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PCTC
PAVEMENT COATINGS TECHNOLOGY COUNCIL

August 10, 2016

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Via email: eccc.substances.eccc@canada.ca

Subject: Canada Gazette, Part I, Vol. 150, June 11, 2016

Draft Screening Assessment
Petroleum Sector Stream Approach
Coal Tars and Their Distillates
Environment Canada
Health Canada
2015

Risk Management Scope
for
Coal Tars and their Distillates
Environment and Climate Change Canada
Health Canada
June 2016

Dear Sir or Madam,

I write today to transmit the comments of the Pavement Coatings Technology Council on one of the measures proposed by the Ministers of Environment and Climate Change Canada and Health Canada in documents published in the Canada Gazette, Part I, Vol. 150 on June 11, 2016. The measure is proposed in the document titled *Risk Management Scope for Coal Tars and their Distillates*[1] (hereafter referred to as the "RMS") on the basis of the scientific findings detailed in the document titled *Draft Screening Assessment, Petroleum Sector Approach: Coal Tars and Their Distillates*[2] (hereafter referred to as the "DSA").

The Pavement Coatings Technology Council (PCTC) is an industry trade association that represents North American manufacturers of pavement sealants and their suppliers. PCTC's

[1] http://www.ec.gc.ca/ese-ees/default.asp?lang=En&n=64CB2092-1
[2] http://www.ec.gc.ca/ese-ees/default.asp?lang=En&n=E34B0A52-1

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mission, dating from the 1990s, has been engineering research and standards. In 2008 PCTC reorganized to include scientific, environmental, safety and health research as well as government affairs in its mission.

The focus of PCTC's comments is the measure proposed by the Ministers in the RMS focused on what is known in the industry as refined coal tar-based pavement sealant (RTS),[3] As described in the RMS, the Ministers are

> …proposing to consider regulatory or non-regulatory initiatives that: …would minimize the use of coal tar-based pavement sealants in order to minimize exposure to the general public and the environment. (RMS, p. i)

PCTC's comments, which are discussed in detail below, are:

I. the proposed risk management initiative is not supported by the scientific findings reported in the DSA,
II. the ecotoxicty evaluation should focus on the absence of real-world impacts, and the estimates of PAHs released to water related to runoff from RTS parking lots are based on a failed RTS application, and
III. the actions listed in RMS Section 7.2, *Pertinent International Risk Management Context,* are of uncertain relevance to the risk management scope under the Canadian Environmental Protection Act (CEPA).

To improve understanding of RTS, we include a description of the "Substance Identity" of RTS as an attachment to these comments.

CEPA has been described as a model of the use of the best available science in environmental regulation. In light of the findings reported in the DSA, Environment and Climate Change Canada and Health Canada can only conclude that the proposed risk management initiative regarding RTS is unwarranted.

COMMENTS

I. The Proposed Risk Management Initiative Is Not Supported by the Scientific Findings Reported in the DSA

In Section 10.3 of the DSA, three potential exposure scenarios to RTS are evaluated:

1. Risk from PAHs in House Dust Associated with the Use of Coal Tar-Based Pavement Sealants,
2. Risk from inhalation exposure to coal tar-based pavement sealant application, and
3. Risk from dermal exposure resulting from coal tar-based pavement sealants.

None of the three potential exposure scenarios were assessed to pose a risk rising above a low level of concern for public health. The three scenarios are discussed in the sections that follow.

[3] In the DSA and the RMS, RTS is referred to as "coal tar-based pavement sealant" or "CTPS."

1. *Risk from PAHs in House Dust Associated with the Use of Coal Tar-Based Pavement Sealants*

On pages 56-58 of the DSA, margins of exposure (MOE) are calculated for risks potentially related to exposure to polycyclic aromatic hydrocarbons (PAHs) in house dust said to be related to the use of RTS on parking lots. The DSA obtained the data used in the exposure scenario from Mahler et al. (2010) and Watts et al. (2010a, b). These two publications have been subjected to detailed post-publication peer review (PPPR) and have been determined to be problematic[4] (Environ, 2010; Keating-Connolly and Magee, 2013; LeHuray, 2016a and b; Magee and Keating-Connolly, 2013) and are of insufficient quality to inform risk assessment or risk management. Indeed, the Agency which published Mahler et al (2010) – the United States Geological Survey (USGS) - failed to disclose experimental methods and data related to the conclusions reached in Mahler et al. (2010). PCTC filed a Freedom of Information Act Request in 2011 seeking this information and, when USGS failed to provide the information, PCTC filed a subsequent Federal lawsuit (PCTC v. USGS, 2014) that has yet to be resolved.

But, for the sake of argument, let us assume that the data in Mahler et al. (2010) and Watts et al. (2010a, b) represent science of sufficient quality to inform risk assessment and potential risk management measures. Using the data to calculate MOEs, the DSA finds the following:

> The resulting MOEs for each age group were then weighted according to their time length; the resulting Lifetime Adjusted MOE is 15,500. The MOEs associated with ingestion of house dust by children is considered potentially inadequate to protect these susceptible subpopulations. (p. 58, paragraph 2).

This statement that a MOE of 15,500 is "inadequate to protect … susceptible subpopulations" suggests that, in the specific case of RTS, Environment and Climate Change Canada and Health Canada have adopted extraordinarily conservative MOE guidelines, above and beyond MOEs used in other instances. As is done in the DSA, MOEs are calculated for specific exposure scenarios and, as in the DSA, typically incorporate conservative assumptions to assure that calculated values are protective. For regulatory purposes, Canada seeks to protect susceptible subpopulations, and chooses input parameters that are accordingly conservative. For example, calculation of the human equivalent dose that is 10,000-fold lower than the $BMDL_{10}$ (the dose at which 10% of experimental animals may get tumors) modified by inclusion of uncertainty factors is an inherently protective approach that is built in to MOE calculations. The United Nations World Health Organization Joint Expert Committee on Food Additives (WHO JECFA), the Scientific Committee of the European Food Safety Agency (EFSA, 2005), and the UK Committee on Carcinogenicity (2012) recommend use of MOE > 10,000 as an indicator of low concern for public health. The EFSA Scientific Committee concluded:

[4] We note that Watts et al. (2010b) has not been available on the University of New Hampshire Stormwater Center's (UNHSC) publications web page for at least the past year.

> The Scientific Committee is of the view that in general a margin of exposure of 10,000 or higher, if it is based on the $BMDL_{10}$ from an animal study, and taking into account overall uncertainties in the interpretation, would be of low concern from a public health point of view and might be reasonably considered as a low priority for risk management actions. (EFSA, 2005, p. 20/31).

From a real-world perspective, use of an MOE > 10,000 as an indicator of a low level of concern can be viewed as a precautionary approach, adopted by some regulatory agencies out of an abundance of caution. An MOE > 30 is viewed by some as a more appropriate scientific approach for substances for which specific data of sufficient quality are available. For example, for a naphthalene risk assessment, Bailey et al. (2016) concluded:

> An MOE greater than 30 is considered to be without appreciable risk based on a combined uncertainty factor of 3 for rat–human pharmacodynamic difference, 3 for human–human pharmacodynamic differences, and 3 for human–human pharmacokinetic differences (i.e., the PBPK model accounts for rat–human pharmacokinetic differences). (Bailey et al, 2016),

For perspective, an MOE of 15,500 can be compared to some common products found in households or to which consumers may be exposed. The table below contains a few examples, calculated similarly to the method used in the DSA, from a table posted on the US National Library of Medicine's ToxNet service (Gold et al., Online).

MOE ($BMDL_{10}$)	**Substance**	**Rodent Carcinogen of Concern**
20	Wine, 20.8 ml	ethyl alcohol
100	Mushroom (*Agaricus bisporus),* 5.34 g	mixture of hydrazines, etc.
100	Gasoline station workers (1997)	MTBE
300	Tomato, 88.7 g	caffeic acid
400	Orange juice, 138 g	d-limonene
500	Coffee, 11.6 g	catechol
600	Apple, 32.0 g	caffeic acid
1,000	Celery, 14 g	caffeic acid
2,000	Potato, 54.9 g	caffeic acid
4,000	Cinammon, 21.9 mg	coumarin
7,000	Pear, 3.7 g	caffeic acid
8,000	Breakfast cereal, 22.7 g	acrylamide
9,000	Potato chips, 5.26 g	acrylamide
10,000	Bacon, 19 g	diethylnitrosamine
20,000	Tap water, 1 liter (1987-92)	chloroform

Taken in context, and in light of the recommendation and practice of the WHO JECFA, EFSA, and the UK Committee on Carcinogenicity, the DSA finding of a MOE of 15,500 for PAHs in house dust does not come close to suggesting the need for a regulatory or non-regulatory risk management initiative.

The MOE calculation considers lifetime exposure. The DSA also considers risks that could be associated with one-time and acute-duration (1 to 3 days) exposures. Similar to the conclusion for lifetime exposures, the DSA found no information that would indicate that acute exposure to PAHs in RTS is a risk to human health, including the health of toddlers exposed to dust in their homes.

2. Risk from inhalation exposure to coal tar-based pavement sealant application

Page 58 of the DSA includes an assessment of potential risks related to exposure to PAHs during application of RTS. The DSA obtained the data used in the exposure assessment from Van Metre et al. (2012a and b). These two publications have been subjected to detailed PPPR and have been determined to be problematic (DeMott et al., 2013; Magee, 2014; LeHuray, 2016c) and are of insufficient quality to inform risk assessment or risk management. It has been demonstrated that the research team responsible for the volatilization as well as for the house dust studies has consistently exaggerate environmental releases of PAHs that they wrongly attribute to RTS.

The authors of the DSA assumed that the data in Van Metre et al. (2012a and b) represents science of sufficient quality to inform risk assessment and potential risk management measures. While PCTC disagrees with this assessment of Van Metre et al (2012a and b), the conclusion reached by the authors of the DSA regarding potential inhalation risks related to exposure during applications is:

> …the few available studies indicate that short-term health effects are limited, localized and generally reversible… (DSA, p. 58)

The conclusion of the DSA is supported by an industry study (Juba, 1991) of workers engaged in various tasks related to the manufacture and application of RTS indicates that exposure to volatiles is lower than applicable standards. It is also the case that RTS has been tested and found to meet the strict standards set by the California Air Resource Board for release of volatile organic compounds.

3. Risk from dermal exposure resulting from coal tar-based pavement sealants

Page 58 of the DSA also includes an assessment of possible risks associated with exposure of the skin to RTS during sealant application.

> The exposure dose for an average Canadian from this use was determined to be low (2.1 mg/kg-bw), and this exposure event is considered to be infrequent (conservatively once every year, but likely less than this). Given the infrequent nature of the exposure and the limited duration for which it is expected to occur, the conclusion is that incidental dermal exposure to CTPS does not constitute a human health concern. (DSA, p. 58)

PCTC agrees that this conclusion is warranted and is supported by industry experience.

II. The ecotoxicity evaluation should focus on the absence of real-world impacts, and the estimates of PAHs released to water related to runoff from RTS parking lots are based on a failed RTS application[5]

With four decades of laboratory and real environment studies of the potential impacts of PAHs in sediments on ecosystem health, it is clearly understood that sediment toxicity often has no relationship with sediment PAH concentrations. Research has demonstrated that the use of sediment quality guidelines for PAHs (either total or individual) is a misleading and usually overly conservative tool. The reason that PAH concentrations of sediments are not predictive of sediment toxicity has been shown to be that PAHs are relatively insoluble and partition strongly to the solid phase, resulting in low bioavailability/bioaccessibility. It has been demonstrated that sediment toxicity often correlates with the concentration of PAHs in pore water in sediment, which is believed to be more representative of bioavailable PAHs (e.g., Arp et al., 2011; Forbes et al., 1998; Geiger, 2011; Hawthorne et al., 2007; Kane-Driscoll and Burgess, 2007; USEPA, 2003). The implications of this body research for the evaluation of the ecotoxicity of PAHs in sediment (whether derived from RTS or other more likely sources) is that studies in the real environment should take precedence over laboratory experiments, which are unlikely to have been published unless they show impacts.

Several studies have been conducted that have attempted to find ecosystem impacts related to RTS. Scoggins et al. (2007) attempted to relate PAH concentrations in stream sediments in Austin, Texas, to RTS-coated parking lots using PAH ratio comparisons as well using spatial relationships. Their findings were as follows:

> We attempted to identify the sources of PAH in the sediments of our study streams using ratio methods, but we were unsuccessful and found no significant clustering of field data with known [i.e., RTS] source data. [Scoggins *et al*. (2007) p. 702].
>
> We attempted to explain the magnitude of PAH contamination at the downstream study sites with spatial data. Neither total area of [RTS] sealed parking lot nor its proximity to sampling locations were significantly correlated with PAH concentrations in the sediments at the downstream sites. [Scoggins *et al*. (2007) p. 705].

Scoggins et al. (2007) confirmed what had been found earlier in studies conducted by the Texas Commission on Environmental Quality (TCEQ, 2003a, b). Recent studies by McIntyre et al. (2014, 2016a, b) demonstrate that organic-rich soils and sediments (mimicked in the lab experiments by artificially constructed bioretention systems) reduce the PAHs in runoff from different sources by 95% and reduce the toxicity of runoff from different surfaces by 100%.

Section 9.3.2 of the DSA is titled *Releases from use of coal tar-based pavement sealant (CTPS)* and contains discussion of PAHs said to be related to runoff from parking lots sealed with RTS. The

[5] The supporting documents for the ecological evaluation have yet to be received. See list at end of this Comment letter. The comments here are thus limited to what can be inferred from the DSA summary.

study cited in the DSA as a source of data is the supplemental information in Watts et al. (2010a). The study reported in Watts et al. (2010a and b) has been subject to detailed PPPR (Keating-Connolly and Magee, 2013; LeHuray, 2016b) and has been found to be of insufficient quality to inform risk assessment or risk management. Watts et al. failed to report that the RTS was applied to the parking lot used in the Watts et al. study under sub-optimal weather conditions (the temperature was too low and the humidity too high), and it rained before the sealant had cured. In its uncured state, RTS remains an aqueous emulsion and, as would be expected, the rain water washed the emulsion off the parking lot so that what remained was, in effect, an unsealed parking lot. The runoff data reported by Watts et al. are not representative of runoff from a successfully sealed parking lot. In the nine years since the failed application at the University of New Hampshire, PCTC is only aware of one other wash-off event, and that occurred because of an unpredicted mid-day thunder storm.

PCTC has not yet received the supporting documentation that provides background and, presumably, detailed information about aspects of the DSA. Based on the summary discussion in the DSA, we infer that the runoff assessments may have also relied on Mahler et al. (2005) and Van Metre et al. (2009). Mahler et al. (2005) and Van Metre et al. (2009) have also been the subject of detailed PPPR (DeMott and Gauthier, 2006; DeMott et al., 2010; Environ, 2006; LeHuray, 2015a and b; O'Reilly et al., 2011, 2012) and are of insufficient quality to inform risk assessment or risk management. Subsequent studies funded by government as well as by industry have been unable to reproduce Mahler et al. (2005) and Van Metre et al. (2009). Emails obtained by PCTC via a Freedom of Information Act request include an author of these publications describing manipulation of the data to implicate RTS to her colleagues. Indeed, like far too many of the papers published by this research group, the three papers cited here - Mahler et al. (2005), Van Metre et al. (2009), and Watts et al. (2010a) - meet the criteria for retraction set by the Committee on Publication Ethics (COPE, 2009).

Section 9.3.2 of the DSA concludes:

> It is noted that these toxic unit calculations are underestimations of the total toxic units from PAHs contributed by CTPS to the environment, as only a limited set of 9 PAHs for the aquatic environment and 12 PAHs for sediment were considered, which included only those PAHs with a CEQG value developed for them (Table 7). Based on the data of Watts et al. (2010b[6]), CTPS contains a high proportion of alkyl-PAHs, which have not been considered here.
>
> The results indicate that PAHs in runoff from CTPS-coated areas can reach levels that are high enough to exert toxicity to aquatic and sediment organisms in receiving water bodies, both through aggregate exposure, and also for individual PAHs, in some cases. Long-term accumulation of PAHs in the sediment bed could cause toxic effects in sediment organisms, as well as exposure to pelagic species should sediment re-suspension occur. (DSA, p. 34)

[6] The DSA citation "Watts (2010b)" refers to the supplemental information in what we refer to as "Watts (2010a)." In these comments, "Watts (2010b) refers to the full study report prepared by the UNHSC. (see fn 4).

In light of the finding that the studies reported in Mahler et al. (2005), Van Metre et al. (2009), and Watts et al. (2010a and b) are not of adequate quality for use in ecological assessments or other regulatory or scientific purposes, PCTC requests that Environment and Climate Change Canada and Health Canada conduct a risk of bias assessment and systematic review of the studies used in its evaluation of potential ecological impacts associated with the use of RTS. PCTC also requests that Environment and Climate Change Canada and Health Canada reconsider its approach to evaluating the potential for PAH ecotoxicity related to RTS or other PAH-containing substances on the basis of sediment quality guidelines.

III. The actions listed in RMS Section 7.2, *Pertinent International Risk Management Context,* are of uncertain relevance to the risk management scope under the CEPA.

For reasons that are unclear, the RMS document references actions taken outside Canada.

- USEPA SNUR. On pages 12-13, the RMS includes a discussion of a Significant New Use Rule (SNUR) issued by the United States Environmental Protection Agency (USEPA) for crude coal tar and for coal tar upper distillates. This SNUR applies to crude coal tar (CAS RN 8007-45-2) and upper distillates (CAS RN 65996-91-0), which are not relevant to RTS.

- Jurisdictions in the U.S. On page 12, the RMS refers to a list of jurisdictions in the United States that have taken action to control or ban the use of RTS. These jurisdictions have taken actions without adequate or, in many cases, *any* evaluations of the relevant science and are not relevant to risk management in Canada – which is based on the best available science. The reference list at the end of this letter includes links to post-publication peer reviews of most of the science publications on which the listed jurisdictions have relied. Many, if not all, of these publications can be characterized as reporting "advocacy research." That is, they are reports of research conducted to confirm pre-determined outcomes. Even so, the DSA includes assessments of three exposure scenarios based on some of these advocacy research papers, and found that the data do not elevate the evaluated exposures to a level above a low level of concern for public health.

- REACH. It is unclear to PCTC whether the discussion of REACH classifications and standards set by Switzerland are included to infer relevance to the proposed risk management initiative vis-à-vis RTS. In the case of REACH, the European General Court has annulled part of the mandatory classification of the substance CTPHT [coal tar pitch, high temperature], (see decision at this link: http://curia.europa.eu/juris/document/document.jsf?docid=169267&doclang=en). In its written opinion, the Court took note of the very low aqueous solubility of coal tar pitch, which is in contrast with the assumption made by European Chemical Agency's (ECHA's) Risk Assessment Committee (RAC) that all of the individual PAHs dissolved in water and were, therefore, available to aquatic biota. According to the Court's opinion, the highest tested *actual* solubility of coal tar pitch was 0.0014%, but the European Commission accepted ECHA's individual polycyclic aromatic hydrocarbon (PAH) constituent method as the basis of the "category 1 acute and chronic aquatic toxicity" classification. The PAH constituent method resulted in a *calculated* solubility of 9.2%.

Both the European Chemical Agency and, apparently, Switzerland, use calculated values based on an "individual PAH constituent" approach to evaluating PAH-containing materials. In contrast, CEPA has taken a "whole mixture" approach to evaluating PAH-containing materials, as is evident in the overall *Petroleum Sector Stream Approach* and the DSA for the *Coal Tars and Their Distillates*.

PCTC commends and endorses CEPA for using the science-based whole mixture approach to assessment potential human health effects of PAH-containing materials. Thus, PCTC supports the resulting human health evaluations reported in the DSA. The PCTC requests a re-evaluation of the ecological assessments summarized in the DSA, as it appears these assessments may be based on studies that are not fit for purpose and may also be based on an outdated sediment quality guideline approach. Neither the public health nor the ecological evaluations support the proposed risk management initiative regarding RTS.

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In conclusion, PCTC reiterates its support of CEPA's use of the best available science to inform environmental regulation. In light of the finding that the studies reported in Mahler et al. (2005), Van Metre et al. (2009), and Watts et al. (2010a and b) are not of adequate quality for use in ecological assessments or other regulatory or scientific purposes, PCTC requests that Environment and Climate Change Canada and Health Canada conduct a risk-of-bias assessment and systematic review of the studies used in its evaluation of potential ecological impacts associated with the use of RTS.

The only conclusion supported by the findings reported in the DSA that Environment and Climate Change Canada and Health Canada can reach is that the proposed risk management initiative regarding RTS is unwarranted. Therefore, PCTC requests that the RMS be revised to reflect the low level of concern for public health associated with exposures to RTS as described in the DSA.

Thank you for your attention and consideration. Should you have any questions, please contact me.

Very truly yours

Anne P. LeHuray, Ph.D.
Executive Director

Attachment

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Supporting Documents Not Yet Received

Environment Canada. 2015a. Supporting Documentation: Ecological Exposure Assessment of Coal Tar Pitch-based Pavement Sealant (CTPS) to the Aquatic Environment. Information in support of the Draft Screening Assessment for coal tars and their distillates. Gatineau, QC: Environment Canada, Ecological Assessment Division. Available upon request from: substances@ec.gc.ca

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Links to Relevant Post-Publication Peer Reviews (PPPR)

https://pubpeer.com/publications/62730EDFFC17A5F85CA9EB7FD04C24#fb42729 (Mahler et al. 2005)

https://pubpeer.com/publications/C3ADDD65D7FDDD9D8F3E06EC0B9A2A#fb4273 (Van Metre et al. 2009)

https://pubpeer.com/publications/DEC6835FF61E589EB95C8597944A7F#fb42759 (Van Metre & Mahler 2014)

https://pubpeer.com/publications/F7AA69C873AB96CA862322CF1929BF#fb42838 (Mahler et al. 2010)

https://pubpeer.com/publications/BEE4406AC9EF33CF9E3E6C238F0EDF (Van Metre & Mahler 2010)

https://pubpeer.com/publications/C6EE9D26B17539950DFCE21E5BBE2F (Williams et al., 2012)

https://pubpeer.com/publications/5EBEB3ACD53C7F2FF65624EC6DDA58 (Williams et al., 2013)

https://pubpeer.com/publications/D11E6D8EA68C093ACB155A821E5DFB (Watts et al., 2010)

https://pubpeer.com/publications/1BC1FF805A0E9DE96ADBA73AC443AD#fb43811 (Crane, 2014)

https://pubpeer.com/publications/C95FA81213FD9D30144C36DD6D3DF9#fb44076 (Witter et al., 2014)

https://pubpeer.com/publications/456CA525683D444D8AE75DB9E88554#fb45568 (Van Metre et al., 2012a and 2012b)

https://pubpeer.com/publications/747B19A6260CA08B9CA4908177268A (Scoggins et al., 2007)

https://pubpeer.com/publications/CA5E52B5AD1819E468B800DB24D261 (Mahler et al., 2015)

https://pubpeer.com/publications/EFBBA26FDD35EBF21FC7A96538B03E#fb46601 (Kienzler et al., 2015)

http://www.pavementcouncil.org/the-study-of-rts-in-springfield-mo-is-critically-flawed-post-publication-peer-review-of-pavlowsky-2013/ (Pavlowsky, 2013)

Two additional PPPR will be made public in the next few weeks. The full PPPR reports are available on request for the following two publications:

McIntyre, J., Edmunds, R., Anulacion, B., Davis, J., Incardona, J. P., Stark, J. D., & Scholz, N. (2016). Severe coal tar sealcoat runoff toxicity to fish is prevented by bioretention filtration. *Environmental Science & Technology*, *50*(3), 1570–1578. doi:10.1021/acs.est.5b04928

Titaley, I. A., Chlebowski, A., Truong, L., Tanguay, R. L., & Massey Simonich, S. L. (2016). Identification and Toxicological Evaluation of Unsubstituted PAHs and Novel PAH Derivatives in Pavement Sealcoat Products. *Environmental Science & Technology Letters*. doi:10.1021/acs.estlett.6b00116

Attachment

Substance Identity

Refined Coal Tar-Based Pavement Sealant (RTS)

The focus of the comments of the Pavement Coatings Technology Council (PCTC) is refined coal tar-based pavement sealant (RTS), which is the name used by the industry for the product identified in the Draft document as "coal tar-based pavement sealants (CTPS)."[7] RTS is based on a selectively manufactured cut off the distillation column designated RT-12[8]. As illustrated in Figure 1, RT-12 is one of a series of "RT" distillation cuts in the refining process.

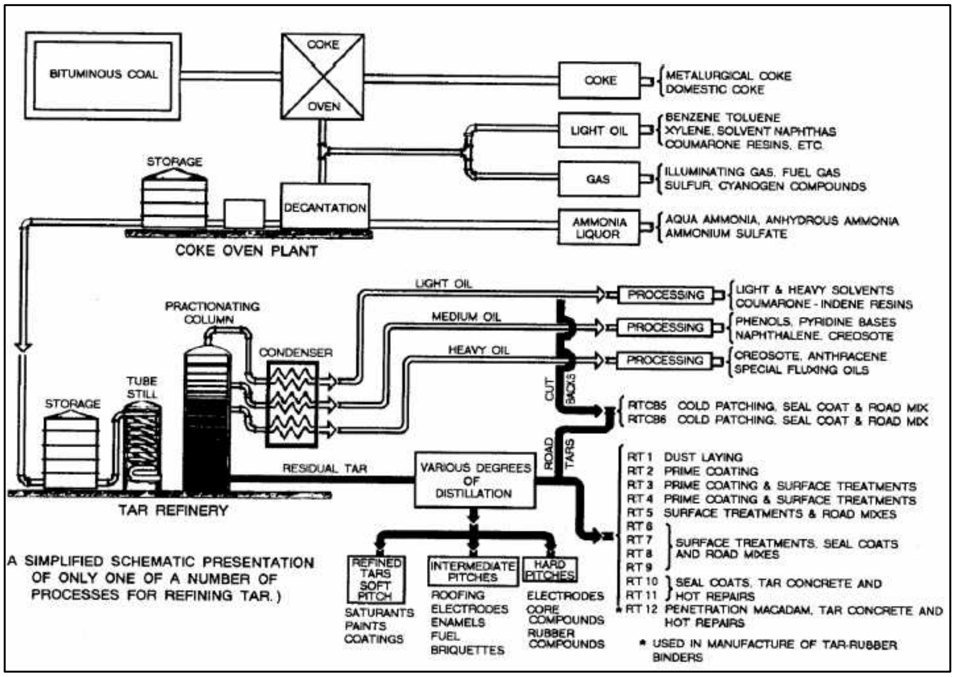

Figure 1. A simplified schematic of a coal tar refining process.

To summarize, "crude coal tar" is the term used in the industry to designate coal tar before it is refined. The applicable Chemical Abstract Service Registration Number (CAS RN) designations are CAS RN 8007-45-2 (coal tar) or CAS RN 65996-89-6 (high-temperature coal tar). Crude coal tar typically contains variable amounts of highly volatile non-PAH compounds as well as some moderately volatile PAHs, along with substances that are only volatile at very high temperatures. The earliest step in the coal tar refining process is to strip out the volatile materials, including volatiles (various CAS RN) and the coal tar oils (CAS RN 65996-82-9, coal tar oils). The remaining material is known as "refined coal tar," which is subject to further distillation and fractionation. The materials shown as "residual tar" in Figure 1 include the broad class of coal tar fractions included in CAS RN 65996-93-2 (high-temperature coal tar pitch or HTCTP).

As described in the document *Refined Coal Tar Grade RT-12: Product Description/Classification,*[9] RT-12 is a medium-soft pitch primary distillation fraction of HTCTP. The manufacturing process for RT-12 is further defined in ASTM D490-92(2011), *Standard Specification for Road Tar*.

[7] DSA p. 10.
[8] "RT" is the acronym for Road Tar.
[9] American Coke and Coal Chemical Institute (1994)

Every aspect of RTS from specifications for RT-12 to manufacture of the sealant emulsion to application is governed by an ASTM standard. The complete list of current ASTM standards is:

ASTM D490-92(2011), Standard Specification for Road Tar, ASTM International, West Conshohocken, PA, 2011, www.astm.org

ASTM D3423 / D3423M-84(2011)e1, Standard Practice for Application of Emulsified Coal-Tar Pitch (Mineral Colloid Type), ASTM International, West Conshohocken, PA, 2011, www.astm.org

ASTM D4866 / D4866M-88(2011)e1, Standard Performance Specification for Coal Tar Pitch Emulsion Pavement Sealer Mix Formulations Containing Mineral Aggregates and Optional Polymeric Admixtures, ASTM International, West Conshohocken, PA, 2011, www.astm.org

ASTM D5727 / D5727M-00(2011)e1, Standard Specification for Emulsified Refined Coal Tar (Mineral Colloid Type), ASTM International, West Conshohocken, PA, 2011, www.astm.org

ASTM D6945-03, Standard Specification for Emulsified Refined Coal-Tar (Ready to Use, Commercial Grade), ASTM International, West Conshohocken, PA, 2003, www.astm.org

ASTM D6946-13, Standard Specification for Emulsified Refined Coal-Tar (Driveway Sealer, Ready to Use, Primary Residential Grade), ASTM International, West Conshohocken, PA, 2003, www.astm.org

As noted in the DSA, the variable chemical composition of RT-12 places it in the class of compounds regulated as “Unknown or Variable composition, Complex reaction products or Biological materials” (UVCBs). The focus of sealant discussions in the DSA is on the polycyclic aromatic compound (PAH) content of RTS.

RTS is a physical mixture of RT-12, an emulsifier, clay, water, sand, and variable proprietary ingredients such as polymers and drying agents. The emulsion is diluted by addition of water and sand (or other material to increase traction) at the point of application. Application of the diluted aqueous emulsion is at ambient temperature.

The physical and chemical properties of RTS are integral to the identity of the product. The refined coal tar content of RTS is limited to the distillation fraction of HTCTP known as RT-12, as described in *Refined Coal Tar Grade RT-12: Product Description/Classification,*[10] and ASTM D490-92(2011).

[10] American Coke and Coal Chemical Institute (1994)