DEVELOPMENT OF CONSUMER PRODUCTS PROFILES and COMPOSITES and ARCHITECTURAL COATINGS PROFILES and COMPOSITES

Madeleine Strum, April 20, 2018

**Introduction**

CARB maintains a database of speciation profiles at <https://www.arb.ca.gov/ei/speciate/speciate.htm>

Some profiles in SPECIATE originate from the CARB database. Two sets of profiles that have originated from the CARB database are: 1) Consumer Products profiles for specific product types and composites developed by CARB from a 1997 survey and 2) architectural coatings profiles from a 1998 survey. Both were added for SPECIATE4.0.

In developing SPECIATE4.5, a needs analysis has identified these profiles as priorities for updates (Bray, 2017 et. al). CARB has updated these data in their own database several times. The most up-to-date profiles in CARB’s speciation database as of January 2018 are consumer products profiles based on a 2010 survey, and architectural coatings profiles based on a 2004 survey.

CARB developed 105 consumer products profiles from their 2010 survey. These profiles cover a variety of specific types of products such as fragrances, deodorants, bathroom and tile cleaners, insecticides and automotive polish. These profiles have CARB’s reference number [70](https://www.arb.ca.gov/ei/speciate/profilereference/ConsumerProducts2010_OG30XX.pdf) which links to the document: “Organic Gas Speciation Profiles for Consumer Products (2010 Update)” written by Wenli Yang, of the Air Quality Planning and Science Division on April 22, 2014. This document can be accessed at [**https://www.arb.ca.gov/ei/speciate/profilereference/ConsumerProducts2010\_OG30XX.pdf**](https://www.arb.ca.gov/ei/speciate/profilereference/ConsumerProducts2010_OG30XX.pdf). CARB did not develop any composites because their inventory is at the same specificity as the profiles.

CARB developed 2 architectural coatings profiles from the 2004 survey: “2004 Architectural Coatings - solvent based - 2005 survey” and “2004 Architectural Coatings - water based - 2005 survey”. These profiles have CARB’s reference number [71](https://www.arb.ca.gov/ei/speciate/profilereference/ArchCoating_OG3901-02.pdf) which links to the document: “2004 Architectural Coatings – Solvent Based – 2005 Survey (OG Profile No. 3901) and 2004 Architectural Coatings – Water Based – 2005 Survey (OG Profile No. 3902) “written by Wenli Yang, of the Planning and Technical Support Division on October 18, 2010. This document can be accessed at [**https://www.arb.ca.gov/ei/speciate/profilereference/ArchCoating\_OG3901-02.pdf**](https://www.arb.ca.gov/ei/speciate/profilereference/ArchCoating_OG3901-02.pdf)

**Incorporation of the CARB profiles into SPECIATE**

The CARB profiles provide TOG weight percents of species based on the species SAROAD code. These need to be mapped to SPECIES IDs in order to be able to put the profiles into SPECIATE. Some of the SAROAD codes represent species that are not in SPECIATE and needed to be identified and added. In addition, the consumer products and architectural coatings profiles contain one or more SAROAD codes that represent “bins” containing multiple species.

The 24 bins are:

|  |  |  |
| --- | --- | --- |
| SAROAD | **ID** | **Type Name** |
| 44001 | CA-BIN-01 | architecural coatings/consumer products bin 1 |
| 44002 | CA-BIN-02 | architecural coatings/consumer products bin 2 |
| 44003 | CA-BIN-03 | architecural coatings/consumer products bin 3 |
| 44004 | CA-BIN-04 | architecural coatings/consumer products bin 4 |
| 44005 | CA-BIN-05 | architecural coatings/consumer products bin 5 |
| 44006 | CA-BIN-06 | architecural coatings/consumer products bin 6 |
| 44007 | CA-BIN-07 | architecural coatings/consumer products bin 7 |
| 44008 | CA-BIN-08 | architecural coatings/consumer products bin 8 |
| 44009 | CA-BIN-09 | architecural coatings/consumer products bin 9 |
| 44010 | CA-BIN-10 | architecural coatings/consumer products bin 10 |
| 44011 | CA-BIN-11 | architecural coatings/consumer products bin 11 |
| 44012 | CA-BIN-12 | architecural coatings/consumer products bin 12 |
| 44013 | CA-BIN-13 | architecural coatings/consumer products bin 13 |
| 44014 | CA-BIN-14 | architecural coatings/consumer products bin 14 |
| 44015 | CA-BIN-15 | architecural coatings/consumer products bin 15 |
| 44016 | CA-BIN-16 | architecural coatings/consumer products bin 16 |
| 44017 | CA-BIN-17 | architecural coatings/consumer products bin 17 |
| 44018 | CA-BIN-18 | architecural coatings/consumer products bin 18 |
| 44019 | CA-BIN-19 | architecural coatings/consumer products bin 19 |
| 44020 | CA-BIN-20 | architecural coatings/consumer products bin 20 |
| 44021 | CA-BIN-21 | architecural coatings/consumer products bin 21 |
| 44022 | CA-BIN-22 | architecural coatings/consumer products bin 22 |
| 44023 | CA-BIN-23 | architecural coatings/consumer products bin 23 |
| 44024 | CA-BIN-24 | architecural coatings/consumer products bin 24 |

Data from the website “Development of an Improved Chemical Speciation Database for Processing Emissions of Volatile Organic Compounds for Air Quality Models” (<http://www.cert.ucr.edu/~carter/emitdb/>) provided by William P.L. Carter were used to speciate the bins.

The species percentages for component species within each bin were obtained from “SpecDB.xlsx” file described as follows on the website:

[**SpecDB.xls**](http://www.cert.ucr.edu/~carter/emitdb/SpecDB.xls) **(September 10, 2016): Spreadsheet with speciation assignments and macros to output files for speciation processing by SMOKE and the Speciation Tool.**

The [**SpecDB.xls**](http://www.cert.ucr.edu/~carter/emitdb/SpecDB.xls)database was downloaded. Thesheet called “Mix Profile Assignments” was filtered for all records that begin with “CA-BIN” to get the weight percent of each component of each groups.

**Development of Composites**

The NEI contains emissions for broader source categories than the categories represented by the CARB profiles. For example, while the NEI has a category of household products, the CARB profiles contain dozens of different types of household products such as floor polishes and bathroom cleaners. As a result, composites of the CARB profiles were developed that would more directly reflect the NEI source classification codes (SCCs). To create the composites, we used emissions of VOC by CARB category (based on the Emission Inventory Code or EIC categorization scheme) along with a mapping of CARB EIC-based categories to NEI SCC-based categories. We computed the fraction of emissions used by each CARB EIC-based category assigned to its respective SCC category, which became the weighting factor used for each CARB profile for the composite. CARB EIC-based categories align directly with CARB profiles, so once the fractions were applied directly to the CARB profiles to compute the composites.

The EIC-based emissions were downloaded from CARB’s online emissions database and the mapping was provided by Alex Huth of CARB in December 2017. Because the mapping included some retired SCCs, some re-mapping was necessary.

The composite profiles and the weighting fractions used are provided in the below table. In the below, the PXXXX represents the detailed CARB profile (and EIC category).

|  |  |
| --- | --- |
| **CONSUMER AND COMMERCIAL PRODS-ADHESIVES AND SEALANTS COMPOSITE CARB 2010 SURVEY** | 0.58\*P3003+0.16\*P3105 + 0.16\*P3001+0.07\*P3096+0.03\*P3002 |
| **CONSUMER AND COMMERCIAL PRODS-HOUSEHOLD COMPOSITE CARB 2010 SURVEY** | .133\*P3040+.118\*P3063+.09\*3018+.051\*P3066+  .048\*P3044+.042\*P3085+.041\*P3058+.039\*P3065+  .03\*P3086+.027\*P3089+.026\*P3093+.021\*P3056+  .02\*P3067+0.019\*(P3042+P3090)+.018\*(P3019+P3021)  +.016(P3050+P3051)+0.015\*P3041+.014\*P3049+  0.013\*P3048+.012\*P3101+.011(P3062+P3098)+  .009\*P3059+.008\*(P3100+P3046+P3045+P3035)+  .007\*(P3060+P3057)+.006\*(P3061+P3054)+  .005\*(P3036+P3088+P3034+P3039+P3037)  +0.004\*(P3043+P3038+P3079+P3033)+  0.003\*(P3052+P3107+P3082+P3083)+  0.002\*(P3080+P3091+P3053+P3087+P3055+P3106) |
| **CONSUMER AND COMMERCIAL PRODS-PERSONAL CARE COMPOSITE CARB 2010 SURVEY** | 32029\*P3073+.173138\*P3071+.12511\*P3078+  .11257\*P30766+.10731\*P3068+.06967\*P3102+  .03411\*P3069+.01545\*P30677+.013\*P3094+  .01193\*P3070+.01022\*P3075+.00495\*P3074+.00225\*P3072 |
| **CONSUMER AND COMMERCIAL PRODS-AUTOMOTIVE AFTERMARKET COMPOSITE CARB 2010 SURVEY** | .26385\*P3012+.13019\*P3013+.12555\*P3005+  .08722\*P3014+.0805\*P3004+.0553\*P3015+.  05175\*P3092+.04386\*P3104+.04257\*P3097+  .03261\*P3009+.0171\*P3010+.01604\*P3017+  .01377\*P3084+0.00967\*P3016+.00961\*P3095+  .00675\*P3081+0.00642\*P3007+.00383\*P3011+  0.00197\*P3006+.00144\*P3008 |
| **CONSUMER AND COMMERCIAL PRODS-ALL FIFRA Related Products COMPOSITE CARB 2010 SURVEY** | 0.437\*P3020+.195\*P3028+.068\*P3026+  .06\*P3032+.05\*P3024+.047\*P3103+  .039\*P3031+.026\*P3029+.02\*P3030+  .015\*P3022+.013\*P3037+.008\*P3023+.004\*P3025 |
| **ARCHITECTURAL COATINGS SOLVENT AND WATERBORNE COMPOSITE** | .5\*P3901+0.5\*P3902 |

The detailed approach which is also documented in the workbook “Copy of EIC\_SCC\_with\_emis\_final.xlsx” was as follows:

1. download 2014 ARB TOG emissions from CEPAM: 2016 SIP - Standard Emission Tool. These emissions are by EIC code. “Emission Projections By Summary Category”. Base Year: 2012. Last updated Feb 15 2017 https://www.arb.ca.gov/app/emsinv/fcemssumcat/fcemssumcat2016.php.

2. use ARB crosswalk of OG profile number with SCC/EIC, fraction19oct16.xlsx

this contains a subset of only the 106 profiles with NOTE = "2010 Updated Consumer Products Survey"

from the "ORGPROFILE\_Note.xlsx" file emailed by Wenli Yang (also on CARB speciation website)

3. use EIC to SCC xwalk emailed by Alex Huth, CARB. email from Alex Huth 12/15 (xwalk) to assign EIC to SCC-based categories.

4. Merge emissions with EIC to SCC xwalk (item 3) with consumer products EIC to profile xwalk (item 2)

C:\Users\MSTRUM\OneDrive - Environmental Protection Agency (EPA)\Documents\SPECIATE\FY18\CARB\carb\_consumer2.r

5. Identified 47 non matched SCC codes - Alex Huth emailed 12/18 a list of retired codes. Use those to assign EIC emissions to one of 5 SCC-based categories: 1) household, 2

Change any EIC with a global assignment of 2460000000 (retired and non-specific SCC code) to either household or personal care based on judgement call.

6. Determine fraction of emissions by CARB profile to apply to generate composite for each of the 5 category composites

7. Separately look at architectural coating CARB profiles and merge in emissions to compute ratio of water and solvent

**Creation of Workbooks with Intermediate Speciation Data**

Ying Hsu of Abt Associates first created a workbook with the composite profiles (TOG95507-95513 CARB Consumer Prods & Architectural Coatings.xlsx). EPA wanted to include both composites and original CARB profiles so Madeleine Strum and Ying Hsu created a second workbook with the original CARB profiles containing the speciated the bins (discussed above) with the resultant weight percents summed for each species within each profile (Copy of CARB\_consprod\_archcoat.xlsx). As a result, there are 2 workbooks associated with the CARB profiles. Note that the workbook for the individual profiles have, in some cases, duplicate species due to spelling issues. Ying Hsu identified these and corrected them prior to uploading into SPECIATE, but the workbook was not fixed to reflect these corrections.

**References:**

Bray, Casey, et. al. “Assessment of Important SPECIATE profiles in EPA’s emissions platform”. Presented at the International Inventory Conference, Baltimore Md, Aug 2017 (<https://www.epa.gov/sites/production/files/2017-11/documents/speciate_profiles.pdf>)

Yang, Wenli, California Air Resources Board. “Organic Gas Speciation Profiles for Consumer Products (2010 Update)” April 22, 2014. accessed at [**https://www.arb.ca.gov/ei/speciate/profilereference/ConsumerProducts2010\_OG30XX.pdf**](https://www.arb.ca.gov/ei/speciate/profilereference/ConsumerProducts2010_OG30XX.pdf)

Yang, Wenli, California Air Resources Board. “2004 Architectural Coatings – Solvent Based – 2005 Survey (OG Profile No. 3901) and 2004 Architectural Coatings – Water Based – 2005 Survey (OG Profile No. 3902) “October 18, 2010. Accessed at [**https://www.arb.ca.gov/ei/speciate/profilereference/ArchCoating\_OG3901-02.pdf**](https://www.arb.ca.gov/ei/speciate/profilereference/ArchCoating_OG3901-02.pdf)

Carter, William P.L. WEBSITE “Development of an Improved Chemical Speciation Database for Processing Emissions of Volatile Organic Compounds for Air Quality Models” (<http://www.cert.ucr.edu/~carter/emitdb/>) accessed December 2017