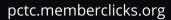# PCTC
PAVEMENT COATINGS TECHNOLOGY COUNCIL

USGS USED INVALID MODELING TO EVALUATE SOURCES OF PAHS IN URBAN SEDIMENTS

Revisited results contained within.

Kanter / O'Reilly

INTRODUCTION

For years, state and local governments have been restricting or banning the use of refined tar sealants (RTS), commonly referred to as coal tar sealants. The primary basis for these restrictions and bans has been the published work of two scientists affiliated with United States Geological Survey (USGS). This work essentially concluded that run-off from parking lots and driveways sealed with coal-tar sealants was a primary source of Polycyclic Aromatic Hydrocarbons ("PAHs") in lakes, rivers and other waterways.

Soon after the USGS funded article was published, the Pavement Coatings Technology Council (an industry trade association) was curious about the approach and questioned the methodology used by the USGS scientists to support their conclusions. PCTC asked to see the underlying data relied on by the USGS scientists to support their conclusion. In essence, PCTC requested what is asked of all scientists and students—"show us your work; show us the support for your conclusion." USGS inexplicitly ignored PCTC's multiple Freedom of Information Act requests, failing to provide the data support for their conclusions and preventing PCTC from attempting to replicate USGS's hypothesis and methodology—a basic, yet critical element for testing a science-based conclusion.

USGS's resistance to show its work triggered the start of a long and expensive legal journey which ultimately resulted in a Federal Court of Appeals ruling in PCTC's favor —stating that government scientists (like the authors of USGS's paper fingering RTS) should not be immune to peer review—that is, analysis of their conclusions by other scientists—and that USGS must provide PCTC with the underlying data used as support for the conclusions reached by USGS scientists so that PCTC could attempt to replicate what USGS had done.

And so, more than ten years after PCTC filed its first Freedom of Information Act request, USGS finally released its data allowing, for the first time, other scientists to fairly evaluate the conclusions reached by the USGS scientists. Kirk O'Reilly, PhD of Exponent has looked behind the veil which USGS had previously hid and has concluded the claims made by the USGS scientists were deeply flawed, were not reproducible, and were not supported by sound scientific methodology. **In short, Dr. O'Reilly has demonstrated that when put to a rigorous scientific analysis, the conclusions of the USGS scientists—that <u>coal-tar sealants are a significant source of PAH's in lakes, rivers and waterways—cannot legitimately be used as a basis to restrict or ban the use of coal-tar sealants.</u>**

SUMMARY

In 2010, USGS published a paper describing the use of EPA's Chemical Mass Balance (CMB) model to assess their hypothesis that refined tar sealants (RTS) are an important source of polycyclic aromatic hydrocarbons (PAHs) in urban sediments (Van Metre and Mahler 2010). As the EPA's CMB model was specifically developed to evaluate sources of air pollution at one location and USGS used it to evaluate sediment samples from 40 lakes from across the country, this application has been the subject of an on-going debate. Resolution of the technical issues was impeded by the failure of USGS to release the outputs of the model runs. After a lengthy legal battle, many of these outputs were released and evaluated in 2022. Additionally, a detailed investigation of the model inputs was published in 2023 (O'Reilly et al. 2023). This document summarizes the finding of these studies.

The key findings are:
- **USGS's modeling approach has not been validated.**
- **USGS used invalid model inputs.**
- **USGS's study did not include appropriate controls.**
- **USGS's conclusions are based on circular reasoning.**
- **The results do not support the hypothesis that RTS is an important source of PAHs in urban sediments.**

CMB: A Brief Tutorial

As stated in its user's manual (Coulter 2004), CMB is an air quality model used to estimate the relative contribution of various sources of air pollution. Its inputs are the chemical make-up or "profiles" of potential site-specific sources and chemical profiles of the environmental samples being evaluated. The model mathematically mixes the potential sources and identifies which combination results in a mixture that is most similar to each environmental sample. Key assumptions are that all important sources are known, relatively stable, and different enough that they can be distinguished by the model. Meeting these assumptions can be challenging when investigating sources of air pollution, but even more so when focused on sediments.

USGS's Use of CMB

USGS used CMB to evaluate the source of PAHs in sediments collected from 40 lakes scattered across America (Van Metre and Mahler 2010). Instead of selecting realistic source inputs from the areas where the lakes were located, they used generic profiles taken from the literature. A detailed study demonstrates that these profiles do not represent any actual sources (O'Reilly et al. 2023). USGS did not use samples of RTS to generate RTS source profiles, but used samples of parking lot dust even though the profile of dust collected from sealed and unsealed lots are indistinguishable. USGS claimed they ran the model about 200 times, but only presented the results of four runs.

Our Evaluation

The technical approaches used to evaluate USGS's work are described in a series of peer-reviewed publications (See Appendix 1).

Findings

- **The use of CMB to evaluate environmental sources of PAHs in sediment has not been validated.**
    - CMB was developed to evaluate sources of <u>diverse contaminants in air, not a single class of contaminants in sediments.</u>
    - The model has <u>strict assumptions</u> that <u>were violated</u> when evaluating PAHs in sediment.
    - While others have used CMB to investigate the link between combustion sources and PAHs in sediments, <u>the results have never been confirmed.</u>
    - USGS is the first to use CMB to evaluate the contribution of both combustion sources and a specific product.

- **The source profiles used by the USGS as model inputs are invalid.**
    - CMB requires appropriate site-specific source inputs, not generic inputs.
    - There was no site-specific evaluation of probable sources.
    - Real world sources are too many and variable to be represented by a few generic profiles.
    - The variability of real sources is so great the model cannot distinguish among different types of sources. <u>USGS improperly lowered the variability factor inputs to get the model to run.</u>
    - The combustion source profiles were artificially constructed from inconsistent data and do not represent any real sources.
    - The source profiles claimed as RTS, do not represent RTS. They are based on samples of parking lot dust, not RTS. Profiles from samples collected at sealed and unsealed parking lots are indistinguishable.

- **USGS's study did not include appropriate controls.**
    - Controlled experiments are required to test a hypothesis.
    - A negative control would be comparing model outputs with RTS as a source input to runs without RTS as a source input. A positive control would be running samples of RTS as a source input.
    - A review of USGS output files indicates a few negative controls were run. The model was able to successfully identify potential sources in the absence of RTS. This is inconsistent with the hypothesis that RTS is an important source.
    - We ran negative controls replacing RTS sealed parking lot dust with unsealed parking lot dust and the calculated contributions were similar. This is inconsistent with the hypothesis that RTS is an important source.
    - There is no evidence USGS ran positive controls. <u>We ran the model with actual RTS profiles and RTS was not identified as a source.</u>

- **USGS's conclusions are based on circular reasoning.**
  - Urban dusts, soils, and sediments contain PAHs derived from many sources.
  - Since they have the same sources, dusts, soils, and sediments have similar and overlapping PAH profiles that are typically called urban background.
  - CMB assigns greater contribution to sources that are most similar to environmental samples.
  - Because USGS labeled parking lot dust derived urban background profiles as RTS, the model assigned dust a higher contribution.

Conclusions
USGS modeling effort does not support the hypothesis that RTS is even a source of PAHs in urban sediments.

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Appendix 1

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