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Study 315: Protocol to Develop a Down-the-Drain Model for Pesticide Registration Evaluation in California

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1. Introduction

Pesticide transport via indoor drains is one of the important pathways of pesticide contamination to surface waters. This component has not yet been consistently addressed in the evaluation of pesticide products submitted for registration in California. Currently, no standardized methodology is available for the California Department of Pesticide Regulation's (CDPR) Surface Water Protection Program (SWPP) to evaluate aquatic risks associated with pesticide uses with the potential to transport pesticides down indoor drains. As such, this study aims to develop a quantitative approach, referred to as the Down-the-Drain (DtD) model, to provide a scientifically sound basis for risk characterization of pesticides indoor DtD release to wastewater collection and treatment systems.

The Exposure and Fate Assessment Screening Tool (E-FAST) DtD model (USEPA, 2014), developed by the US Environmental Protection Agency (USEPA), is a screening-level model that estimates environmental concentrations of pesticide active ingredients (AI) within domestic wastewater collecting and treatment systems. Although the E-FAST DtD model provides a promising quantitative approach, the application of this model to DPR's product registration evaluation process can be challenging due to certain technical obstacles.

First, the E-FAST DtD model requires specifying the total pesticide use in the region of interest. This information may be well established for an existing product; however, it is usually difficult to acquire for a new product. Registrants may submit this type of data based on their marketing projections, but this information is not required for registration application and therefore not always available. A method is needed to help project the use amount of a new AI/product for evaluation purposes.

Second, the use amount of the pesticide is not necessarily equivalent to the amount of the pesticide that is actually released down the drain. Some products are applied at the same time as washing (e.g., pet shampoos, detergents, cleansers, sewer root killers, etc.), while others are applied to targets, which are then washed after a period of time (e.g., pet spot-on products, pet lotions, treated articles, etc.) (Moran and TenBrook, 2014). In the latter scenario, the actual

pesticide release rate is only a small fraction of the application rate of the pesticide. The relationship should be well-defined in order for the evaluation to be sound.

Last, the E-FAST DtD model is parameterized based on national data, thus lacking details at the state level. CDPR has a more complete documentation of pesticide use and sales data for California, which can be used to provide insights for model parameterization. Thus, a California-based DtD model becomes possible by taking advantage of these available data.

2. Objectives

The objective of this study is to develop a DtD model for risk evaluation of pesticide products submitted for registration in California for uses associated with pesticide indoor DtD release to wastewater. The objective will be completed by accomplishing the following four activities:

1) Review the USEPA E-FAST DtD model and its applications.
2) Develop the California-relevant DtD model based on refinements of the E-FAST DtD model.
3) Explore California pesticide databases, focusing on the pesticide product/label database, pesticide use report (PUR), and pesticide sales report. Parameterize the California DtD model by using California-specific data.
4) Model testing – compare the modeling results to SWPP previous best-professional-judgement based evaluations and/or monitoring data.

3. Personnel

This study will be conducted by SWPP staff under the general direction of Nan Singhasemanon, Environmental Program Manager I. Key personnel are listed below:

- Project Leader: Yina Xie, Ph.D.
- Reviewing Scientists: Yuzhou Luo, Ph.D., Jenifer Teerlink, Ph.D.

Questions regarding this protocol should be directed to Yina Xie, Environmental Scientist, at 916-324-4111 or by email at Yina.Xie@cdpr.ca.gov.

4. Study Plan

4.1 Model review and literature review

In order to develop a California-based DtD model, the following items will be reviewed.

First, the USEPA E-FAST DtD model will be reviewed for reference. The review will involve the examination of the conceptual model, assumptions and limitations of the E-FAST DtD model. Another important part of the E-FAST modeling documentation is the national wastewater treatment plant (WWTP) survey, which is used to inform the parameterization of the E-FAST DtD model. The survey will also be reviewed to derive statistics that can be used for the development of SWPP's DtD model.

Second, USEPA applications of the above approach, for either registration or risk assessments, will be reviewed. Recently, the USEPA published an ecological risk assessment for pyrethroids

(USEPA, 2016). In the study, the E-FAST DtD method, in conjunction with the USEPA EPI Suite (for estimating the pesticide removal efficiency in wastewater treatment process), was used to evaluate the aquatic risk associated with the DtD indoor uses.

Third, previous SWPP best-professional-judgment based evaluations will be reviewed. Review will also include considerations of comment letters from the Bay Area Clean Water Agency (https://bacwa.org/document-category/comment-letters/), which are sometimes linked to SWPP's "down-the-drain" evaluations. Those letters provide case study materials for model development and methodology testing. Monitoring data from wastewater influent/effluent and receiving water bodies will also be compiled and reviewed.

4.2 Model development

SWPP's DtD model will be a modified version of the USEPA E-FAST DtD model with customization of California-specific conditions. SWPP's DtD model will predict environmental concentrations of a new product submitted for registration in California for uses with a potential to transport pesticides down the drain. The model will consider the following processes: 1) DtD release of the pesticide from projected users, 2) dilution from non-users, 3) pesticide removal in the wastewater collection system, 4) pesticide removal in the wastewater treatment process, and 5) dilution in the receiving water body to which the WWTP discharges.

Several general rules will be applied to the model setup. First, SWPP's DtD model will focus on pesticide DtD release from municipal sources. Estimations of pesticide loads and concentrations from industrial sources are outside the scope of this study, but can be assessed in the post-use evaluation by using the same conceptual model as developed in this study.

Second, the model will mainly focus on products registered for the designated indoor DtD uses, including 1) pet products (e.g., shampoos, lotions, and spot-ons), 2) treated articles/human clothing (washable), 3) laundry-related products (e.g., fabric treatment, cleanser, bleach, etc.), 4) indoor pest control products (e.g., spray, fogger, dust used on pet beddings, human beddings, carpets/rugs/upholstered furniture), 5) sewer/drain products (e.g., drain cleaners, insecticides used on floor drains, root killers for sewer/collection lines), and 6) swimming pool/cooling water tower treatment products. Note that evaluation of products used to treat wastewater effluent and storm drains or products designated for outdoor uses but may also result in indirect pesticide transport down the drain are out of the scope of the study. Also note that residential outdoor uses are evaluated specifically by SWPP's Pesticide Registration Evaluation Model's (PREM) module for urban scenarios (Luo, 2014).

Third, as a registration evaluation tool, the model is intended to provide conservative results, meaning that modeled concentrations are at the higher end or greater than the observed values. Thus the model is designed to compute pesticide loadings under the worst-case scenario. The model will use conservative inputs, for example, the maximum application rate allowed by the proposed label, dry season wastewater flow (based on the California conditions), etc. Conservative design may also be applied to determine other key factors, such as the removal coefficient in the wastewater collection system and the stream dilution factor.

Because the information needed to parameterize the model is not always available (i.e., not required for registration), one important part of the model development will be to create working methods to determine the values of the parameters if they are not available. For example, in order to estimate the number of projected users in California for a new AI/product, pesticide use and sales data of similar existing products would be examined. Methods available for estimating pesticide removal coefficient in wastewater treatment would be examined as well. Candidate method includes the Sewage Treatment Fugacity Model (STPWIN™) of EPISUITE v.4.11 (USEPA, 2012).

4.3 Methodology testing

The proposed SWPP DtD model will be evaluated by comparing the model recommendations (i.e., support/deny/conditionally support registration) to that made for the products that were previously evaluated by SWPP on the indoor DtD uses based on best professional judgement. The purpose of the test is to demonstrate the validity and consistency of the proposed evaluation procedure and its capability for assessing pesticides for registration in California. If necessary, the model will also be validated against monitoring data (both in wastewater influent/effluent and receiving water bodies) to justify the basis of parameterization.

5. Timelines and Expected Deliverables

The proposed study will last two years. Detailed timelines are demonstrated in Table 1. The final deliverable will be a California-based DtD model, which will be appropriate for evaluating aquatic risk of pesticide products submitted for registration in California for uses with the potential to transport pesticides down the drain.

Table 1: Study timelines

2017				2018			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
I							
II							
	III						
				IV			

Explanations:

I. Protocol review and discussions
II. Literature review, data collection and processing
III. Model development and testing
IV. Report write-up and review

References

Luo, Y. (2014). *Methodology for Evaluating Pesticides for Surface Water Protection III. Module for Urban Scenario*. (http://www.cdpr.ca.gov/docs/emon/surfwtr/methodology_urban_pesticide.pdf). California Department of Pesticide Regulation, Sacramento, CA.

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