



www.epa.gov

The role of the Product Use Scheduler (PUS) in determining Product Use Categories (PUCs) for Owners and Renters in the Combined Human Exposure Model (CHEM)

Alexander East¹, Sydney Brady¹, Kristin Isaacs², and Daniel Vallero²

¹Oak Ridge Associated Universities, assigned to U.S. Environmental Protection Agency, Office of Research and Development, Center for Computational Toxicology and Exposure, Research Triangle Park, NC 27709

²U.S. Environmental Protection Agency, Office of Research and Development, Center for Computational Toxicology and Exposure, Research Triangle Park, NC 27709

Alexander W. East | East.Alexander@epa.gov | 919-541-4064

Abstract

The Product Use Scheduler (PUS) is the second of three modules in the Combined Human Exposure Model (CHEM), which estimates exposure from consumer products. PUS accepts an .csv input file (normally from the Residential Population Generator, RGen). The module returns diaries of product use, which are passed to Source-to-Dose (S2D) in CHEM. Diaries are 364 days long, seasonal, and have rules based on the type of product, clusters, the characteristics of the household, and the age of the user. Differences in Product Use Categories are demonstrated using a case example of owners and renters.

Features

Clusters

Some products are oftentimes used together (toothpaste, shower gel, conditioner). These are paired in PUS to create realistic diaries.

Seasonality

In the 364-day diary, children are home from school in summer, impacting the use patterns (Brandon et al., 2018).

Communal

Some products pertain to the entire household. For example, a spray cleaner, if used, will benefit the entire household, and only one individual partakes in this activity per household.

Age

Children aged 0-12 do not use communal products, and 0-5 are assigned a different suite of consumer products.

Ever/Never

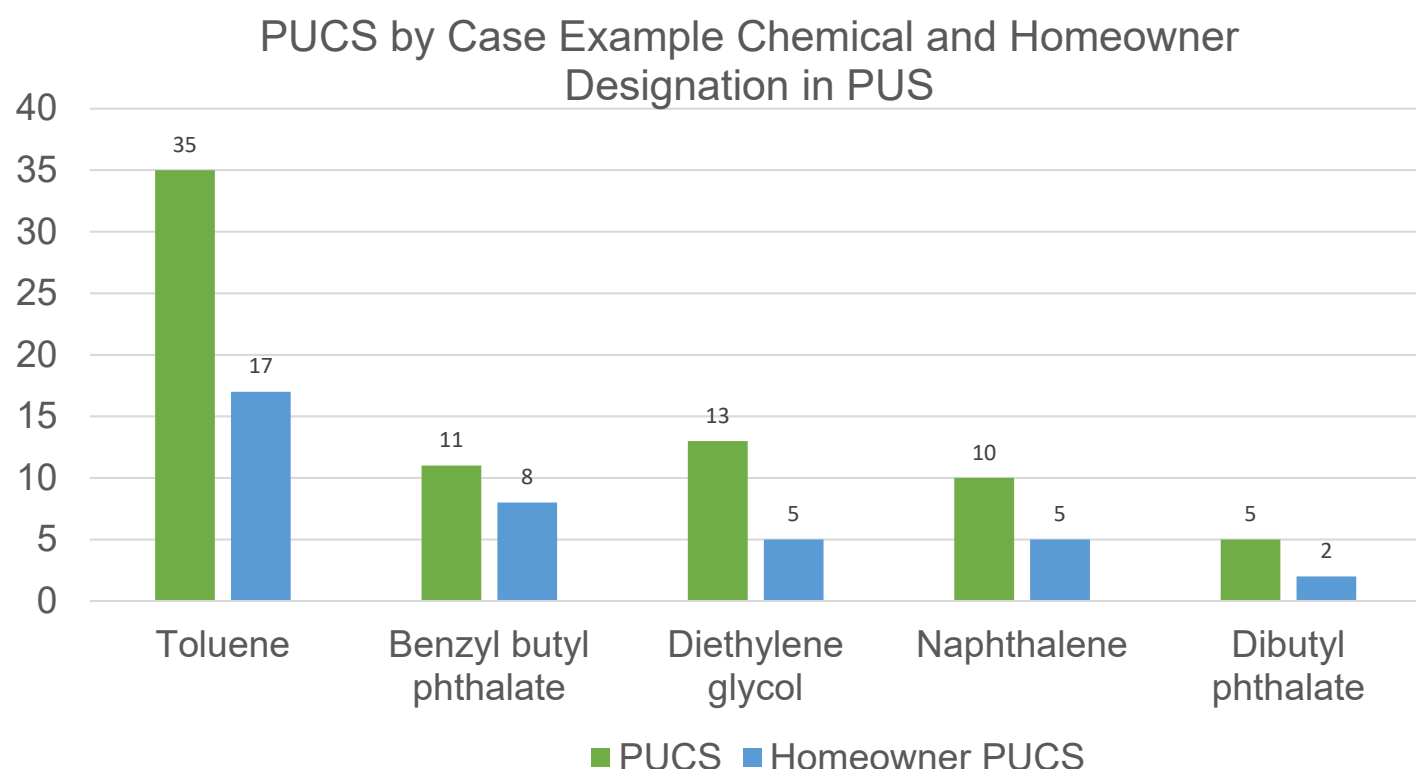
Some products are influenced by the characteristics of the household: if a home has a lawn, there are lawn care product uses scheduled. However, if the household does not have a lawn, it is assumed that the individuals never use lawn care products.

Methods

Product Use Scheduler is built as a dynamic tool to fit different assumptions and scenarios. To demonstrate the difference in exposure between homeowners and those without, a subset of ‘Homeowning PUCs’ was selected by modifying the input file FullENT.csv per the instruction in the Technical Manual (Dionisio et al., 2018). Five chemicals which were included in Product Use were selected: Benzyl butyl phthalate, Dibutyl phthalate, Diethylene glycol, Toluene, and Napthalene.

Results & Discussion

Figure 1. Proportion of PUCs influenced by Home ownership in PUS.



In Figure 1, the proportion of Homeowner PUCs for each of the 5 case examples are shown. Toluene is the most prevalent chemical and has 17 of 35 PUCs corresponding to the household. Dibutyl phthalate is in only 5 PUCs, 2 of which are influenced by the homeowner ever/never rules. However, because PUCs are not equally assigned (some are scheduled more frequently than others), presence in a PUC does not relate specifically to exposure.

The selected chemicals pertaining to household ownership are in Table 1. These mostly include home improvement and care (caulk, surfacing, stain cleaning, finishing), as it was assumed that a specialist would perform these tasks in a rented residence.

Table 1. Product Use IDs associations with chemicals, product, and case example chemicals.

PUCID	Chemicals	Products	Description	Cases
HM.0100.020.099.F	58	65	adhesives and adhesive removers , multipurpose adhesive NOC	Dibutyl phthalate, Toluene
HM.0100.030.099.F	3	3	adhesives and adhesive removers , wood adhesive NOC	Toluene
HM.0400.010.099.F	40	31	caulk/sealant , caulk/sealant NOC	Benzyl butyl phthalate, Toluene
HM.0600.010.050.F	13	6	corrosion protection , corrosion protection spray	Toluene
HM.0800.010.050.F	13	5	finish , finish spray	Benzyl butyl phthalate, Toluene
HM.0800.010.099.F	28	14	finish , finish NOC	Naphthalene, Toluene
HM.1400.010.040.F	23	57	paint/stain and related products , paint exterior	Benzyl butyl phthalate, Diethylene glycol, Toluene
HM.1400.010.041.F	14	85	paint/stain and related products , paint interior	Diethylene glycol
HM.1400.010.050.F	39	126	paint/stain and related products , paint spray	Dibutyl phthalate, Toluene
HM.1400.010.099.F	30	87	paint/stain and related products , paint NOC	Benzyl butyl phthalate, Diethylene glycol, Naphthalene, Toluene
HM.1400.020.099.F	15	6	paint/stain and related products , paint cleaner NOC	Toluene
HM.1400.040.099.F	10	7	paint/stain and related products , paint thinner NOC	Toluene
HM.1400.050.050.F	5	4	paint/stain and related products , primer spray	Toluene
HM.1400.050.099.F	16	8	paint/stain and related products , primer NOC	Benzyl butyl phthalate, Naphthalene, Toluene
HM.1400.070.099.F	15	15	paint/stain and related products , stripper NOC	Toluene
HM.1500.020.099.F	5	3	patch and repair , putty or filler NOC	Benzyl butyl phthalate
HM.2000.040.050.F	6	1	surface sealers , surface sealer spray	Benzyl butyl phthalate, Toluene
HM.2100.010.099.F	6	2	tiling , grout sealer NOC	Benzyl butyl phthalate
LY.0200.010.099.F	26	20	grill/camping fuel , grill/camping fuel NOC	Diethylene glycol, Naphthalene, Toluene
VE.0200.040.099.F	22	3	boat care and maintenance , boat engine fluids NOC	Diethylene glycol, Naphthalene, Toluene

References

Brandon, N., Dionisio, K., Isaacs, K., Tornero-Velez, R., Kapraun, D., Setzer, R., & Price, P. (2018). Simulating exposure-related behaviors using agent-based models embedded with needs-based artificial intelligence. *Journal of Exposure Science & Environmental Epidemiology*, 30, 184 - 193.

Dionisio, K., Hong, T., Levasseur, J. Arun, V. (2018, September). *Product Use Scheduler Module Technical Manual*. EPA. https://github.com/HumanExposure/HEM-Documentation/blob/master/ProdUseSched_TechMan_2018Sept11.pdf

