (urban and ag)
- Incorporation with Best Management Practice (BMP) modeling
- Vegetative drainage ditch (VDD, under development)
- Vegetative filter strip (VFS, completed)
- Comparison with USEPA/OPP residential settings in the ecological risk assessment (ERA) for pyrethroids (EPA-HQ-OPP-2010-0384-0045)
Summary

- Surface water evaluations with PREM
  - Consistently & reliably identify adverse risks of products to water quality & aquatic life
  - Avoid involved, costly & protracted post-registration efforts to develop & implement mitigation or regulations
  - Successful resolution between DPR & registrants (data needs, label changes)
  - Reinforces the usefulness & importance of SW registration evaluations & PREM

- PREM continually evolving for evermore realistic & CA-centric predictions
  - Eventually anyone could run model
PREM timeline
PreM Pesticide Registration Evaluation Model (PREM) website

www.cdpr.ca.gov/docs/emon/surfwtr/sw_models.htm
Thanks

Yuzhou Luo

(916) 445-2090

Yuzhou.Luo@cdpr.ca.gov