AN EVALUATION OF PAVEMENT DRESSING CONDITIONER

Prepared for

TOWN OF POMFRET

Application on

LONGMEADOW DRIVE POMFRET CONNECTICUT

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Amended to December 1, 2016

Prepared by

Normand Thibeault Jr., P.E.
CT License #22834

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FIGURES

ATTACHMENTS

1. Abstract

On July 11th & July 12th, 2016 Surtreat Technologies was contracted by the Town of Pomfret to conduct a pavement restoration project on Longmeadow Drive and multiple cul-de-sac roads off Longmeadow. The purpose of the project was to extend the life of the existing pavement at a cost savings to the Town and residents. The product selected was Pavement Dressing Conditioner (PDC) marketed as an asphalt ñrejuvenatorò that penetrates into the asphalt surface and becomes an integral part of the pavement structure. It is designed to expand and contract as the asphalt surface heats or cools and extends the life of the pavement; it is warranted for 3 years.

Residents of Longmeadow became concerned as a result of the odor of the product as it was being applied. Since completion of the product application, additional concerns have been raised regarding product safety and potential health risks that could be attributed to it. In particular, the concerns stem from the composition of the product that includes coal tar, a source of Polycyclic Aromatic Hydrocarbons (PAHôs), which are a known carcinogen.

Per request of the Town of Pomfret, this report will examine PDC properties and specifications, the manner by which it was applied and compare it to other pavement treatment products to determine the potential effect on health, residential wells and the environment.

2. Site Conditions

The project resulted in the reconditioning of Longmeadow Drive, Fairview Circle, Ruth Circle, Evelyn Circle, Delores Circle, Sanda Circle, Margaret Circle, and Amanda Circle; a total of approximately 7,200 linear feet of pavement. Longmeadow is a loop road accessed from south via Route 44 and traverses north to east to where it intersects with Gary School Road; it is essentially the collector road from which all of the ñcircleò roads are accessed. Drainage from the roadways is collected in a series of catch basins (26 basins total) with discharges at low points along Longmeadow. Figure 1 depicts the limits of the project.

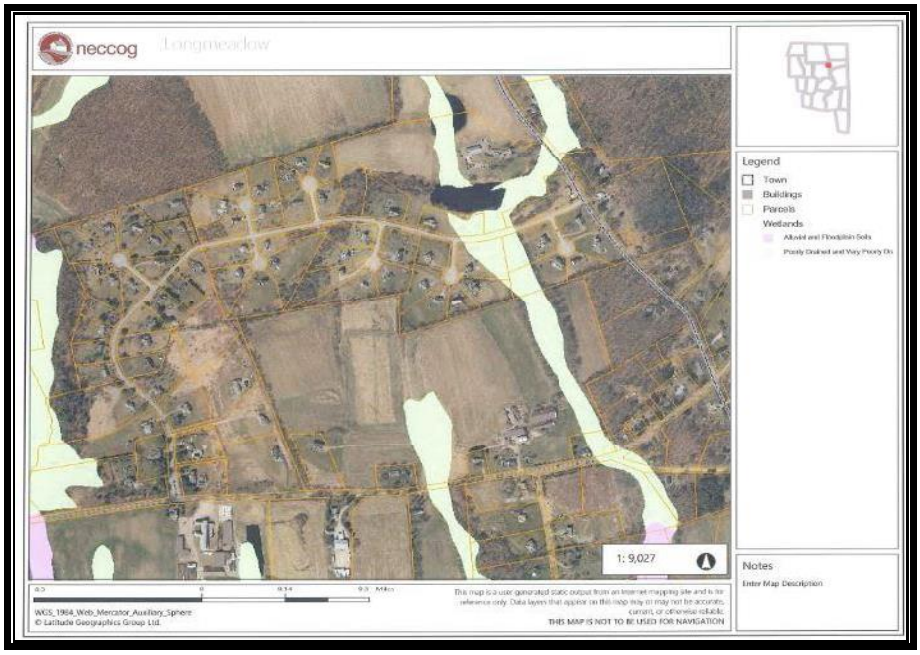

Figure 1: Project Area (source:NECCOG GIS)

Killingly Engineering Associates (KEA) first went to inspect the roadway surface on August 1st at the request of the First Selectman; this site walk occurred approximately 2 weeks after the application. The first observation noted was that unlike typical surface treatments of pavement (such as sealcoating), the pavement had a glassy appearance and looked to be wet. KEA inspected several areas along Longmeadow, Fairview Circle and Amanda Circle by first walking along the surface, scratching with a fingernail and lastly with a key. There was no evidence of tackiness under foot and scratching with a fingernail and key did not result in removal of any of the product.

KEA inspected for evidence of tracking of the product which is typical for new paving or with pavement sealants. Driveways on the subject roads were inspected for this with particular attention to lighter colored driveway surfaces. In general, most driveways did not show evidence of tracking and several showed minimal faint tracking; most of the driveways had some degree of overspray of the PDC from the initial application. Photo #1 shows a typical driveway overspray and minor tracking within Longmeadow.

Photo #1: Typical driveway with overspray and faint tracking

After application of the PDC, significant cracks in the pavement were filled with a typical asphaltic based crack filler product commonly utilized for this purpose. On the August 1st inspection it was noted that the asphaltic crack filler was substantially different from the PDC in appearance and texture. The product was very soft and malleable, had a dull appearance and was visibly granular. We also noted that this product was being tracked from vehicle tires as seen in Photo #2.

Photo #2: Tire tracking from bituminous crack filler

For comparative purposes, the following photograph was taken in Killingly at the entrance to a recently paved parking lot. Note the significant tracking of bitumen into the road from this paving project.

Photo #3: Tracking from new paving

It is also our understanding that during the application of the product there were concerns regarding the associated fumes generated by the PDC product. KEA did not detect any discernable odor during the August 1st inspection.

3. Additional Site Observations

KEA was retained by the Town of Pomfret on August 16th to evaluate the PDC application and a second site investigation was conducted on September 8th. At that time additional photos were taken with focus on the stormwater drainage system. A total of 26 catch basins were inspected and all of them were noted to have PDC coating on the frames and grates. In addition to the coatings on the frames and grates, several catch basins had significant overspray into the throats of the structures. The following 2 photographs depict each of those conditions.

Photo #4
PDC overspray onto catch basin frame and grate

Photo #5
PDC overspray into catch basin throat

It is our understanding that with the exception of the basins that exhibit overspray, the frames and grates were covered during the spray application and the PDC was ñrolledò onto the grates at a later time. This explanation appears is consistent with what was observed on site.

In addition to the application of the pavement rejuvenator, there have been questions from residents with regard to the suitability of the pavement subbase. Signs of subbase failure typically include various types of cracking (alligator, longitudinal, block or transverse), potholes, depressions, rutting or upheaval. None of these conditions were observed to indicate defective subbase in the pavement.

We have also reviewed extensive photographic records of the roadway construction provided by the Town of Pomfret. The photographs show the project from initial grading to final pavement course including installation of subbase materials, compaction procedures, and most importantly nuclear density testing for compaction. It is our professional opinion that the pavement base was properly installed.

4. Coal Tar

Coal tar is a heavy viscous black oily substance that is generated as a by-product coking*, liquefaction or gasification of coal operations and is primarily utilized in electrode manufacturing for the aluminum industry[1]. Coal tar is also utilized in numerous everyday products. These products include, but are not limited to:

- Dandruff shampoos;
- Skin care treatment (psoriasis);
- Roofing materials;
- Makeup;
- Rayon & Nylon;
- Soaps;
- Solvents;
- Plastics;
- Carbon fiber;

These uses aside, coal tar is has been identified as a source of Polycyclic Aromatic Hydrocarbons (PAHôs), which if ingested may result in elevated risks of lung, skin, bladder and respiratory cancers[2].

*A process that results in the production of coke, a solid carbonaceous material and fuel source derived from destructive distillation of low-ash, low-sulfur bituminous coal.

5. PAH

According to *Toxipedia*, Polycyclic Aromatic Hydrocarbons (PAHôs), also known as polycyclic aromatic compounds, polyaromatic hydrocarbons, or polynuclear aromatics are a group of over 100 different environmentally persistentò chemical compounds consisting of carbon and hydrogen fused-ring structures. They are found in coal and petroleum and but they are also products of incomplete combustion. They are found naturally in the environment from sources such as forest fires and volcanos and can also be man-made (anthropogenic) from burning of wood, coal, oil and gas, electric power generation, or other organic substances like tobacco or charbroiled meat. The greatest sources of PAHôs are incomplete combustion of organic materials.

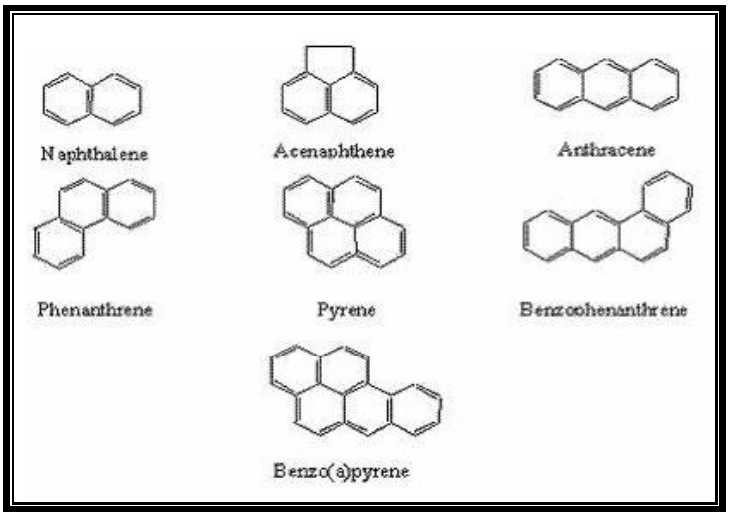

Figure 2: Common Polycyclic Aromatic Hydrocarbons
Source: www.truthaboutcoaltar.com

Due to their potential toxicity[1] and distribution in the environment, including air, soils, and sediments, some PAHs (16 total) have been listed as priority pollutants by the United States Environmental Protection Agency. It is important to note that in general, most PAHs do not dissolve in water but, instead, bind to sediments. When sediments become suspended in water, PAHs can be transported with the sediment.

6. Pavement Sealcoats

Pavement Sealcoats are products designed to maintain, protect and enhance the appearance of paved asphalt surfaces and are typically asphalt or coal tar based with some percentage of water, and sand added for traction; they are applied to the surface of the pavement. The sand which is an additive for friction also is subject to wear from friction from automobile tires and even foot traffic which ultimately lends to transport of the product. These products do not expand or contract with the pavement and are typically designed to last from 1-3 years. Photo #6 shows a typical sealcoat surface 2 years after application.

Photo #6: Worn sealcoat surface ï note proximity to storm drain.

Coal tar sealcoats, which contain 20-40 percent coal tar or coal tar pitch, is commonly applied to parking areas and driveways. Numerous studies have suggested that incidental ingestion of PAHôs occur as a consequence of dusts generated from coal tar sealed pavements[3/4] and as a result some cities and states have banned the use of coal tar sealants altogether with recommendations for alternatives[5] such as asphalt, acrylic or agricultural based sealants.

The potential for ingestion or exposure of PAHôs from pavement sealcoating is the result of abrasion of the product from the pavement surface on which it is applied followed by the transport of particles by wind, foot traffic, or stormwater runoff[6]. Short term exposure may be the result of release of PAHôs to the atmosphere (volatilization) as a product is being applied and may result in short-term (acute) health effects with symptoms such as eye irritation, nausea, vomiting, diarrhea, and confusion. The volatilization rate decreases rapidly over the weeks following the application, but typically continues at higher rates than from unsealed pavement surfaces[7]. The Material Safety Data Sheet for a coal tar based sealcoat product (attachment 2) warns that it may cause cancer, is harmful if swallowed and may cause skin irritation. The ingredients are up to 60% quartz, kaolin & bentonite (sands & clays).

Human exposure to volatized PAHs occur when they breathe smoke, auto emissions or industrial exhausts. Frequent exposure over many years may lead to health problems, particularly to the lungs and heart. People with the highest exposures are smokers and, people who live or work with smokers, as well as roofers, road builders and people who live near industrial sources.

7. Pavement Dressing Conditioner (PDC)

PDC is listed under a series of patents which describe the product as *"a novel composition for treating asphalt and concrete surfaces..."* The first patent for a pavement rejuvenator is dated 12/7/1965 and is followed by a series of modifications and improvements dated to 1996. Copies of Patent numbers 4,661,378 (1987 & 1994) and 5,580,603 (1996) are enclosed as Attachment 1 of this document.

The product is composed of coal tar derivatives (topped coke oven tar), petroleum oils (bitumen) and an aromatic solvent. Additionally, a ñblackening agentò is incorporated into the mix to give the product the appealing black surface associated with newer pavement. The patent lists numerous constituents for the blackening agent that may include coal tar pitch, aromatic cracked petroleum residue, silicone, aliphatic amine or carbon black. Unlike sealcoats which sit on the surface of the pavement, PDC is designed and patented to penetrate the pavement surface, restore/replenish the plasticity of the pavement binder, and extend the life of the pavement for 3-5 years (the product provides a 3-year unconditional performance guarantee). It therefore becomes an integral part of the pavement structure. PDC is not available for purchase by the general public at local home improvement stores or on line (as are coal tar based pavement sealcoats) and must be applied by a certified operator.

The Material Safety Data Sheet for the product (Attachment 3) identifies a number of potential hazardous, health and/or environmental effects that the product may be subject to including flammability, genetic damage or a cancer source from naphthalene and phenol (PAHôs). Constituents of the product may also be toxic to aquatic life. As with any potential hazardous substance, the producers of the product are mandated to list any potential hazards in entirety and the MSDS sheets are technical documents which provide detailed and comprehensive information on a controlled productôs potential health effects as a result of exposure. They provide hazard evaluation related to the productôs handling, storage or use,

measures required to protect workers at risk of exposure, and emergency procedures. For comparative purposes the MSDS sheet for turpentine is also included with this writing at Attachment 3, which is a readily accessible product, also with hazardous chronic effects.

The application of PDC in Pomfret was completed on July 11th and 12th by a trained operator through Surtreat Technologies. Prior to application of the product, the cleaning of the roadways in accordance to the manufacturerôs recommendation was completed by the Town of Pomfret and included sweeping the pavement followed by blowing dust and sediment from the surface. It is our understanding that there were some initial delays in calibrating the applicator but ultimately the project was completed within the two days.

PDC application rates vary from project to project and typically specified to be spread at a rate of 0.05 to 0.07 gallons per square yard. Prior to the start of the project the proposed rates for this work was 0.05 gallons per square foot. At the termination of the work it was determined that the average rate of application was 0.0618 gallons per square yard; higher than proposed rate but within the specified parameters.

8. Rejuvenators vs. Sealcoats

The primary mechanism of pavement deterioration is oxidation and embrittlement of asphalt binder at the pavement surface. Loss of fine aggregates from the surface of the asphalt pavement matrix is often attributed as the major cause leading to raveling of larger aggregate and ultimate pavement failure. *Rejuvenators* are designed to re-soften oxidized asphalt binder at the pavement surface, which assists the binder in retaining encapsulated aggregate fines and preventing aggregate loss by traffic wear. They are designed to become an integral part of the pavement.

Seal coat mix formulations are emulsions designed to provide a sealing membrane on the pavement surface to protect the pavement from water penetration. Seal coat formulations typically contain a sand component and have been widely used in parking lot and roadway maintenance programs. Coal tar based sealcoats have become scrutinized (an even banned in some communities) due to their propensity for frictional wear as a result of the sand component, which ultimately results in the transport of the product by wind, rainwater runoff or foot traffic. The following table summarizes the basic properties of these products:

	Rejuvenators	Sealcoats
Application	Penetrating	Surface
Product Base	Coal tar	Coal tar or Asphaltic
Product Availability	Licensed Contractor	Contractor or General Public
Installation	Licensed Contractor	Contractor or General Public
Prevents Water Penetration	Yes	Yes
Chemical Resistant	Yes	Yes
Prone to Frictional Wear	No	Yes

Figure 3: Product Properties

9. Resident Concerns

Since the application of the PDC, residents have been very much concerned with the safety of the product and the potential effects on their health, groundwater and the surrounding environment. Upon the initial application of the Pavement Dressing Conditioner, the fumes associated with the product became a concern of the residents. As previously discussed, PAHs may cause short-term (acute) health effects with symptoms such as eye irritation, nausea, vomiting, diarrhea, and confusion. It is our understanding that several of the residents reported eye irritation and nausea; (this was documented in a conversation with one resident). We are not aware of vomiting, diarrhea or confusion. KEA was not able to find any documentation of lingering or long term health effects from acute exposure regarding the volatilization of this product or any other coal tar based product.

The second concern of the residents is with regard to the possibility of well water contamination. Although evidence of PAH contamination in groundwater has been documented[8] in environments subjected to coal tar exposure, PAHôs exhibit low water solubility[11] (to the extent that they are considered *insoluble*) and are transported by dislodged particle transport (friction) and/or adhesion to soil particles. It is our opinion that the potential for groundwater or well contamination is highly unlikely as a result of the application of this product.

The final concern of residents is the fate and transport of PAHôs into the surrounding environment, specifically on adjacent water resources and aquatic life. The USEPA reports that stormwater runoff from coal tar sealcoat on pavement has been shown to be acutely toxic to some sensitive aquatic species[9]. The toxicity can be attributed to particles of coal tar base sealants being worn followed by particulate transport via stormwater runoff.

10. Conclusions

Although the nausea and other reactions experienced by some Longmeadow residents were a cause for alarm and discomfort, there is no evidence in the literature to suggest that these acute reactions will lead to any long term (chronic) conditions. During subsequent inspections at Longmeadow by Killingly Engineering, no lingering fumes or odors typically associated with paving projects were noted.

The U.S. Environmental Protection Agency (USEPA) has established maximum contaminant levels (MCLs) for *public* water supplies to reduce the chances of adverse health effects from drinking contaminated water. MCLs are enforceable limits that public water supplies must meet. These standards are much lower than levels at which health effects have been observed. USEPA has not established MCLs for individual PAHs, but has set an MCL for total PAHs of 0.2 parts per billion. It should also be noted that there are currently no standards for regulating levels of these chemicals in private wells. That being said, these levels should be adhered to for private water supplies as well.

With regard typical pavement sealcoat products, none of them offers a guarantee or warrantee. These products sit on the surface of the pavement and it has been well documented in the referenced reports and well as many others that friction over the surface of these products and the resulting particles result in the transport of PAHôs into the environment. There is no arguing the acute and chronic health effects of coal tar, the associated PAH content, and the mobility and exposure concerns from these types of applications. More importantly, there is indisputable scientific evidence that long term exposure to coal tar and PAHôs may lead to health problems,

particularly to the lungs and heart and transport in the environment has shown to be toxic to aquatic life.

PDC is marketed to ñseal and restoreò pavement with the ability not sit on the pavement surface as a ñtypicalò emulsion product. It contains a coal tar constituent but to date there are no studies or evidence to suggest that it functions or wears in the same manner; the product guarantees a 3-year performance against cracking, peeling and delamination. As advertised and patented, it *rejuvenates* the pavement by penetration and restores the original flexible properties; it will not crack as it ñmovesò with the pavement. It has been utilized by hundreds of airport facilities throughout the US and abroad and approved by the FAA (Engineering Brief 44B Specification, Attachment 3). It has been used at US and international military installations, professional automobile racing tracks, Gillette Stadium and the Polynesian Gardens at Walt Disney world in Orlando, Florida. It has been approved by the US Army Corps of Engineers for surface Areas Materials Utilization (see Attachment 4) and is the only recognized rejuvenation product by the U.S Asphalt Institute. It has also been used for pavement rejuvenation at the EPA Research Commons Administration and Environmental Research Center in Durham, NC and for over 1,000 miles of residential applications.

We have not found evidence to suggest that this product is prone to frictional mobilization and PAH transport into the environment. There are however, lingering concerns with residents regarding the product because it contains coal tar. Although it is a reasonable assumption that frictional mobilization of PDC is not expected, we also have not found any documentation that definitively rules *out* frictional transport of the product. In addition, although the product as utilized in myriad commercial and industrial settings has proven to be effective in restoring and extending pavement life, use of the product in residential settings and in New England has been limited thus far.

11. Recommendations

Although PDC does not exhibit the same properties as a typical emulsion pavement sealer and that frictional pollutant generation and transport presumably should not happen, application of the product for Longmeadow has raised significant concerns of the residents; specifically, the potential for mobilization of PAHôs as a result road sanding and plowing. We strongly discourage the use of coal tar emulsions as it has been demonstrated that they erode from the pavement surface and mobilize into the environment. A recent document prepared by the CT Department of Public Health (11/01/2016 EHS Circular Letter #2016-49) enclosed as Attachment 6, encourages the use of asphalt based sealants in lieu of coal tar based products. Additionally, a coal tar technical brief issued by the DOH in 2014 warns of the potential risks of coal tar generated dusts as determined by a USGS study in Austin Texas in 2009 (also included as Attachment 6).

It is noted in the EHS circular letter that the USGS is currently investigating and evaluating the PDC application in Longmeadow. I contacted Dr. Gary Ginsberg at the State Department of Public Health with regard to the study and was told that the study is continuing and he does not anticipate any results or conclusions until 2017. The focus of the study is on determining whether the PDC application results in elevated PAH levels in dusts and sediments. Although we recognize that available studies are prepared from analysis of sealcoat emulsion products, based on the DOHôs recommendations and public health concerns, as well as the documented potential health effects of some coal tar products, asphaltic based products would be a safer prudent alternative at this time.

It is our understanding that the roadway will be resurfaced in 2017 to address the continuing potential health related concerns but until that time there are procedures that can be followed to verify that the product is not mobilized. The procedures and recommendations are as follows:

1) If the road were resurfaced in the typical manner where the top course was milled there would be a concern for PAH mobilization at that time. Milling is a dust generating operation and as discussed, the mechanism for transport of PAHôs into the environment is typically by dust and sediment transport. If new paving is the future goal for the Town of Pomfret, we would recommend an overlay on top of the existing pavement, adjustment (or replacement) of the existing drainage structures, and installation of new curbing to avoid the potential for dust generation. It is important to note that with an overlay of pavement, there will still be product on the frames and grates of the drainage structures and on the existing curbing.

2) With regard to the health implications from the volatilization of the product, the Town could consider having some air quality testing conducted. However, extracting or detecting volatile PAHôs in air may present problems as some PAHs are known to be susceptible to oxidation by ozone and other oxidants present in the air which may produce skewed results from the collection process[10]. Killingly Engineering is not qualified to conduct monitoring or to specify methodology; a qualified consultant such as Mystic Air Quality does have the capability to provide air monitoring if the Town feels it is necessary to do so.

3) There is the evidence of overspray onto and possibly *into* some of the catch basins throughout the project limits. KEA noted that ALL catch basin grates and some of the throats were coated with the products (see photos 4 & 5). Although the product does appear to be well adhered to throats of the basins, overspray into the basins through the grates of these few could potentially have resulted in the deposition of some product into the sediment on the bottoms of the basins. At the average application rate applied for this project of 0.0618 gallons per square yard multiplied by the open area of the grate (0.56 square yards per grate) times 5 grates, the potential of overspray into the basins would be approximately 0.17 gallons total for the entire project. Catch basins were dry at the time of each inspection but all were noted to contain sediment, some up to the flow lines of the outlet pipes. The overspray into the throats of the basins noted in several (4 or 5) structures was the result of not installing protective fabric beneath the grates prior to spraying; this was condition was acknowledged Surtreat Technologies. Product on the remaining structures was applied by roller, reportedly after installing fabric beneath the catch basin grates. If this were not the case; the overspray for all basins could have potentially resulted in over 0.8 gallons total.

4) If transport of the product into the drainage system remains a concern, we would recommend sampling each of the overspray basins for evidence of PAH presence. A control sample should also be obtained from a catch basin outside of the PDC treatment area and analyzed for existing background levels. If the basins are cleaned prior to analysis, the sediment should be stockpiled, covered and surrounded by silt fence or staked haybales to prevent stormwater run on or runoff until testing results have been verified.

5) During winter activities of snow removal and sanding, there is concern for potential frictional displacement of PDC. Locations where snow is stockpiled would be

particularly susceptible for concentrated deposition if it were to occur. Sampling and analysis of sands in these areas should be evaluated after stockpiled snow has melted.

The recommendations listed would be appropriate precautionary measures to serve as further checks and reassurances for Longmeadow and Town residents.

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ATTACHMENT 1

PDC PATENTS

United States Patent [19]

McGovern

[11] **Patent Number: 4,661,378**

[45] **Date of Patent: Apr. 28, 1987**

[54] **PAVEMENT DRESSING CONDITIONER FORMED OF TAR, AN AROMATIC SOLVENT AND A BITUMINOUS PAVEMENT REJUVENATOR**

[75] Inventor: **Edward W. McGovern**, Pittsburgh, Pa.

[73] Assignee: **Koppers Company, Inc.**, Pittsburgh, Pa.

[21] Appl. No.: **757,895**

[22] Filed: **Jul. 23, 1985**

[51] **Int. Cl.**[4] **B32B 35/00**

[52] **U.S. Cl.** **427/140;** 106/278; 106/285; 427/138; 427/393.6

[58] **Field of Search** 427/138, 139, 140, 393.6; 106/278, 285

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,221,615 12/1965 McGovern 106/285
3,261,269 7/1966 McGovern 427/138

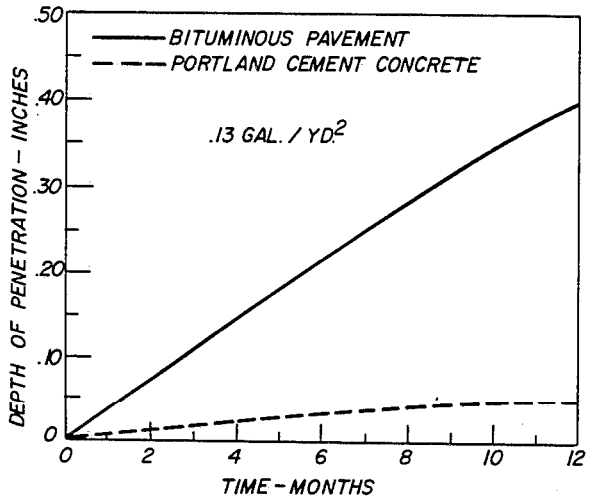
Primary Examiner—Sadie L. Childs

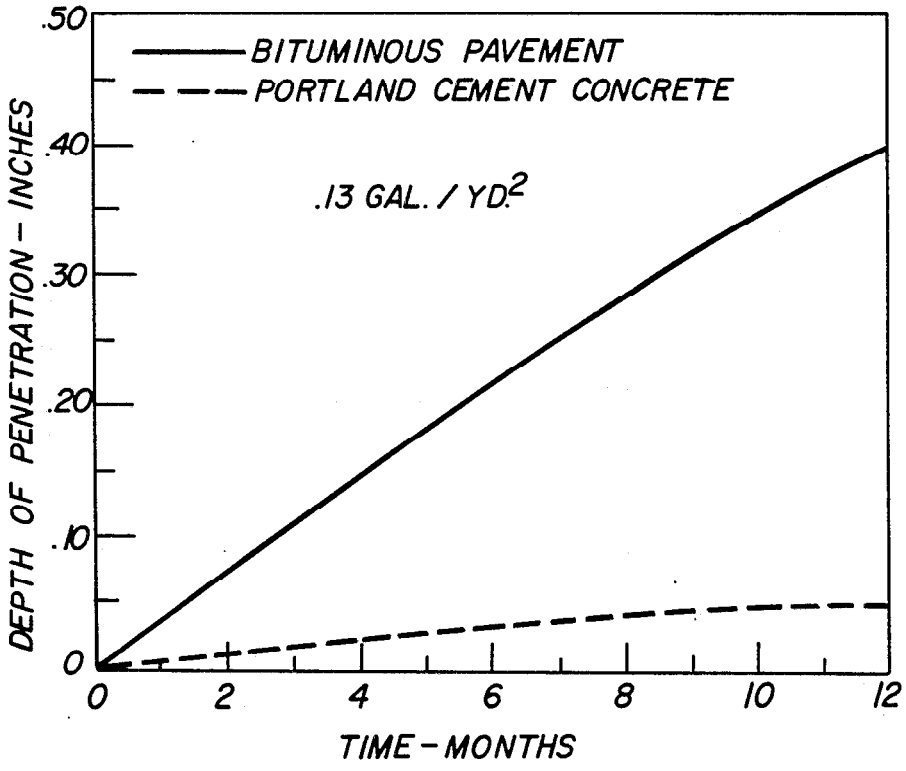
Attorney, Agent, or Firm—Herbert J. Zeh, Jr.; Donald M. MacKay

[57] **ABSTRACT**

A novel composition for treating asphalt and concrete surfaces is provided formed of a mixture of topped coke oven tar, an aromatic solvent having an API Gravity@ 60° F. of 11–30, Specific Gravity 60°/60° F. of from 0.876–0.993, Distillation Range ° F. of 310–450 IBP (initial boiling point) to 350–550 DP (dry point), and a Flash pt. ° F. TCC of 110–250; and a bituminous pavement rejuvenator which is a composition derived from coal tar and comprises a mixture of di-, tri- and tetracyclic aromatic compounds and their alkyl homologs containing lower alkyl groups together with a significant amount of phenolic and hydroxy derivatives and having a specific gravity at 25°/25° C. of at least 1.08, an initial boiling point of at least 180° C., and a continuous boiling range to at least 300° C., 70–40% by volume of the material remaining as residue at 300° C., and the distillate to 300° C. having a minimum specific gravity at 25°/25° C. of about 1.025.

4 Claims, 1 Drawing Figure

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TIME - MONTHS

PAVEMENT DRESSING CONDITIONER FORMED OF TAR, AN AROMATIC SOLVENT AND A BITUMINOUS PAVEMENT REJUVENATOR

BACKGROUND OF THE INVENTION

This is an improvement on my pavement dressing conditioner described in U.S. Pat. No. 3,261,269 issued July 19, 1966.

BRIEF DESCRIPTION OF THE INVENTION

The invention relates to sealing, reconditioning and dressings for bituminous and concrete surfaces formed of a mixture of topped coke oven tar, an aromatic solvent preferably having as its major components trimethylbenzenes and ethyltoluenes and a bituminous pavement rejuvenator described in U.S. Pat. No. 3,221,615 issued Dec. 7, 1965 (herein incorporated by reference in its entirety) which rejuvenator is a composition which is derived from coal tar and comprises a mixture of di-, tri- and tetracyclic aromatic compounds and their alkyl homologs containing lower alkyl groups together with a significant amount of phenolic and hydroxy derivatives.

The novel composition is a low odor composition acceptable for use in suburban areas where odor has heretofore inhibited use. In addition the composition is more environmentally acceptable because of the elimination of coal tar heavy solvent naphtha.

BRIEF DESCRIPTION OF THE DRAWING

The drawing illustrates the depth that the composition will penetrate aged bituminous paving and Portland cement concrete pavement with the passage of time.

DETAILED DESCRIPTION OF THE INVENTION

Bituminous pavings are smooth, comfortable to ride upon and easily applied. Unfortunately, the smooth, even surface is not as lasting as would be desired. Bituminous pavements, for example asphalt roads, tend to harden, crack, ravel and generally deteriorate over a period of years until finally the road becomes unsatisfactory for further use. The phenomena is not completely understood. It is believed that the hardening of the asphalt roads may be caused by slow loss of volatile materials from the asphalt and by the oxidation of the asphalt itself. The deterioration proceeds at an increasing rate as the surface of the paving hardens, because it cracks thereby exposing more bituminous surface for oxidation. The cycle repeats; the cracks deepen. Factors such as the penetration of gasoline, kerosene and motor oil dropped from vehicles passing over the surface and also the penetration of water which, in colder climates, causes the pavement to crack due to the freeze-thaw cycle accelerate this deterioration.

Thus arises the need for economically prolonging the useful life of bituminous pavements and the need for economically repairing a badly cracked bituminous pavement.

Concrete surfaces are also subject to deterioration due to the freeze-thaw cycle because water can easily penetrate into the concrete through the small cracks and pores that naturally occur in concrete surfaces. Furthermore, chemicals which are placed on concrete to melt snow and ice accelerate the deterioration.

Seals of coal tar pitch emulsion or asphalt emulsions or slurries as heretofore known have afforded only temporary protection for the pavement surface and have had no beneficial effect on the pavement materials as little or no penetration into the paving material occurs. The seals have only capped the substrates. It has now been found in accordance with the invention that bituminous pavements which are in the process of becoming or have become dry and brittle through aging and weathering may be revitalized and protected by applying said sealer composition.

Surprisingly, it has also been found that the composition of the invention will penetrate concrete surfaces. Thus, the composition penetrates and seals the pores and small cracks in the concrete so that solvent, chemicals and water cannot enter even should a break occur in the surface coating. The degree of penetration into the concrete will depend upon the porosity of the concrete.

The novel composition of this invention contains from 40 to 60 percent by weight of a topped coke oven tar which is a topped, high temperature coke oven tar (a tar which has had from 5 to 25% of the lower boiling compounds removed by distillation) having a float test of 50–300 sec. at 50° C. The float test is a standard test defining the consistency of a topped coke oven tar (ASTM method D-139) with tar of this consistency being designated as RT-10, RT-11 and RT-12 and soft pitch.

The composition contains 20 to 35% by weight of an aromatic solvent with the following properties.

API Gravity @ 60° F. of from 11–30,

Specific Gravity @ 60/60° F. of from 0.876–0.993,

Distillation Range °F. of from 310–450 IBP (initial boiling point, ASTM: D86-62), to 350–550 DP (dry point, ASTM: D86-62), and a

Flash pt °F. TCC of from 110–250

Preferred aromatic solvents are the following Hi-Sol solvents sold by Ashland Oil & Refining Company. Hi-Sol 10 is the most preferred solvent.

	AROMATIC SOLVENTS							
	API Gravity	Specific Gravity	Distillation Range °F.			Flash Pt. °F.	KB	Mixed Aniline
Product	@ 60° F.	60/60° F.	IBP	50%	DP	TCC	Value	Pt. °F.
Hi-Sol TM 10	30.0	.876	315	325	350	110	90	55
Hi-Sol 15	28.0	.887	360	371	400	145	90	61
Hi-Sol 100P	28.0	.887	310	380	450	110	96	55
Hi-Sol 4-1	15.4	.963	400	443	490	170	100	55
Hi-Sol 4-2	12.0	.986	420	462	520	190	102	51
Hi-Sol 4-2K	17.4	.950	400	462	550	195*	112	84
Hi-Sol 4-3	11.0	.993	450	490	545	250*	104	52

TM = trademark of Ashland Oil & Refining Company
*COC

The preferred solvent Hi-Sol 10 has as its principal components:

1,2,4-trimethylbenzene	37.5%
m-ethyltoluene	19.0
1,3,5-trimethylbenzene	11.0
1,2,3-trimethylbenzene	7.6
p-ethyltoluene	7.5
o-ethyltoluene	6.7

The composition also contains from 15 to 35 percent by weight of bituminous pavement rejuvenator.

Briefly the bituminous pavement rejuvenator is a blend of coal tar distillate fractions derived from high temperature coal tar and consists of high boiling, multicyclic aromatic compounds. The blend has a specific gravity at 25/25° C. of at least 1.08 and an initial boiling point of at least 180° C., a continuous boiling range to at least 300° C. with 70–40% of the material remaining as residue at 300° C. with a distillation curve to 300° C. of

Temperature, °C.:		Distillate
180	max	1.0
190	max	2.0
200	max	3.0
210	max	4.0
220	max	5.0
230	max	6.0
240	max	10.0
250		2–18
260		5–30
270		15–40
280		20–45
290		25–55
300		30–60

and said distillate to 300° C. having a minimum specific gravity at 25/25° C. of about 1.025. The aromatic compounds are di-, tri and tetracyclic hydrocarbons and their derivatives including a significant amount (from about 1 to 10%) of phenolic and hydroxy derivatives. The composition contains resinous materials which are the multicyclic condensation products of the di-, tri- and tetracyclic compounds formed when the compounds are subjected to high temperature distillation.

While the bituminous pavement rejuvenator may contain many aromatic compounds which boil above 180° C. the major components that a typical blend contains are listed in Table II along with the desired ranges in percent by weight in which each component should be present.

TABLE I

Major components of bituminous pavement rejuvenator	
Compounds:	Percent by weight
Naphthalene	1–5
α-Methylnaphthalene	1–10
β-Methylnaphthalene	1–15
Dimethylnaphthalene	1–20
Acenaphthene	1–10
Fluorene	2–20
Phenanthrene	2–20
Anthracene	2–10
Carbazole	1–5
Fluoranthene	1–5
Pyrene	1–5
Crysene	1–5
Tar acids	1–10
Tar bases	1–15
Resinous compounds	1–10

The bituminous pavement rejuvenator includes a larger percentage of aromatic compounds having high solvent powers (e.g., alkyl-naphthalenes) than are normally found in a simple coal tar distillate having the same general boiling range. These solvent compounds are particularly compatible with the bituminous pavement materials and this gives the rejuvenator its excellent penetrating and plasticizing properties. At the same time the solvents prevent any crystals from forming in the rejuvenator due to supersaturation of the solutions with any of its components.

The presence of the tar acids (phenolic and hydroxyl derivatives) acts to plasticize the brittle oxidized asphalt by dissolving the oxidation products therein. These tar acids include for example xylenols, naphthols, p-phenyl phenol, hydroxyphenanthrene, etc.

In the case of bituminous surfaces, the novel pavement dressing conditioner is believed to rejuvenate or prolong the useful life of the bituminous pavements by plasticizing the binder. The novel composition, however, protects both bituminous and concrete surfaces from the deteriorative effects of solvents, chemicals and water by effectively sealing the surface to prevent their penetration into the pavement. The novel composition of this invention is a liquid which can be applied at ambient temperatures (30°–120° F.), dries quickly and provides rapid and effective penetration into the surface of the pavement. It will also provide water-tight seals for concrete pipe.

The novel composition is preferably applied in the amount of about 0.05 to 0.5 gallon per square yard. Less than 0.05 gallon per square yard seems to be insufficient to adequately seal and rejuvenate the pavement and more than 0.5 gallon per square yard may even cause bituminous pavements to become unstable. Conventional methods of handling liquid bituminous material can be used in applying the composition such as spraying through a bituminous distributor or painting with a brush or roller, or squeegee.

After the novel composition is applied to paving, it is permitted to set for a short period, for example, a half hour. Then, the surface is brushed with a stiff broom to remove any excess composition from low areas and deposit it in the cracks. Thereafter the paving is ready for the movement of rubber tired vehicles thereover. With time, the composition plasticizes old bituminous pavement and softens the material in the vicinity of the cracks to the extent that rubber tired traffic will close the cracks. In areas such as airports where the vehicular traffic may be small, it is desirable to roll the treated paving with a rubber tired roller.

The novel composition of this invention continues to penetrate into the surface for a substantial period of time. The extent of penetration may be readily determined visually since the portion which has been penetrated by the novel composition has a color that is darker than that of the original pavement. This penetration is a direct function of the length of time after application. The drawing shows, for example, the depth of penetration in inches of asphalt and concrete paving as a function of time, the determinations having been made

by drilling a core from the pavement at various intervals of time.

The extent of plasticizing of the aged bituminous pavement can be conveniently illustrated by the use of the characteristic of a bituminous paving material such as penetration. Penetration (ASTM D5-25) is determined by measuring the distance in tenths of a millimeter that a needle penetrates into the asphalt under controlled conditions. An asphalt paving was tested as to penetration after the addition of the novel sealing and rejuvenating composition of this invention to the paving at a rate of 0.07 gallon per square yard. The results of the tests are illustrated in Table II as compared to an untreated sample.

TABLE II

Penetration at 77° F.	
Treated	Untreated
43	26

A typical pavement dressing conditioner of this invention can be prepared by mixing the components in a conventional mixing tank in the manner of Example I.

EXAMPLE 1

Topped coke oven tar (75–100 seconds float test at 50° C., 46.0 parts by weight) at a temperature of 200°–220° F. was added to a mixing tank equipped with recirculation. To the tank was then added at a temperature of 150° F., 24 percent by weight bituminous pavement rejuvenator. The mixture was recirculated and then at ambient temperature 30 percent by weight of Hi-Sol 10 was added. When homogenous, the mixture was allowed to stand at ambient temperature.

The specifications for the sealing, dressing and rejuvenating compositions of this invention are as follows:

Test Method	Characteristic	
ASTM D-3142	Sp. Gravity, 25/25° C.	1.06 min.
D-1665	Engler Specific Viscosity, 50 cc. at 50° C.	2.5 max.
D-95	Water	2.0 max. Percent by Weight
D-20	Distillation to:	
	170° C.	5.0 max.
	270° C.	25–45
	300° C.	35–55
D-36	Softening point, residue above 300° C. (Ring and Ball).	30–55° C.

It is believed that if it were possible to segregate the action of the components that the tar portion of the novel composition provides a solvent and water-tight seal for the substrate, while the bituminous pavement rejuvenator portion revitalizes the aged bituminous paving substrate by replacing volatile materials and by plasticizing the binder thereby preventing further cracking of the pavement and healing existing cracks and fissures. The solvent portion not only provides a compatible vehicle for the other two components but, more importantly, permits the composition to be used for applications, heretofore, unacceptable because of odor and and also permits it to be applied at ambient temperatures (30°–120° F.) and promotes rapid penetration of the composition into the substrate. The solvent portion also promotes drying of the surface. These actions occur conjointly and the action of one mutually affects the action of the other so that separation of the effects is not possible.

The composition can be mixed with sand, pozzolana or other fine mineral aggregates prior to application where due to heavy traffic, a coating having more body is desired.

In treating bituminous and concrete paving, the composition is applied to the paving advantageously by spraying at a rate, for example, of 0.1 gallon per square yard. The composition is permitted to soak for 15 minutes to one-half hour and thereafter distributed further over the surface and into the cracks by brushing with a stiff broom. The drying time of the material will vary between 30 minutes to 12 hours depending upon the type of pavement, condition of the pavement and climatic conditions. When traffic is to proceed immediately over the paving, it is desirable to sprinkle the paving with sand so as to minimize pickup of the rejuvenating composition on the tires of the cars. The composition effectively seals concrete and bituminous surfaces against fuel, oil, water and ice removing chemicals.

If the traffic is not heavy, it is advantageous to roll bituminous paving at the end of 60 days with a roller having rubber tires. The rejuvenator restores the cold flow properties of bituminous pavement and its flexibility so that it behaves in the manner of a new pavement.

The composition can be used to rejuvenate old bituminous pavements and seal them against further deterioration as well as sealing bituminous or concrete surfaces which have not begun to deteriorate but due to age, use or climatic conditions will be suspected to soon deteriorate unless an effective sealing compound is applied.

In the sealing of the surface of concrete pipe the composition can be applied to either the inner or outer surfaces of the pipe by sprayer, brush or roller. A satisfactory rate of application would be, for example, 0.1 gallon per square yard. The composition prevents the seepage of liquids through the pipe wall and thus provides an effectively sealed conduit. It also prevents the passage of moisture into the pipe wall, which, in cold climates would freeze and crack the pipe.

The foregoing specification has described novel compositions and methods of rejuvenating asphalt pavements, sealing and dressing asphalt and concrete pavements and providing a water-tight seal for porous material such as concrete pipe. It is particularly advantageous for use on airport runways, taxiways and parking strips to rejuvenate old bituminous pavements and to provide an effective seal against the effects of gasoline, JP-4 fuel and motor oil. It is also advantageous for use on city streets where decreasing curb heights inhibit the use of additional pavement overlays unless new curbs are placed or unless the present pavement is removed to some depth in order to provide effective drainage. It is also advantageous for use on concrete pavements where in cold climates the effect of penetration by water and the resulting freeze-thaw cycles and the placing of ice and snow removal chemicals on the surface causes rapid deterioration unless some protective layer is applied. The composition can be applied at ambient temperatures which eliminates the necessity for heating the composition prior to application with its attendant unfavorable economic aspect and problems due to fumes which can have adverse effects on the personnel applying the coating. The solvent system provides a quick drying surface and permits the rejuvenating and sealing

compound to rapidly penetrate the pavement to an effective depth.

Other applications of the novel composition include the pretreatment of cracked pavements prior to overlaying with new bituminous courses so that the cracks in the old pavement will not be reflected up to the new overlay. It can be used to pretreat pavement surfaces after planing operations with a conventional heater planer or to pretreat pavement prior to heating with conventional infrared equipment used for healing cracks.

What is claimed is:

1. A sealing and rejuvenating composition for bituminous and concrete surfaces comprising 40–60% by weight of topped coke oven tar having a float test of 50–300 seconds at 50° C., 20–35% by weight of an aromatic solvent having API Gravity at 60° F. of from 11–30, Specific Gravity 60/60° F. of from 0.876–0.993, IBP (initial boiling point) between 310 and 450, DP (dye point) of between 350 and 550, and a Flash pt. °F. TCC of from 110–250, and 15–35% by weight of a mixture of di-, tri- and tetracyclic aromatic compounds and their alkyl homologs containing lower alkyl groups together with 1–10% by weight of phenolic and hydroxy derivatives, said mixture being derived from the distillation of coal tar, said mixture having a specific gravity of 25/25° C. of at least 1.08 and an initial boiling point of at least 180° C., a continuous boiling range to at least 300° C., with a distillation curve to 300° C., 70–40% of the material remaining as residue at 300° C., the distillate at 300° C. having a minimum specific gravity at 25/25° C. of about 1.025.

2. The composition of claim 1 wherein the aromatic solvent comprises as its major components trimethylbenzenes and ethyltoluenes.

3. A method of sealing and rejuvenating bituminous and concrete surfaces which comprises applying to the surface at a rate of 0.05–0.5 gallon per square yard a composition comprising 40–60% by weight of topped coke oven tar having a float test of 50–300 seconds at 50° C., 20–35% by weight of an aromatic solvent having API Gravity at 60° F. of from 11–30, Specific Gravity 60/60° F. of from 876–993, IBP (initial boiling point) between 310 and 450, DP (dry point) of between 350 and 550, and a Flash pt. °F. TCC of from 110–250, and 15–35% by weight of a mixture of di-, tri- and tetracyclic aromatic compounds and their alkyl homologs containing lower alkyl groups together with 1–10% by weight of phenolic and hydroxy derivatives, said mixture being derived from the distillation of coal tar, said mixture having a specific gravity of 25/25° C. of at least 1.08 and an initial boiling point of at least 180° C., a continuous boiling range to at least 300° C., 70–40% of the material remaining as residue at 300° C., with a distillation curve to 300° C., the distillate at 300° C. having a minimum specific gravity at 25/25° C. of about 1.025.

4. The method of claim 3 wherein the aromatic solvent comprises as its major components trimethylbenzenes and ethyltoluenes.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : B1 4,661,378
DATED : January 18, 1994
INVENTOR(S) : Edward W. McGovern

It is certified that error appears in the above-indentified patent and that said Letters Patent is hereby corrected as shown below:

On the Title Page, Item [57], line 5, "0.993." should read --0.993,--.
Claim 1, column 1, line 30, "0.933" should read --0.993--.
Claim 1, column 1, line 33, "°F.TCC" should read --°F. TCC--.
Claim 5, column 2, line 17, "boil" should read --boiling--.
Claim 6, column 2, line 26, after "50° C." insert --,--.

Signed and Sealed this
Twelfth Day of July, 1994

Attest:

BRUCE LEHMAN

Attesting Officer

Commissioner of Patents and Trademarks

US004661378B1

REEXAMINATION CERTIFICATE (2191st)

United States Patent [19]

[11] B1 4,661,378

McGovern

[45] Certificate Issued Jan. 18, 1994

[54] **PAVEMENT DRESSING CONDITIONER FORMED OF TAR, AN AROMATIC SOLVENT AND A BITUMINOUS PAVEMENT REJUVENATOR**

[75] Inventor: **Edward W. McGovern**, Pittsburgh, Pa.

[73] Assignee: **K. A. E. Paving Consultants, Inc.**, Pittsburgh, Pa.

Reexamination Request:
No. 90/002,855, Oct. 8, 1992

Reexamination Certificate for:

Patent No.:	**4,661,378**
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Filed:	**Jul. 23, 1985**

[51] **Int. Cl.**[5] **B32B 35/00**
[52] **U.S. Cl.** **427/140**; 106/278; 106/285; 427/138; 427/393.6
[58] **Field of Search** 427/138, 139, 140, 393.6, 427/136, 417, 443; 106/278, 285

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Primary Examiner—Terry J. Owens

[57] **ABSTRACT**

A novel composition for treating asphalt and concrete surfaces is provided formed of a mixture of topped coke oven tar, an aromatic solvent having an API Gravity@ 60° F. of 11–30, Specific Gravity 60°/60° F. of from 0.876–0.993. Distillation Range °F. of 310–450 IBP (initial boiling point) to 350–550 DP (dry point), and a Flash pt. °F. TCC of 110–250; and a bituminous pavement rejuvenator which is a composition derived from

coal tar and comprises a mixture of di-, tri- and tetracyclic aromatic compounds and their alkyl homologs containing lower alkyl groups together with a significant amount of phenolic and hydroxy derivatives and having a specific gravity at 25°/25° C. of at least 1.08, an initial boiling point of at least 180° C., and a continuous boiling range to at least 300° C., 70–40% by volume of the material remaining as residue at 300° C., and the distillate to 300° C. having a minimum specific gravity at 25°/25° C. of about 1.025.

REEXAMINATION CERTIFICATE ISSUED UNDER 35 U.S.C. 307

THE PATENT IS HEREBY AMENDED AS INDICATED BELOW.

Matter enclosed in heavy brackets [ ] appeared in the patent, but has been deleted and is no longer a part of the patent; matter printed in italics indicates additions made to the patent.

AS A RESULT OF REEXAMINATION, IT HAS BEEN DETERMINED THAT:

The patentability of claims 3 and 4 is confirmed.

Claim 1 is determined to be patentable as amended.

Claim 2, dependent on an amended claim, is determined to be patentable.

New claims 5 and 6 are added and determined to be patentable.

1. A sealing and rejuvenating composition for bituminous and concrete surfaces comprising 40–60% by weight of topped coke oven tar having a float test of 50–300 seconds at 50° C., 20–35% by weight of an aromatic solvent having API Gravity at 60° F. of from 11–30, Specific Gravity 60/60°F. of from 0.876–0.933, IBP (initial boiling point) between 310 and 450, DP ([dye] *dry* point) of between 350 and 550, and a Flash pt. °F.TCC of from 110–250, and 15–35% by weight of a mixture of di-, tri- and tetracyclic aromatic compounds and their alkyl homologs containing lower alkyl groups together with 1–10% by weight of phenolic and hydroxy derivatives, said mixture being derived from the distillation of coal tar, said mixture having a specific gravity of 25/25° C. of at least 1.08 and an initial boiling point of at least 180° C., a continuous boiling range to at least 300° C., with a distillation curve to 300° C., 70–40% of the material remaining as residue at 300° C., the distillate at 300° C. having a minimum specific gravity at 25/25° C. of about 1.025.

5. A sealing and rejuvenating composition for bituminous and concrete surfaces consisting essentially of 40–60% by weight of topped coke oven tar having a float test of 50–300 seconds at 50° C., 20–35% by weight of an aromatic solvent having API Gravity at 60° F. of from 11–30, Specific Gravity 60/60° F. of from 0.876–0.993, IBP (initial boiling point) between 310 and 450, DP (dry point) of between 350 and 550, and a Flash pt. °F. TCC of from 110–250, and 15–35% by weight of a mixture of di-, tri- and tetracyclic aromatic compounds and their alkyl homologs containing lower alkyl groups together with 1–10% by weight of phenolic and hydroxy derivatives, said mixture being derived from the distillation of coal tar, said mixture having a specific gravity of 25/25° C. of at least 1.08 and an initial boil point of at least 180° C., with a distillation curve to 300° C., 70–40% of the material remaining as residue at 300° C., the distillate at 300° C. having a minimum specific gravity at 25/25° C. of about 1.025.

6. A method of sealing and rejuvenating bituminous and concrete surfaces which comprises applying to the surface at a rate of 0.05–0.5 gallon per square yard a composition consisting essentially of 40–60% by weight of topped coke oven tar having a float test of 50–300 seconds at 50° C. 20–35% by weight of an aromatic solvent having API Gravity at 60° F. of from 11–30, Specific Gravity 60/60° F. of from 0.876–0.993, IBP (initial boiling point) between 310 and 450, DP (dry point) of between 350 and 550, and a Flash pt. °F. TCC of from 110–250, and 15–35% by weight of a mixture of di-, tri- and tetracyclic aromatic compounds and their alkyl homologs containing lower alkyl groups together with 1–10% by weight of phenolic and hydroxy derivatives, said mixture being derived from the distillation of coal tar, said mixture having a specific gravity of 25/25° C. of at least 1.08 and an initial boiling point of at least 180° C., with a distillation curve to 300° C., 70–40% of the material remaining as residue at 300° C., the distillate at 300° C. having a minimum specific gravity at 25/25° C. of about 1.025.

* * * * *

US005580603A

United States Patent [19]

McGovern

[11] Patent Number: 5,580,603

[45] Date of Patent: Dec. 3, 1996

[54] **PAVEMENT REJUVENATOR AND DRESSING CONDITIONER WITH BLACKENING AGENT**

[75] Inventor: **Edward W. McGovern**, Pittsburgh, Pa.

[73] Assignee: **K.A.E. Paving Consultants, Inc.**, Pittsburgh, Pa.

[21] Appl. No.: **429,578**

[22] Filed: **Apr. 27, 1995**

[51] **Int. Cl.**[6] **P32K 35/00**

[52] **U.S. Cl.** **427/138**; 106/232; 106/278; 106/285; 427/140; 427/393.6; 427/258

[58] **Field of Search** 427/138, 393.6, 427/140, 258; 106/232, 278, 285

[56] **References Cited**

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Primary Examiner—Janyce Bell

Attorney, Agent, or Firm—Webb Ziesenheim Bruening Logsdon Orkin & Hanson, P.C.

[57] **ABSTRACT**

A pavement rejuvenating composition in which particular coal tar derivatives and other optional ingredients are admixed with one or more blackening agents. The blackening agent may be one or more of the following: soft coal tar pitch, aromatic cracked petroleum residue, silicone, aliphatic amine, carbon black or 0.01–2.0% by weight pavement dressing conditioner to give the desired blackening and pavement preservation effect.

12 Claims, No Drawings

PAVEMENT REJUVENATOR AND DRESSING CONDITIONER WITH BLACKENING AGENT

FIELD OF THE INVENTION

The invention relates to improvements in pavement rejuvenator and dressing conditioner compositions through the use of blackening agents.

BACKGROUND OF THE INVENTION

At the same time that the paving industry is experiencing the commercial stresses of increasingly strict environmental controls of all kinds, the paved surfaces themselves are experiencing the stresses of greater traffic and larger, heavier vehicles as well as increasing corrosion from the ever-wider use of chemicals for snow and ice removal. The competing demands of new laws and performance standards virtually mandate improvements in paving materials and maintenance methods therefor.

One way to maintain the integrity of paved surfaces is actively to preserve them, so as to avoid the necessity of rebuilding or resurfacing them. A bituminous pavement rejuvenator for such a purpose is disclosed in U.S. Pat. No. 3,221,615, incorporated herein by reference, which is a coal tar derivative composition containing specific ingredients and having particular specifications. Other pavement treating compositions are disclosed in U.S. Pat. Nos. 3,261,269 and 4,661,378, also incorporated herein by reference, which disclose pavement dressing conditioners which contain the above-described bituminous pavement rejuvenator together with additional ingredients and/or solvents. These pavement treating compositions are generally spread or sprayed onto existing pavement surfaces (not only bituminous surfaces but concrete and other surfaces as well) to preserve and to restore the integrity of the pavement.

Even these pavement preserving and restoring compositions, however, do not meet all the needs of the current pavement maintenance industry. For example, pavement restorers often wish to restore the original black color of bituminous pavement which has faded to gray or white. This change of color to black is needed for safety reasons to preserve contrast between painted center and shoulder lines; even intact road markings become faint or invisible when the road surface itself fades to white or gray. It has also been discovered that blacker pavements retain more heat from solar energy, and thus need fewer and less frequent applications of de-icing chemicals than faded roads do. Those who pave and maintain road surfaces, and are thus always mindful of the need to minimize costs and damage associated with de-icing chemicals, therefore also appreciate the need for restoring a dark or black color to paved surfaces of all kinds.

Even beyond these concerns, a ubiquitous goal in restoring old asphalt is inevitably the solving of the "water run-off" problem. The same drying, sun bleaching and oxidation of the asphalt material which originally caused the fading color also invariably causes the asphalt surface to harden, lump and crack. This loss of smooth surface causes rainwater to pool and/or to run in large and sometimes deep gulleys which wreak havoc on traffic and further the degradation of the road. Restoration of the original, smooth, waterproof surface is thus an important consideration in any pavement preservation technique.

Accordingly, a need remains for a treating composition and method for asphalt and other bituminous pavement materials which can simultaneously permanently blacken it and smooth and waterproof it to overcome unwanted water run-off.

SUMMARY OF THE INVENTION

In order to meet this need, the present invention is a pavement rejuvenating composition in which particular coal tar derivatives and other optional ingredients are admixed with one or more blackening agents. The blackening agent may be one or more of the following: soft coal tar pitch, aromatic cracked petroleum residue, silicone, aliphatic amine, carbon black or 0.01–2.0% by weight pavement dressing conditioner (described below) to give the desired blackening and pavement preservation effect.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is a pavement rejuvenating composition in which particular coal tar derivatives and other optional ingredients are admixed with one or more blackening agents. The blackening agent may be one or more of the following: soft coal tar pitch, aromatic cracked petroleum residue (Monsanto PR Resin, Shell 100 or 420, or Sun Monar), silicone, aliphatic amine, carbon black or 0.01–2.0% by weight pavement dressing conditioner (described below) to give the desired blackening and pavement preservation effect.

Pavement rejuvenating and conditioning compositions are disclosed in U.S. Pat. Nos. 3,221,615, 3,261,269 and 4,661,378 (now Reexamination Certificate 4,661,378) incorporated herein by reference. It is helpful in the context of this specification, however, to provide the following summary of these rejuvenating and conditioning compositions, so as to make the claimed invention more clear.

The bituminous pavement rejuvenator disclosed in U.S. Pat. No. 3,221,615 is a coal tar derivative containing a mixture of di-, tri- and tetracyclic aromatic compounds and their alkyl homologs containing lower alkyl groups together with a significant amount of phenolic and hydroxy derivatives, said mixture having a specific gravity at 25/25° C. of at least 1.08, a maximum Brookfield viscosity at 25° C. of 30 cps, and an initial boiling point of at least 180° C. and a continuous boiling range to at least 300° C., 70–40% by volume of the material remaining as residue at 300° C. (together with additional specifications). The rejuvenator is disclosed as at least primarily intended to rejuvenate bituminous pavement, namely, asphalt roads. The patent identifies the ability of the composition to plasticize the binder of the bituminous pavement as the assumed basis for its utility, and states that "[i]t has been found that the paving treated in accordance with this invention exhibits characteristics similar to those of a new pavement" and that "the pavement regains its ability to heal cracks under traffic and previously curled surfaces flatten under traffic," or in other words "regains its cold flow properties." The composition is handled in the same manner as previously existing liquid bituminous materials, and is heated and sprayed onto the pavement surface to be treated in the amount of about 0.05 to 0.5 gallons per square yard surface.

The above-described bituminous pavement rejuvenator is itself an ingredient in the pavement dressing conditioner described in U.S. Pat. No. 3,261,269. The pavement dressing conditioner can be applied to asphalt, concrete and other

paved surfaces and contains "road tar" and coal tar solvent in addition to bituminous pavement rejuvenator. When used to treat paved surfaces, this admixture is believed to restore the resilience of pavement which has otherwise started to harden and to crack, so as to prevent further cracking and even to restore the ability for self-healing of cracks to the existing pavement.

The pavement dressing conditioner described in Reexamination Certificate No. 4,661,378 is very similar to the pavement dressing conditioner disclosed in the '269 patent, except that it also includes a specialized solvent.

Both pavement dressing conditioners and the bituminous pavement rejuvenator described above may be enhanced by the addition of blackening agents according to the present invention. It should be noted, however, that generally it is the bituminous pavement rejuvenator (BPR) to which the blackening agent is added, even if that blackened BPR is then used as a constituent of a pavement dressing conditioner (PDC) incorporating the blackened BPR. It should also be noted that ordinary PDC itself, in small amounts, can serve as the blackening agent additive to the BPR, even though (unblackened) BPR is an ingredient of (unblackened) PDC. The reason for this is that PDC contains "road tar" and is thus inherently blacker than its constituent BPR for this reason.

The blackening agent should be incorporated into the BPR (or into the PDC) in the amount of about 0.01 to 15% by weight, except that when PDC is used as the blackening agent about 0.01–2.0% by weight should be incorporated. The blackening agent may also be one or more of the following: soft coal tar pitch, silicone, aliphatic amine, or carbon black such as the various commercially available lampblack compositions. It should be borne in mind that the black color of all these materials is relative, so that when (unmodified) PDC is used as the blackening agent to blacken a quantity of BPR, and the blackened BPR is used as an ingredient in a new batch of PDC, the resulting PDC will have a darker black color than the (unmodified) PDC used as the blackening agent in the first instance. While this is somewhat complicated, it is all consistent with the overriding goal of the invention—to add blackening agent to BPR and/or PDC so as to impart long-lasting restored black color to bituminous pavements treated therewith, and to increase the wear- and water-run-off-resistance of the treated surfaces.

Mixed blackening agents may also be used. For example, a preferred blackening component may be made up of five parts lampblack, 1–3 parts fatty acid amine and up to about one-half part silicone (polyorganosiloxane polymer). Other mixtures of the disclosed blackening agents are also contemplated, in varying amounts.

In practice, the blackening agent additive need merely be mixed with the BPR and/or PDC, in a suitable vessel and/or with suitable mixing equipment, at moderately elevated temperatures. Generally, BPR should be admixed at a temperature of about 150°–250° F., whereas PDC should be heated only to maximum 150° F. The blackened compositions are applied in the same way as are ordinary BPR and/or PDC compositions, that is, they are usually sprayed on existing pavement to impregnate them before the compositions cure. When traffic is to proceed immediately over the pavement, it is desirable to sprinkle the pavement with sand (black sand is preferred) so as to minimize pick-up of the composition(s) by vehicle tires. If traffic is not heavy, it is advantageous to roll the pavement at the end of seven days with a rubber tired roller. This speeds the restoration of the flexibility and cold flow properties when the pavement is asphalt, so that it behaves in the manner of new paving materials. In the event light colored sand has been used, rolling also incorporates this light sand into the pavement and helps in the restoration of the desired black color.

The following examples are illustrative, and not intended to be limiting.

EXAMPLE 1

About 90 parts by weight of bituminous pavement rejuvenator prepared according to U.S. Pat. No. 3,221,615 was placed in a stainless steel mixing tank fitted with a mixing impeller. To the tank were added about 5 parts by weight of a commercially available lampblack composition sold under the tradename Columbia Carbon Lampblack, about 3 parts by weight of Redicote 2323 fatty acid amine, and about one-half part silicone (polyorganosiloxane). Other lampblack compositions are Monsanto Lampblack No. 10 and Harshaw Blue Tone, which could have been substituted, as well as other lampblack materials known in the art.

EXAMPLE 2

Topped coke oven tar (75–100 seconds Float Test at 50° C., 47.4% by weight) at a temperature of 180° F. was added to a mixing tank equipped with a three-bladed impeller, and 5% by weight lampblack was added thereto with mixing. To the tank were then added, at ambient temperature, 11.6% by weight of B-T-X solvent and 20% by weight of crude heavy solvent naphtha (containing 50% resinifiable coumarone-indene resin). The mixture was stirred at 60 r.p.m. for 15 minutes and then 16.0% by weight of bituminous pavement rejuvenator (according to U.S. Pat. No. 3,221,615) at a temperature of 150° F. was added. The mixture was stirred for an additional 120 minutes in order to mix the ingredients thoroughly. The resulting pavement dressing conditioner containing blackening agent was then transferred to a storage tank at ambient temperature, for storage prior to use.

EXAMPLE 3

The composition according to Example 2 was further blended with about 30% by weight of an aromatic solvent sold under the tradename Hi-Sol 10 and having the following specifications: API Gravity @60° F. of from 11–30, Specific Gravity @60/60° F. of from 0.876–0.993, Distillation Range °F. of from 310–450 IBP (initial boiling point, ASTM: D86-62), to 350–550 DP (dry point, ASTM: D86-62) and a flash point °F. TCC of from 110–250.

EXAMPLE 4

Example 1 was repeated several more times, using the following ingredients and proportions (all percentages are by weight):

- 95.0–99.0% BPR, 1.0–10.0% coal tar pitch (float test 50–300 seconds @50° C.), 0.001–0.05 silicone and 0–5.0% aromatic solvents;
- 80.0–98.0% BPR, 2.0–20.0% PDC, 0.001–0.05% silicone;
- 87.0–98.0% BPR, 2.0–10.0% coal tar pitch, 0.05–3.0% amine, and 0.001–0.05% silicone;
- 77.0–98.0% BPR, 2.0–20.0% PDC, 0.05–3.0% amine, and 0.001–0.05% silicone; and
- 92.0–99.0% BPR, 0.001–0.05% silicone, 0.05–3.0% amine, and 0.01–5.0 carbon black (lampblack).

All of the compositions, when applied to faded asphalt pavement, restored the black color of the pavement and gave good penetration and restoration of waterproofing and cold flow properties.

Although the above description and examples are illustrative of the present subject matter, the invention is only to be limited insofar as is set forth in the accompanying claims.

What is claimed is:

1. A pavement treating composition comprising a quantity of bituminous pavement rejuvenator consisting essentially of a coal tar derivative containing a mixture of di-, tri- and tetracyclic aromatic compounds and their alkyl homologs containing lower alkyl groups together with a significant amount of phenolic and hydroxy derivatives, said mixture having a specific gravity at 25/25° C. of at least 1.08, a maximum Brookfield viscosity at 25° C. of 30 cps, and an initial boiling point of at least 180° C. and a continuous boiling range to at least 300° C., with 70–40% by volume of said mixture remaining as residue when said mixture is boiled at 300° C., in admixture with a quantity of a blackening agent, wherein the composition contains about 77–99 weight % bituminous pavement rejuvenator.

2. The composition according to claim **1** wherein said blackening agent is one or more of the compositions selected from the group consisting of soft coal tar pitch, aromatic cracked petroleum residue, pavement dressing conditioner comprising said bituminous pavement rejuvenator and tar, elemental carbon, lampblack and aromatic cracked petroleum residue.

3. The composition according to claim **2** further comprising an additive selected from the group consisting of aliphatic amine, aliphatic fatty acid amine and silicone.

4. The composition according to claim **1** consisting essentially of: 90.0–99.0% of said bituminous pavement rejuvenator, 1.0–10.0% coal tar pitch (float test 50–300 seconds @50° C.), 0.001–0.05 silicone and 0–5.0% aromatic solvents.

5. The composition according to claim **1** consisting essentially of: 80.0–98.0% of said bituminous pavement rejuvenator, 2.0–20.0% pavement dressing conditioner comprising bituminous pavement rejuvenator and tar and 0.001–0.05% silicone.

6. The composition according to claim **1** consisting essentially of: 87.0–98.0% of said bituminous pavement rejuvenator, 2.0–10.0% coal tar pitch, 0.05–3.0% amine, and 0.001–0.05% silicone.

7. The composition according to claim **1** consisting essentially of: 77.0–98.0% of said bituminous pavement rejuvenator, 2.0–20.0% pavement dressing conditioner comprising said bituminous pavement rejuvenator and tar, 0.05–3.0% amine and 0.001–0.05% silicone.

8. The composition according to claim **1** consisting essentially of: 92.0–99.0% bituminous pavement rejuvenator, 0.001–0.05% silicone, 0.05–3.0% amine, and 0.01–5.0% carbon black.

9. A method for blackening pavement, comprising:

admixing a blackening agent into a composition containing a bituminous pavement rejuvenator, said bituminous pavement rejuvenator consisting essentially of a coal tar derivative containing a mixture of di-, tri- and tetracyclic aromatic compounds and their alkyl homologs containing lower alkyl groups together with a significant amount of phenolic and hydroxy derivatives, said mixture having a specific gravity at 25/25° C. of at least 1.08, a maximum Brookfield viscosity at 25° C. of 30 cpS, and an initial boiling point of at least 180° C. and a continuous boiling range to at least 300° C., with 70–40% by volume of said mixture remaining as residue when said mixture is boiled at 300° C.; and

applying the resulting composition to the pavement to be treated, wherein the composition contains about 77–99 weight % of said bituminous pavement rejuvenator.

10. The method according to claim **9** wherein said blackening agent is at least one agent selected from the group consisting of soft coal tar pitch, aromatic cracked petroleum residue, pavement dressing conditioner, elemental carbon, lampblack and aromatic cracked petroleum residue.

11. The method according to claim **10** wherein said blackening agent is a mixture of lampblack, fatty acid amine and silicone.

12. The method according to claim **10** wherein said step of admixing a blackening agent into a composition containing a bituminous pavement rejuvenator further comprises admixing an additive into said composition wherein said additive is selected from the group consisting of aliphatic amine, aliphatic fatty acid amine and silicone.

* * * * *

ATTACHMENT 2

SEALCOAT MATERIAL SAFETY DATA SHEETS

SAFETY DATA SHEET

Issuing Date 13-Oct-2016 **Revision Date** **Revision Number** 0

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

GHS Product Identifier
Product Name: **Coal Tar Ultra Blend Sealer**

Other Means of Identification
Product Code(s): **S1001**
Synonyms None

Recommended Use of the Chemical and Restrictions on Use
Recommended Use: No Information Available
Uses Advised Against: No Information Available

Supplier Address
SealMaster
Locations Nationwide
www.sealmaster.net
1-800-341-7325

Manufacturer Address
SealMaster
Locations Nationwide
www.sealmaster.net
1-800-341-7325

Emergency Telephone Number Chemtrec 1-800-424-9300

2. HAZARDS IDENTIFICATION

Classification

Carcinogenicity	Category 1B

GHS Label Elements, Including Precautionary Statements

Emergency Overview

Signal Word **Danger**

- May cause cancer
- Harmful if swallowed
- May cause skin irritation

Appearance: Black
Odor

Physical State: Liquid

Odor: Coal Tar

Precautionary Statements

Prevention

- Obtain special instructions before use.
- Do not handle until all safety precautions have been read and understood.
- Use personal protective equipment as required.

Inhalation: May cause irritation of respiratory tract.
Eye Contact: Contact with eyes may cause irritation.
Skin Contact: May cause irritation.
Ingestion: Ingestion may cause stomach discomfort.

General Advice	• If exposed or concerned: Get medical attention/advice.
Storage	• Store locked up.
Disposal	• Dispose of contents/container to an approved waste disposal plant.

Hazard Not Otherwise Classified (HNOC)
Not applicable

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS Number	Weight %	Trade Secret
Coal Tar Pitches	65996-93-2	20-40	*
Quartz	14808-60-4	<20	*
Kaolin	1332-58-7	10-30	*
Bentonite	1302-78-9	<10	*

**The exact percentage of composition has been withheld as a trade secret.*

4. FIRST AID MEASURES

Description of Necessary First-Aid Measures

Eye Contact	Rinse thoroughly with plenty of water, also under the eyelids, for at least 15 minutes. If symptoms persist, call a physician.
Skin Contact	Wash off immediately with soap and plenty of water. In the case of skin irritation or allergic reactions, see a physician.
Inhalation	Move to fresh air. If symptoms persist, call a physician.
Ingestion	Drink plenty of water. Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Consult a physician if necessary.

Most Important Symptoms/Effects, Acute and Delayed
Most Important Symptoms/Effects No information available

Indication of Immediate Medical Attention and Special Treatment Needed, If Necessary
Notes to Physician Treat Symptomatically. May cause sensitization by skin contact.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media
Carbon Dioxide (CO_2). Dry Chemical. Foam. Water Fog.

Unsuitable Extinguishing Media CAUTION: Use of water spray when fighting fire may be inefficient.

Specific Hazards Arising from the Chemical
No information available

Explosion Data

Sensitivity to Mechanical Impact	None
Sensitivity to Static Discharge	None

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure- demand MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures
Personal Precautions: Ensure adequate ventilation. Avoid contact with skin, eyes and clothing. Use personal protective equipment.

Environmental Precautions
Environmental Precautions: See Section 12 for additional Ecological Information.

Methods and Materials for Containment and Cleaning Up
Methods for Containment: Prevent further leakage or spillage if safe to do so.

Methods for Cleaning Up: Dam up. Soak up with inert absorbent material. Pick up and transfer to properly labeled containers. Clean contaminated surface thoroughly.

7. HANDLING AND STORAGE

Precautions for Safe Handling

Handling: Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes, and clothing. Wear personal protective equipment. Avoid breathing vapors or mists. Do not eat, drink, or smoke when using this product. Wash thoroughly after handling.

Conditions for Safe Storage, Including Any Incompatibilities

Storage: Keep container tightly closed

Incompatible Products: Strong oxidizing agents. Acids.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Control Parameters

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Coal Tar Pitches 65996-93-2	TWA: 0.2 mg/m³benzene soluble aerosol	TWA: 0.2 mg/m³benzene soluble fraction (vacated) TWA: 0.2 mg/m³benzene soluble fraction	IDLH: 80 mg/m³ TWA: 0.1 mg/m³ Cyclohexane-extractable fraction
Quartz 14808-60-7	TWA: 0.025 mg/m³ respirable fraction	30/(%SiO2+2) mg/m³ TWA, Total Dust; 250/(%SiO2+5) mppcf TWA, respirable fraction; 10/(%SiO2+2) mg/m³ TWA, respirable TWA: 0.1 mg/m³ (vacated)	IDLH: 50 mg/m³ respirable dust TWA: 0.05 mg/m³ respirable dust
Kaolin 1332-58-7	-	TWA: 15 mg/m³ total dust TWA: 5 mg/m³ respirable fraction (vacated) TWA: 10 mg/m³ total dust (vacated) TWA 5 mg/m³ respirable fraction	TWA: 15 mg/m³ total dust TWA: 5 mg/m³ respirable dust
Bentonite 1302-78-9	TWA 1 mg/m³ respirable fraction	-	-

Appropriate Engineering Controls

Engineering Measures: Showers
Eyewash Stations
Ventilation Systems

Individual Protection Measures, such as Personal Protective Equipment

Eye/Face Protection: If splashes are likely to occur, wear: Safety glasses with side shields.

Skin and Body Protection: Impervious gloves.

Respiratory Protection: No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn.

Hygiene Measures: Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on Basic Physical and Chemical Properties

Physical State: Liquid
Appearance: Black
Odor: Coal Tar Odor
Odor Threshold: No Information Available

Property	Values	Remarks/Method
pH	No data available	None known
Melting Point/Range	No data available	None known
Boiling Point/Boiling Range	100° C	None known
Flash Point	No data available	None known
Evaporation Rate	No data available	None known
Flammability (solid, gas)	No data available	None known
Flammability Limits in Air		
Upper flammability limit	No data available	
Lower flammability limit	No data available	

Vapor Pressure	No data available	None known
Vapor Density	No data available	None known
Specific Density	1.08-1.32 @ 77 F	None known
Water Solubility	Easily dispersible	None known
Solubility in other solvents	No data available	None known
Partition coefficient: n-octanol/water	No data available	None known
Autoignition Temperature	No data available	None known
Decomposition Temperature	No data available	None known
Viscosity	No data available	None known
Flammable Properties	Not Flammable	
Explosive Properties	No data available	
Oxidizing Properties	No data available	
VOC Content	No data available	

10. STABILITY AND REACTIVITY

Reactivity:	No data available
Chemical Stability:	Stable under recommended storage conditions.
Possibility of Hazardous Reactions:	None under normal processing.
Hazardous Polymerization:	Hazardous polymerization does not occur.
Conditions to Avoid:	Incompatible Products.
Incompatible Materials:	Strong oxidizing agents. Acids.
Hazardous Decomposition Products:	Carbon Oxides, Nitrogen Oxides (NOx), Sulfur Oxides

11. TOXICOLOGICAL INFORMATION

Information on Likely Routes of Exposure

Product Information

Inhalation:	May cause irritation of respiratory tract.
Eye Contact:	Contact with eyes may cause irritation.
Skin Contact:	May cause irritation.
Ingestion:	Ingestion may cause stomach discomfort.

Chemical Name	LD50 Oral	LD50 Dermal	LD50 Inhalation
Bentonite	>5000 mg/kg (Rat)	-	-
Quartz	500 mg/kg (Rat)		

Symptoms Related to the Physical, Chemical, and Toxicological Characteristics

Symptoms: No information available.

Delayed and Immediate Effects and also Chronic Effects from Short and Long Term Exposure

Sensitization: No information available.

Mutagenic Effects: No information available.

Carcinogenicity: The table below indicates whether each agency has listed any ingredient as a carcinogen. The IARC, NTP, and OSHA do not list asphalt as a carcinogen. In general, the oxidation of polycyclic aromatic hydrocarbons destroys their carcinogenic potential. Petroleum asphalt, shale oil asphalts, and coal tars show distinct variation in their relative carcinogenicity for experimental animals. This product contains crystalline silica (quartz) in a non-respirable form. Inhalation of crystalline silica is unlikely to occur from exposure to this product.

Chemical Name	ACGIH	IARC	NTP	OSHA
Coal Tar Pitches	A1	Group 1	Known	X
Quartz	A2	Group 1	Known	X

ACGIH: (American Conference of Governmental Industrial Hygienists)
A1 – Known Human Carcinogen
A2 – Suspected Human Carcinogen
IRAC: (International Agency for Research on Cancer)
Group 1 – Carcinogenic to Humans
NTP: (National Toxicity Program)
Known – Known Carcinogen
OSHA: (Occupational Safety & Health Administration)
X – Present

Reproductive Toxicity:	No information available.
STOT - Single Exposure:	No information available.
STOT – Repeated Exposure:	No information available.
Aspiration Hazard:	No information available.

Numerical Measures of Toxicity – Product
The following values are calculated based on Chapter 3.1 of the GHS document

LD50 Oral: 75299 mg/kg; Acute toxicity estimate

12. ECOLOGICAL INFORMATION

Ecotoxicity
The environmental impact of this product has not been fully investigated.

Chemical Name	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Daphnia Magna (Water Flea)
Bentonite 1302-78-9		LC50 96 h: 8.0-19.0 g/L (Salmo gairdneri) LC50 96 h: = 19000 mg/L static (Oncorhynchus mykiss)		

Persistence and Degradability: No information available.

Bioaccumulation

Chemical Name	Log Pow
Coal Tar Pitches	6.04

Other Adverse Effects: No information available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods: This material, as supplied, is not a hazardous waste according to Federal regulations (40 CFR 261). This material could become a hazardous waste if it is mixed with or otherwise comes in contact with a hazardous waste, if chemical additions are made to this material, or if the material is processed or otherwise altered. Consult 40 CFR 261 to determine whether the altered material is a hazardous waste. Consult the appropriate state, regional, or local regulations for additional requirements.

Contaminated Packaging: Do not re-use empty containers.

14. TRANSPORTATION INFORMATION

DOT: Not regulated

15. REGULATORY INFORMATION

International Inventories
TSCA – Complies
DSL/NDSL – Complies

Legend
TSCA – United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL – Canadian Domestic Substances List/Non-Domestic Substances List

U.S. Federal Regulations
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product contains a chemical or chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372:

SARA 311/312 Hazard Categories

Acute Health Hazard	No
Chronic Health Hazard	Yes
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

CERCLA
This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific requirements at the local, regional, or state level pertaining to releases of this material.

U.S. State Regulations
California Proposition 65:

Chemical Name	CAS Number	California Prop. 65
Quartz	14808-60-7	Carcinogen

U.S. State Right-To-Know Regulations
"X" designates that the ingredients are listed on the state right to know list.

Chemical Name	New Jersey	Massachusetts	Pennsylvania	Illinois	Rhode Island
Coal Tar Pitches	X	X	X	X	
Quartz	X	X	X	-	X
Kaolin	X	X	X		X

U.S. EPA Label Information
EPA Pesticide Registration Number: Not applicable

16. OTHER INFORMATION

NFPA	**Health Hazard:** 1	**Flammability:** 0	**Instability:** 0	**Physical and Chemical Hazards-**
HMIS	**Health Hazard:** 1*	**Flammability:** 0	**Physical Hazard:** 0	**Personal Protection: X**

**Indicates a chronic health hazard.*

Revision Date: 13-Oct-2016
Revision Note: No information available.

General Disclaimer
The information provided on this SDS is correct to the best of our knowledge, information, and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

ATTACHMENT 3

PDC MATERIAL SAFETY DATA SHEETS

MATERIALS SAFETY DATA SHEET

Medical Emergencies
CHEMTREC Assistance:
800-424-9300
Customer Assistance:
412/721-9212

KAE Paving Consultants, Inc.
P. O. Box 1126.
Wexford PA 15090

This MSDS was produced on September 8, 2009 for
Asphalt Restoration Technology Systems, Inc..

Section 1 – Product Identification:

Product Code: PDC
Label Name: Pavement Dressing Conditioner
Synonym: PDC Coal Tar Sealer & Rejuvenator
Chemical Class: Polycyclic and light aromatic hydrocarbons
Hazardous Material Identification System (HMIS) Classification:
Health: 2* Flammability: 2 Reactivity: 0
Personal Protection: depends upon conditions

Section 2 – COMPOSITION/WORKPLACE EXPOSURE LIMITS:

Component	CAS Reg. Number	Appr. Pct.	--- OSHA-PEL --- TWA	Ceiling	--- ACGIH TLV --- TWA	STEL
1. Refined coal tar	65996-93-2	<50	0.2 mg/m3*	NE	0.2 mg/m3* A1	NE
2. Light arom. solvent naphtha	64742-95-6	<35	50ppm***	NE	100 ppm***	NE
3. BPR **	N/A	<30				

Notes on Exposure Limits: NE = Not Established

- *For coal-tar pitch volatiles, benzene-soluble fraction.
- ** See Section 13
- *** For Stoddard Solvent, a similar material.

Section 3 – HEALTH HAZARDS:

Inhalation: Mist or vapor can irritate the respiratory tract. Overexposure to vapors can cause headache, dizziness, and/or nausea. Prolonged exposure to airborne concentrations significantly beyond workplace exposure limits can cause respiratory difficulty, convulsions, and possible cardiovascular collapse.

Eye Exposure: Vapor and liquid can irritate eyes. Direct contact may cause burning, tearing and redness. Repeated or prolonged exposure may cause eye damage.

Skin Exposure: Liquid can cause skin irritation and dermatitis, including acne. Coal tar pitch is a phototoxic substance which, in the presence of ultraviolet light (sunlight) can cause a skin reaction similar to an exaggerated sunburn, frequently causing blisters. Hot material can cause severe heat burns.

Ingestion: Swallowing can cause severe gastrointestinal irritation, nausea, vomiting and depression of the central nervous system. Solvent can enter the lungs during swallowing or vomiting, causing lung inflammation and damage.

Delayed Effects: Long-term overexposure to coal tar pitch can affect skin pigmentation. It can cause growths on the skin or skin cancer. It may cause cancer of the lungs, kidneys or bladder.

Carcinogenicity Determinations: Coal tar pitch has been determined by IARC to be a human carcinogen. Coal tar pitch and several of its specific ingredients have been determined by NTP to cause cancer in experimental animals. Coal tar, when cured, is virtually inert.

Section 4 – FIRST AID MEASURES:

Inhalation: Remove subject to fresh air immediately. Give artificial respiration if breathing has stopped. Administer oxygen if breathing is difficult. Consult a physician after reviving unconscious victim or if symptoms persist.

Eye Contact: Flush eyes with plenty of water for at least 15 minutes. Consult a physician if irritation persists.

Skin Contact: If contacted by unheated liquid, remove contaminated clothing. Then remove material from skin with vegetable oil and wash thoroughly with soap and water. Hydrocortisone cream may be used for relief of skin irritation. Consult a physician if irritation persists. If contacted by hot liquid, do not remove clothing in affected areas. Instead, immerse affected areas immediately in ice-cold water until all heat has dissipated. Then wrap them in gauze and get medical attention promptly.

Ingestion: Do not give anything by mouth. Do not induce vomiting; pulmonary complications can result. Consult a physician or poison control center at once.

Section 5 – FIRE HAZARDS AND THEIR MANAGEMENT:

Ingestion Data:

Flash Point:	125 – 135 F
Lower Flammable Limit:	0.5 percent (est.)
Upper Flammable Limit:	6 percent (est.)
Autoignition Temperature:	Not determined
Combustion Products:	can include oxides of nitrogen, carbon and possible sulfur.

Fire Fighting Guidelines: Extinguishing media: Use Class B extinguishant, e.g., dry chemical, foam, carbon dioxide, or water fog. In closed tanks, water or foam may cause frothing or eruption. Wear respirator (pressure demand, self-contained breathing apparatus, MSHA/NIOSH-approved), and full protective gear for working fires. Cool exposed containers with water spray.

Section 6 - ACCIDENTAL RELEASE MEASURES:

Personal Protection: Follow all precautions given in Section 8, and, in addition, wear permeation-resistant, elastomeric boots or overshoes.

Clean Up: Eliminate all sources of ignition and, if indoors, ventilate spill area. Stop source of spill or leak if possible. Contain spillage by diking with sand, earth, or other inert material in order to prevent spillage from entering sewers or open bodies of water and/or to prevent soil contamination. In compliance with 40 CFR Part 302, report the release immediately to the National Response Center if amount released exceeds 75 pounds, an amount based upon the concentrations of benzo(a)pyrene and benzo(b)fluoranthene present in this material and listed in Table 302.4. Allow hot material to cool, then transfer spillage to labeled recovery containers.

Section 7 – HANDLING AND STORAGE:

Store containers separate from oxidizers, and meet, as a minimum, all application requirements of ANSI/NFPA 30 – Flammable and Combustible Liquids Code (1990) as it applies to Class II liquids. If material temperature is above its flashpoint, handle as a Class I liquid.

Section 8 – PROTECTION FROM OVEREXPOSURE:

Ventilation and Containment: Keep containers closed when not in use. If indoors, use either local or general exhaust ventilation sufficient to keep vapor and fume levels below applicable exposure limits. If outdoors, stay upwind whenever practical to do so.

Respiratory Protection: If ventilation/containment measures do not reliably protect against inhalation overexposure, wear MSHA/NIOSH-approved respirator suitable for protection from the vapor concentrations encountered.

Eye Protection: Wear splash goggles (ANSI Z87.1-1990) when pouring or transferring this material. Do <u>not</u> wear contact lenses.

Skin Protection: Avoid skin contact by wearing permeation-resistant, elastomeric gloves and clothes with long sleeves and pants. Replace elastomeric protective equipment whenever it becomes swollen, gummy, torn or shows evidence of barrier loss. Apply a solvent-resistant skin barrier cream to area of skin that may come in contact with material. If working out-of-doors, first apply sunscreen lotion with a high sun block protection factor to skin exposed to sunlight, then apply barrier cream.

Other Protective Measures: An eyewash station and emergency shower (ANSI Z358.1-1990) should be readily available.

Personal Hygiene: Remove product from skin with vegetable oil whenever observed; reapply barrier cream as appropriate. Wash hands and forearms with soap and water after handling, and especially before eating or smoking. Shower at end of work shift. Wash contaminated clothing before reuse.

Section 9 – PHYSICAL AND CHEMICAL DATA:

Appearance:	Black viscous liquid	Specific Gravity:	>1.04
Odor:	Hydrocarbon odor	Pct. Volatiles:	37 (est)
Water Solubility:	Negligible	Initial Boiling Pt.	150 C/ 313 F (est)
Vapor Density:	Above 1.0	Vapor Pressure:	2 mm Hg @ 20 C (est)

Section 10 – STABILITY AND REACTIVITY

Stability: This material is stable under normal conditions of storage and handling. That is, it does not react with common substances (air, water, etc.), nor decompose during foreseeable conditions of storage or use.

Reactivity: Materials react violently with strong oxidizers such as liquid chlorine, sodium or potassium hypochlorite, nitric acid and peroxides.

Section 11 – DISPOSAL

Containers: Empty containers may contain hazardous residues (vapor, liquid, or solid). All MSDS and label precautions should be observed until containers are reconditioned. Do not apply heat, flame-cut, or weld on container. Crush or puncture containers before discarding them to prevent unauthorized reuse.

Waste Disposal: Incinerate at a permitted facility in accordance with local and state regulations. In accordance with 40 CFR Parts 261 and 262, store and ship waste as Unlisted Hazardous Wastes Characteristic of Ignitability, RCRA #D-001, RQ: 100 lbs.

Section 12 – TRANSPORTATION REGULATIONS: The following information applies to ground shipments within North America, and may
not apply otherwise.

Bulk shipments – Bill of Lading Descriptions

Loading Temperature Range: Below 114 F:

RQ Combustible, nos NA 1999, PG III
(petroleum distillates, tar pitch/HAZ SUB: benzo(a)pyrene, benzo(b)fluoranthene)

Loading Temperature Range: Above 211 F

RQ, HOT, Flammable liquid elevated temperature, material, nos, e, NA9276, PG III
(petroleum distillates, tar pitch/HAZ SUB: benzo(a)pyrene, benzo(b)fluoranthene)

Section 13 – OTHER REGULATORY INFORMATION: The following ingredients are reportable under SARA Section 313 (40 CFR Part 37,
Subpart D):

Name	CAS Number	Concentration
Naphthalene	91-20-3	6.3
Anthracene	120-12-7	1.1

Coal Tar Oil *

*Contains

Component	CAS Reg. Number	Appr. Pct.	--OSHA-PEL -- TWA	Ceiling	-----ACGIH TLV ----- TWA	STEL
Acenaphthene	83-32-4	NE	NE	NE	NE	
Benzene (below 0.1 percent)	71-43-2		1 ppm	5 ppm STEL	0.3 ppm SKIN	NE
Biphenyl	92-52-4	0.2 ppm	NE		0.2 ppm	NE
Chrysene	218-01-9		0.2mg/m3*	NE	A2	NE
Cresols	1319-77-3		5 ppm SKIN	NE	5 ppm SKIN	NE
Dibenzofuran	132-64-9		NE	NE	NE	NE
Fluorene	86-73-7		NE	NE	NE	NE
Indan	496-11-7		NE	NE	NE	NE
2-Methylnaphthalene	91-57-6		NE	NE	NE	NE
9-Methylanthracene	779-02-2		NE	NE	NE	NE
Napthalene	91-20-3		10 ppm	NE	10 ppm	15 ppm
Phenanthrene	85-01-8		0.2 mg/m3*	NE	0.2 mg/m3*	NE

Phenol	108-95-2		5 ppm SKIN	NE	0.2 mg/m3*	NE
Pyrene	129-00-0		0.2 mg/m3*	NE	0.2 mg/m3*	NE
Quinoline	91-22-5	NE	NE	NE	NE	
Xylene	1330-20-7	100 ppm	NE	100 ppm	150 ppm	
Tar Oil	64746-31-3	20	None	None	None	

Notes on Exposure Limits: NE = Not Established.

- For benzene – (or cyclohexane) soluble fraction of coal-tar pitch volatiles.

ATTACHMENT 4

TURPENTINE MATERIAL SAFETY DATA SHEETS

Signs and Symptoms Of Exposure

See Potential Health Effects.

Medical Conditions Generally Aggravated By Exposure

None known.

4. First Aid Measures

Emergency and First Aid Procedures

INHALATION:

If user experiences breathing difficulty, move to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

SKIN CONTACT:

Wash with soap and water. If irritation persists, get medical attention.

EYE CONTACT:

Flush eyes with water for at least 15 minutes. Get immediate medical attention.

INGESTION:

Do not induce vomiting. Immediately call your poison control center, hospital emergency room, or physician immediately for instructions. Drink large quantities of water to dilute substance. Never give anything by mouth to an unconscious person.

5. Fire Fighting Measures

Flammability Classification: IC

Flash Pt: 97.00 F Method Used: TAG Closed Cup

Explosive Limits: LEL: No data. UEL: No data.

Fire Fighting Instructions

Self-contained respiratory protection should be provided for fire fighters fighting fires in buildings or confined areas. Storage containers exposed to fire should be kept cool with water spray to prevent pressure build-up. Stay away from heads of containers that have been exposed to intense heat or flame.

Flammable Properties and Hazards

Danger! Flammable! Keep away from heat, sparks, flame, and all other sources of ignition. Do not smoke. Extinguish all flames and pilot lights, and turn off stoves, heaters, electric motors and all other sources of ignition during use and until all vapors are gone. Beware of static electricity that may be generated by synthetic clothing and other sources.

Material floats on water.

Excessive temperatures and/or contact with air may cause decomposition or oxidation.

Hazardous Combustion Products

Carbon monoxide and carbon dioxide.

Extinguishing Media

Use carbon dioxide, dry powder, or foam.

Unsuitable Extinguishing Media

No data available.

6. Accidental Release Measures

Steps To Be Taken In Case Material Is Released Or Spilled

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind, out of low areas, and ventilate closed spaces before entering. Shut of ignition sources; keep flares, smoking or flames out of hazard area.

Small Spills: take up liquid with sand, earth or other noncombustible absorbent material and place in a plastic container where applicable.

Large Spills: dike far ahead of spill for later disposal.

7. Handling and Storage

Precautions To Be Taken in Handling

Read carefully all cautions and directions on product label before use. Since empty container retains residue, follow all label warnings even after container is empty. Dispose of empty container according to all regulations. Do not reuse this container.

Precautions To Be Taken in Storing

Keep container tightly closed when not in use. Store in a cool, dry place. Do not store near flames or at elevated temperatures.

8. Exposure Controls/Personal Protection

Respiratory Equipment (Specify Type)

For occasional consumer use - Use with adequate ventilation to prevent a build-up of vapors in confined areas. Open windows or position fans to provide cross ventilation. If a mild to strong odor is noticeable, ventilation is not adequate.

For OSHA controlled workplace and other regular users - Use only with adequate ventilation under engineered air control systems designed to prevent exceeding appropriate TLVs.

For occasional use, where engineered air control is not feasible, use properly maintained and properly fitted NIOSH approved respirators. A dust mask does not provide protection against vapors.

Eye Protection

Safety glasses, chemical goggles, or face shields are recommended to safeguard against potential eye contact, irritation, or injury. Contact lenses should not be worn while working with chemicals.

Protective Gloves

Wear impermeable gloves. Gloves contaminated with product should be discarded.

Other Protective Clothing

Various application methods can dictate use of additional protective safety equipment, such as impermeable aprons, etc., to minimize exposure.

Engineering Controls (Ventilation etc.)

Use only with adequate ventilation to prevent buildup of vapors. Do not use in areas where vapors can accumulate and concentrate, such as basements, bathrooms or small enclosed areas. Whenever possible, use outdoors in an open air area. If using indoors open all windows and doors and maintain a cross ventilation of moving fresh air across the work area. If strong odor is noticed or you experience slight dizziness, headache, nausea or eye-watering -- STOP -- ventilation is inadequate. Leave area immediately and move to fresh air.

Work/Hygienic/Maintenance Practices

Wash hands thoroughly after use and before eating, drinking, or smoking.

Clothing that becomes soiled with product should be removed as soon as possible and laundered separately.

A source of clean water should be available in the work area for flushing of eyes and skin.

9. Physical and Chemical Properties

Physical States: [ ] Gas [X] Liquid [ ] Solid
Melting Point: No data.
Boiling Point: 315.00 F - 338.00 F
Autoignition Pt: No data.
Flash Pt: 97.00 F Method Used: TAG Closed Cup
Explosive Limits: LEL: No data. UEL: No data.
Specific Gravity (Water = 1): 0.86 at 25.0 C
Density: 7.189 LB/GL at 75.0 F
Bulk density: No data.
Vapor Pressure (vs. Air or mm Hg): <=4 MM HG at 20.0 C
Vapor Density (vs. Air = 1): > 1
Evaporation Rate (vs Butyl Acetate=1): < 1
Solubility in Water: No data.
Solubility Notes

less than 0.1% -- Floats on water.

Percent Volatile: 100.0 %
Heat Value: No data.
Particle Size: No data.
Corrosion Rate: No data.
pH: No data.
Appearance and Odor

Colorless.
Typical pine terpene.

10. Stability and Reactivity

Stability: Unstable [ ] Stable [X]
Conditions To Avoid - Instability

No data available.

Incompatibility - Materials To Avoid

Incompatible with strong oxidizing agents, strong bases, and strong acids

Hazardous Decomposition Or Byproducts

carbon monoxide and carbon dioxide

Hazardous Polymerization: Will occur [ ] Will not occur [X]
Conditions To Avoid - Hazardous Polymerization

No data available.

11. Toxicological Information

No data available.

Carcinogenicity/Other Information

No data available.

Hazardous Components (Chemical Name)	CAS #	NTP	IARC	ACGIH	OSHA
1. Turpentine {Gumspirits; Supfate wood turpentine}	8006-64-2	n.a.	n.a.	A4	n.a.

12. Ecological Information

Related chemicals are known to be biodegradable and non-accumulating in the environment.

13. Disposal Considerations

Waste Disposal Method

Dispose in accordance with applicable local, state, and federal regulations.

14. Transport Information

LAND TRANSPORT (US DOT)

DOT Proper Shipping Name UN1299, Turpentine, 3, PGIII, LTD. QTY.

Additional Transport Information

For D.O.T. information, contact W.M. Barr Technical Services at 1-800-398-3892.

The supplier may apply one of the following exceptions: Combustible Liquid, Consumer Commodity, Limited Quantity, Viscous Liquid, Does Not Sustain Combustion, or others, as allowed under 49CFR Hazmat Regulations. Please consult 49CFR Subchapter C to ensure that subsequent shipments comply with these exceptions.

15. Regulatory Information

US EPA SARA Title III

Hazardous Components (Chemical Name)	CAS #	Sec.302 (EHS)	Sec.304 RQ	Sec.313 (TRI)	Sec.110
1. Turpentine {Gumspirits; Supfate wood turpentine}	8006-64-2	No	No	No	

US EPA CAA, CWA, TSCA

Hazardous Components (Chemical Name)	CAS #	EPA CAA	EPA CWA NPDES	EPA TSCA	CA PROP 65
1. Turpentine {Gumspirits; Supfate wood turpentine}	8006-64-2	No		Inventory	

SARA (Superfund Amendments and Reauthorization Act of 1986) Lists:

Sec.302: EPA SARA Title III Section 302 Extremely Hazardous Chemical with TPQ. * indicates 10000 LB TPQ if not volatile.

Sec.304: EPA SARA Title III Section 304: CERCLA Reportable + Sec.302 with Reportable Quantity. ** indicates statutory RQ.

Sec.313: EPA SARA Title III Section 313 Toxic Release Inventory. Note: -Cat indicates a member of a chemical category.

Sec.110: EPA SARA 110 Superfund Site Priority Contaminant List

TSCA (Toxic Substances Control Act) Lists:

Inventory: Chemical Listed in the TSCA Inventory.

5A(2): Chemical Subject to Significant New Rules (SNURS)

6A: Commercial Chemical Control Rules

8A: Toxic Substances Subject To Information Rules on Production

8A CAIR: Comprehensive Assessment Information Rules - (CAIR)

8A PAIR: Preliminary Assessment Information Rules - (PAIR)

8C: Records of Allegations of Significant Adverse Reactions

8D: Health and Safety Data Reporting Rules

8D TERM: Health and Safety Data Reporting Rule Terminations

12(b): Notice of Export

Other Important Lists:

CWA NPDES: EPA Clean Water Act NPDES Permit Chemical

CAA HAP: EPA Clean Air Act Hazardous Air Pollutant

CAA ODC: EPA Clean Air Act Ozone Depleting Chemical (1=CFC, 2=HCFC)

CA PROP 65: California Proposition 65

International Regulatory Lists:

EPA Hazard Categories:

This material meets the EPA 'Hazard Categories' defined for SARA Title III Sections 311/312 as indicated:

[X] Yes [ ] No Acute (immediate) Health Hazard
[X] Yes [ ] No Chronic (delayed) Health Hazard
[X] Yes [ ] No Fire Hazard
[ ] Yes [X] No Sudden Release of Pressure Hazard
[ ] Yes [X] No Reactive Hazard

16. Other Information

Company Policy or Disclaimer

The information contained herein is presented in good faith and believed to be accurate as of the effective date shown above. This information is furnished without warranty of any kind. Employers should use this information only as a supplement to other information gathered by them and must make independent determination of suitability and completeness of information from all sources to assure proper use of these materials and the safety and health of employees. Any use of this data and information must be determined by the user to be in accordance with applicable federal, state and local laws and regulations.

ATTACHMENT 5

US ARMY CORPS OF ENGINEERS DOCUMENTATION

U.S. Army Corps of Engineers
Surface Areas Material Utilization
Catalog (date May 1990)

MATERIAL: Pavement Dressing Conditioner (PDC)

DESCRIPTION:

PDC is a proprietary bituminous pavement rejuvenator and sealer manufactured by K.A.E. Paving Consultants, Inc., Pittsburgh, Pennsylvania 15233-4606, Telephone No. (412) 488-7311. PDC is a blend of coal tar oils that is cold applied to bituminous and portland cement concrete (PCC) pavements with a bituminous distributor.

AREAS OF APPLICATION (AS RECOMMENDED BY MANUFACTURER):

1. Bituminous pavement rejuvenator.

2. Fuel resistant seal for use in fuel spillage areas.

3. Protective coating for concrete to protect it from chemical attack and erosion.

4. Protective coating for concrete prior to bituminous overlay.

5. Rejuvenator used during heater remix operations.

PHYSIOGRAPHIC FACTORS:

PDC is normally applied through a pressure distributor at a temperature of 60°F to 110°F. The pavement surface must be dry and the pavement surface temperature shall be 50°F or higher. Applications at lower pavement temperatures may be allowed when a longer curing time is acceptable. Higher temperatures are desired because the material will penetrate deeper and cure faster. The manufacturer claims that PDC has a double-action process where part of the material penetrates into and chemically rejuvenates the asphalt and the remainder protects the surface of the pavement from climatic effects and fuel spills. The proprietary material has an effectively unlimited shelf life and is available in train and car tank loads and in 55-or 5-gallon drums.

DISCUSSION AND RECOMMENDATIONS:

Bituminous Pavement. PDC is currently being used by several military bases and states and also private companies. The rate of application of PDC will depend on the condition of the surface of the pavement to be treated. The more open the texture of the pavement surface the greater the application rates that can be applied. Therefore, it is important to place test sections for each pavement condition to determine a proper application rate. The curing time will vary according to local climatic conditions. Under optimum conditions, the pavement can be opened to traffic within 12 to 24 hours. Recommended rates are 0.05 to 0.07 gallon per square yard at a cost of $0.45 to $1.00 per square yard applied in one coat. PDC can effectively extend the service life of a pavement by lowering the viscosity and raising the penetration of the surface asphalt cement. Cost savings can be achieved by recognizing the need for a rejuvenator early and taking action rather than letting the pavement deteriorate to a poor condition requiring extensive repairs. Application of PDC will tend to reduce the skid resistance of a pavement; however, when applied at the correct application rate, the skid

resistance should return to preapplication levels within 24 to 48 hours. The actual time will depend on the type of pavement surface, weather conditions, and the amount of material applied. PDC may be applied to runways, high-speed curves, intersections, etc. where a reduction in skid resistance would be extremely dangerous provided precautions are taken to control traffic until the skid resistance returns to pretreatment levels. PDC has been successfully applied to several runways at commercial airports and also to the asphalt pavement of a high speed raceway.

PCC Pavement. According to the manufacturer, PDC has demonstrated the ability to salt proof PCC. A single application of from 0.04 to 0.06 gallons per square yard will protect uncracked PCC from snow and ice removal chemicals that can cause spalling. On weathered concrete, higher application rates may be required. As previously mentioned, test sections should be used in all cases to determine application rates. The manufacturer also recommends using PDC as a protective coating (prime coat) of PCC prior to bituminous overlay. The manufacturer recommends PDC for use in hot in-place recycling operations; although currently, the material has not been used under controlled conditions for this purpose.

SUMMARY:

PDC is a suitable material for the maintenance of bituminous pavement. It has demonstrated penetrating and softening characteristics. Careful selection of the pavements to be treated and the amounts applied are critical as the skid resistance of the pavement can be lowered for a period of time after application.

POINTS OF CONTACT:

J. E. Shoenberger
Waterways Experiment Station
Vicksburg, MS 39180-6199
Telephone No. (601) 634-3553

G. L. Carr
Waterways Experiment Station
Vicksburg, MS 39180-6199
Telephone No. (601) 634-3387

ATTACHMENT 6

CT DEPARTMENT OF PUBLIC HEALTH
COAL TAR TECHNICAL BRIEF, 2014

CT DEPARTMENT OF PUBLIC HEALTH EHS
CIRCULAR LETTER #2016-49

Environmental Health Technical Brief
Coal Tar Driveway Sealant

Environmental & Occupational Health Assessment Program

Issue #10 September 2014




Resealing driveways is a common maintenance activity by homeowners. However, this can involve the handling of a product which contains toxic and carcinogenic ingredients. The product, coal tar sealant, may also be used by commercial contractors who seal driveways, access roads and parking lots. When the sealant is applied it releases vapors which can be a transient odor and exposure issue. However, recent data show that the greater concern is from the degradation of the sealed pavement surface over time; this can release toxic ingredients in coal tar, thus creating risks to human health and the environment. An alternative product is an asphalt-based sealant. It does not contaminate the environment and is an effective sealant. However, homeowners and particularly contractors may still use the coal tar-based sealant. This technical brief describes research by the United States Geological Survey (USGS) on this topic and its implications for protecting public health in Connecticut.

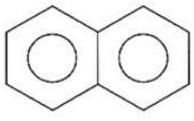
What is Coal Tar Sealant?

The main ingredient of coal tar sealant is coal tar pitch, a heavy viscous black oil that is a byproduct of coking operations and other processes involving coal (e.g., coal gasification). The sealant is painted or sprayed onto the pavement surface and allowed to cure before being driven or walked upon. The sealant protects the underlying road surface so that much more costly repaving can be avoided.

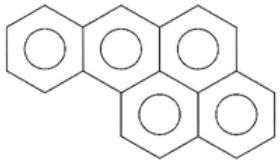
Coal tar pitch is a complex mixture of over 10,000 chemicals, a sizeable percentage of which is from the class called polycyclic aromatic hydrocarbons (PAHs). The PAH content of coal tar has been estimated at 5% (50,000 ppm) (USGS: http://tx.usgs.gov/sealcoat.html), a high concentration compared to background soil concentrations of PAHs which are typically less than 10 ppm.

What are the Potential Health Risks?

PAHs are a wide variety of multi-ringed compounds that include numerous carcinogens and chemicals capable of other kinds of toxicity. Highlighted in the figure below are naphthalene, a PAH of moderate volatility, which can damage the liver, respiratory tract, eyes and nose (if inhaled). Also shown in the figure is benzo(a)pyrene (BaP), a potent human carcinogen. These chemicals are relatively stable in nature but when taken up by humans and wildlife are converted to more toxic and reactive metabolites.



Naphthalene
$C_{10}H_8$



Benzopyrene
$C_{20}H_{12}$

BaP is the most heavily studied PAH as it is one of the most toxic and carcinogenic members of this class. The BaP content of coal tar is approximately 2%. While BaP is also present in air pollution, cigarette smoke and char-broiled meats, its high content in coal tar makes this a potentially important source of exposure. The only other significant source of coal tar exposure are coal tar based ointments and shampoos for the treatment of psoriasis and dandruff. While coal tar is a potent skin carcinogen in animal studies (e.g., Siddens et al. 2012), the cancer risk from the dermatological use of coal tar has not been clearly established. As described below, USGS has measured PAH levels in house dust adjacent to coal tar sealed parking lots and converted these measurements to estimates of human cancer risk.

The USGS Studies

Through a series of detailed studies, USGS researchers identified coal tar sealant as an important source of PAHs, initially finding this to be true for streams and lakes, and then to street and house dust. These studies have been reported in peer reviewed publications and USGS reports that are available on their website (http://tx.usgs.gov/sealcoat.html).

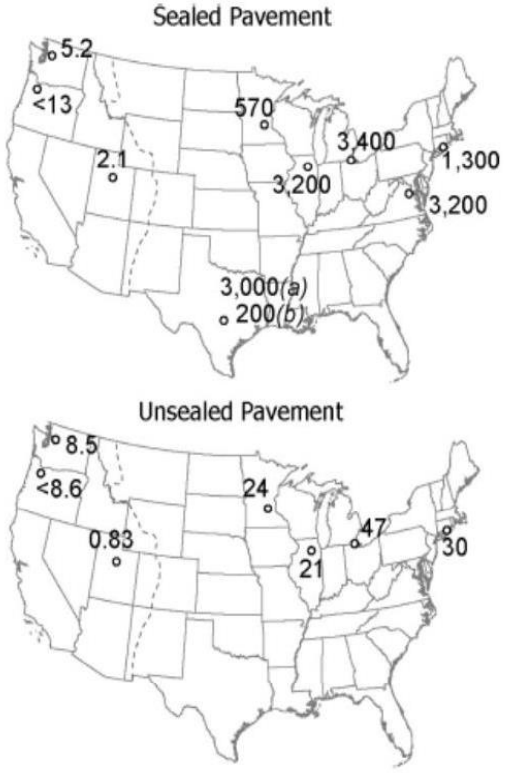


Figure 1. USGS PAH Data for Sealed and Unsealed Parking Lots Across the U.S.

Discovery of PAH Release from Applied Coal Tar Sealant

The USGS has a mandate to monitor water and sediment quality across the country. Their evaluation of lake sediment has typically shown decreasing trends of legacy contaminants such as banned pesticides and PCBs. However, in 2005 USGS reported an increasing trend of PAHs in lake sediment from suburban and urban areas. This trend led to a search for the source of the increasing PAH in the environment. PAHs are well known as combustion byproducts and so are common air pollutants, a factor which can contribute to the levels in water bodies. However, air pollutant levels of PAHs have not been rising dramatically in recent years so this was unlikely to be the explanation. Other potential sources of PAHs such as used motor oil, do not have high enough PAH concentrations to explain the sediment data. The first clue was a study in Austin TX which identified high concentrations of PAHs in the sediments of a small stream in a residential area; when the concentrations were followed upstream they pointed to a drainage outfall from a parking lot that had been coated with coal tar sealant. Follow-up investigations demonstrated that the dust swept up from parking lots treated with coal tar sealant had very high PAH content (in the thousands of ppm) while lots not sealed with coal tar were on average, 80 fold lower (Van Metre et al. 2009).

Figure 1 summarizes these results, first by comparing sealed lots in the eastern and western US. Coal tar sealant is sold in the eastern and central US but is not available for purchase in the far west; this differential is clearly shown in the top map in Figure 1. The ***un***sealed lots from midwestern and eastern locations had very low PAH content in dust (bottom of Figure 1). This indicates that lots in the same geographic zone and thus exposed to similar ambient conditions had vastly different PAH content depending upon whether they were sealed (top vs bottom map). The PAH content of soil and street dust near the sampled lots reflected the differences seen on the lots suggesting that the sealcoated lots represent a source of PAH contamination not only to local streams but also to the neighboring community (Van Metre et al. 2009).

Evaluation of PAH Contamination of Homes

USGS also sampled the floor dust in 23 ground floor apartments either adjacent to coal tar sealed parking lots or adjacent to unsealed lots (Mahler et al. 2010). They measured the levels of 16 priority pollutant PAHs, 7 of which are considered by USEPA to be carcinogenic. The results are summarized in Figure 2. Coal tar lots had 530 times higher PAH level in pavement dust than did the non-sealed lots. Indoor house dust showed on average 25 fold high PAH content for the apartments adjacent to coal tar lots as compared to non-coal tar. A variety of factors that could contribute to indoor levels of PAHs (e.g., smoking, surrounding urban land use) were taken into account and did not offer an explanation for the high PAH levels in some apartments and not others. Rather, the strongest correlate of apartment PAH levels was the nearby presence of a coal tar sealed parking lot.

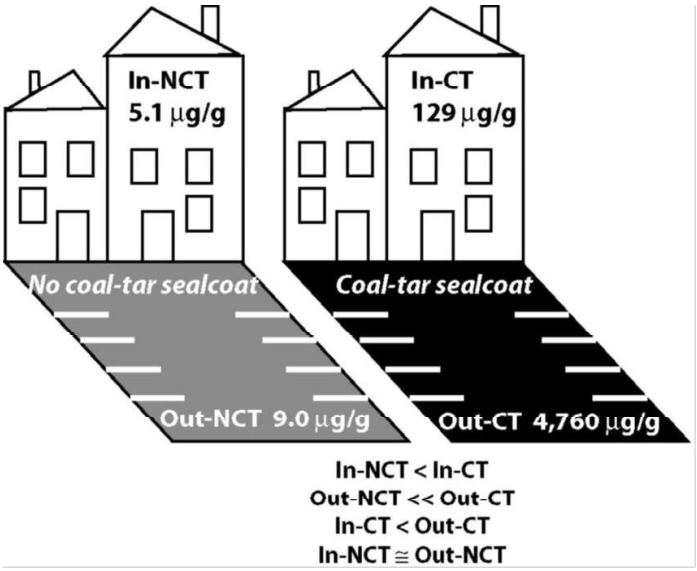
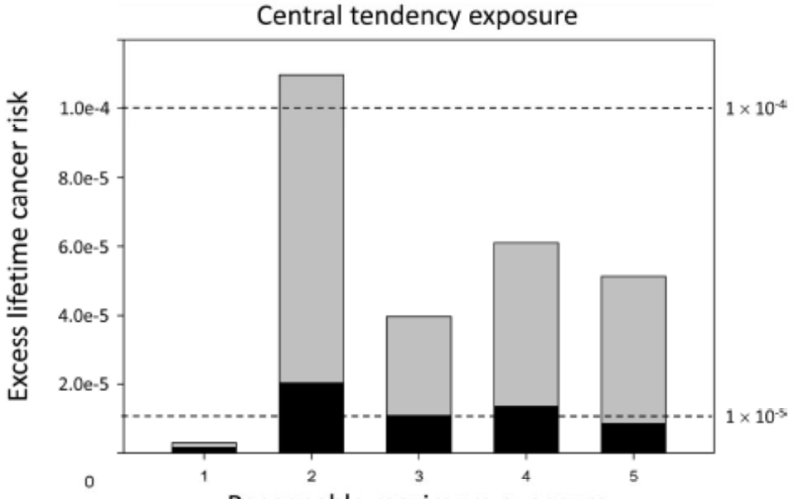


Figure 2. USGS Results at 23 Ground Level Apartments Next to Paved Parking Lots. In-CT means indoor dust next to coal tar lot; In-NCT means indoor dust next to non-coal tar lot; Out-CT means outdoor dust on a coal tar sealed lot; Out-NCT means outdoor dust on a non-coal tar lot.

Evaluation of Cancer Risk from House Dust Contaminated with Coal Tar PAHs

USGS combined with Baylor University to calculate the cancer risk associated with the data from the 23 homes sampled for soil and house dust (Williams et al. 2013). Five different exposure scenarios were constructed representing ingestion of soil/house dust adjacent to coal tar sealed lots for the entire lifespan vs from only certain periods during childhood and compared to background conditions (no coal tar sealant in the immediate environment). Elevated cancer risk above de minimis (1 in a million) was found for all coal-tar related scenarios but not for the background scenario (Figure 3). House dust ingestion on a daily basis was estimated to contribute roughly 1 in 100,000 cancer risk (10x de minimis) while ingestion of house dust plus soil adjacent to the apartment was estimated to create risks over 1 in 10,000 (100x de minimis). The reasonable maximum risks in Figure 3b represent high end but still realistic rates of soil and dust ingestion (95^{th} %). The PAH driving the risk was BaP (75% of the cancer risk); this PAH is well characterized for its cancer potential and risk to human health. Overall, risks from ingestion of house dust and soil adjacent to coal tar sealed lots was 40 fold greater than the background risk, and these estimates do not take into account children's play on the parking lots themselves. Parking lot dust was shown to have the highest PAH content. Further, the USGS sampling was conducted 2.5 years after coal tar sealcoat had been banned in the city where the samples were taken (Austin TX). After this period of weathering, PAH levels in dust may have declined. For perspective on this exposure relative to typical background exposures, food is an important source of PAHs, especially char-broiled meats. The level of PAH exposure from house dust ingestion was 2 to 3 times higher than dietary ingestion of PAHs for young children (Williams et al. 2013).

3a.



3b.

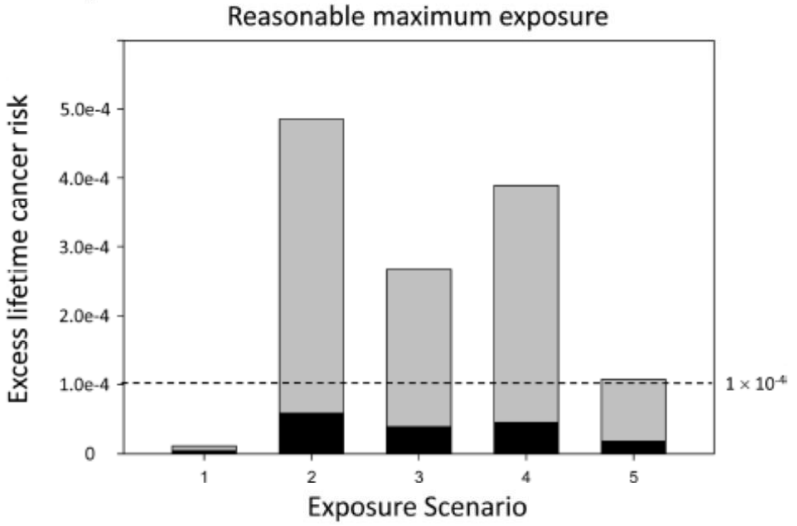


Figure 3. Central and Upper Bound (reasonable maximum) Estimates of Cancer Risk Associated with 5 Coal Tar Scenarios: 1) Background - no coal tar sealant; 2) Lifetime exposure – 70 years of living adjacent to coal tar lot; 3) Early childhood – first 6 years adjacent to coal tar lot; 4) Full childhood – first 18 years adjacent to coal tar lot; 5) Adult only – childhood free of coal tar contamination. Each bar composed of dark shading (house dust risk) and light shading (soil risk).

The significance of these findings is that coal tar sealant has clearly been shown to release PAHs into the human environment to contaminate parking lot surfaces and adjacent soil and indoor house dust. This contamination will also occur with coal tar treated driveways. These are all areas where children play which will naturally lead to exposure via the inadvertent ingestion of soil and dust. Some of the PAHs present in coal tar are potent carcinogens (e.g., BaP). This leads to an elevated cancer risk, estimated by USGS and Baylor Univ to be 40 fold greater than the background from soil and house dust not affected by the breakdown of coal tar sealant. This PAH source of exposure is substantial relative to dietary exposure and thus represents a controllable source of cancer risk.

Is there an alternative sealant?

Yes, driveways, access roads and parking lots can be sealed with an asphalt sealant that has an oil rather than coal-tar basis. This alternative is low in PAHs and is widely used in locales where coal tar sealant is not available for sale. Asphalt seal coat is comparable in cost and is sufficiently protective of pavement in low wear areas (e.g. driveways, parking lots) to hold up over time. A number of large retailers have stopped carrying coal tar sealants even in the Midwest and Eastern parts of the US. Thus, coal tar sealant is less available to homeowners than in the past but contractors and some homeowners may still get this product.

What is the regulatory status of coal tar sealant?

Coal tar sealant has been banned in two states, Washington and Minnesota, and in a number of cities and towns (e.g., Washington DC, Austin TX). We are not aware of any efforts at the federal (USEPA) or local (cities and towns in Connecticut) level to further regulate this product.

Options for managing this issue in Connecticut

Local health departments can educate the public regarding this consumer product on their webpage with link to fact sheets available on the internet (see below). Further, outreach to developers, pavers, property management companies and building owners can inform them of the risks associated with coal tar sealant while pointing out the alternative. Town Public Works departments should be aware of this information so that resealing at parks, schools and other town projects does not involve coal tar-based sealant. The local health department can also recommend to the town council to institute a local ordinance limiting the use of coal tar sealants (see model ordinance below).

Resources and References

Resources

- USA Today, 2013: Toxic Driveways? Cities Ban Coal Tar Sealants
- USGS Research
- Model Ordinance
- USEPA Fact Sheet
- University of Wisconsin Fact Sheet
- Great Lakes Fact Sheet

References

- Mahler BJ, Metre PC, Wilson JT, Musgrove M, Burbank TL, Ennis TE, Bashara TJ. (2010) Coal-tar-based parking lot sealcoat: an unrecognized source of PAH to settled house dust. Environ Sci Technol. 44: 894-900.
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- Van Metre PC, Mahler BJ, Wilson JT. (2009) PAHs underfoot: contaminated dust from coal-tar sealcoated pavement is widespread in the United States. Environ Sci Technol. 43: 20-5.
- Williams ES, Mahler BJ, Van Metre PC. (2013) Cancer risk from incidental ingestion exposures to PAHs associated with coal-tar-sealed pavement. Environ Sci Technol. 47: 1101-9.

For additional information, contact Dr. Gary Ginsberg (gary.ginsberg@ct.gov) at the CT Department of Public Health Environmental & Occupational Health Assessment Program (860-509-7740).

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

Raul Pino, M.D., M.P.H.
Commissioner

Dannel P. Malloy
Governor

Nancy Wyman
Lt. Governor

Environmental Health Section

EHS Circular Letter # 2016-49

DATE: November 1, 2016

TO: Local Health Directors

FROM: Brian Toal, Supervisor, Environmental and Occupational Health Assessment

RE: Important Reminder Regarding Coal Tar Sealants for Road Repair

The Connecticut Department of Public Health (DPH) is aware that towns in Connecticut have a need to reseal roads and other paved surfaces and may encounter contractors who propose to use coal tar-based sealants. An example of such an application occurred over the summer of 2016 in eastern Connecticut. CT DPH recommends against the application of coal tar-based road sealants because they can increase human exposure to carcinogenic polycyclic aromatic hydrocarbons (PAHs) in certain outdoor and indoor settings. Fortunately there is a good alternative, an asphalt based sealant, which is low in PAHs.

Background

CT DPH developed a Technical Brief and Fact Sheet in September 2014 describing the environmental and human health risks from coal tar based sealants. (These DPH materials were based upon research by the United States Geological Survey (USGS)). USGS has been tracking the environmental release of PAHs from coal tar based sealants as they break down over time from being driven on and weathering. USGS has documented increasing PAH levels in streams, lakes, street dust and indoor house dust in relation to the recent application of this type of road sealant. PAHs are well known carcinogens that can be present in polluted air, cigarette smoke and char-broiled foods. A public health goal is to minimize PAH levels in the environment and decrease exposures to children and other human receptors. Coal tar-based road and driveway sealants represent an unnecessary source of PAHs given that there are safer alternatives. Asphalt-based sealants work well on paved surfaces and do not contain high levels of PAHs or other highly toxic chemicals.

Phone: (860) 509-7740 • Fax: (860) 509-7785
410 Capitol Avenue, P.O. Box 340308
Hartford, Connecticut 06134-0308
www.ct.gov/dph

Example from Last Summer

The application of a coal tar-based product in a Connecticut town came to DPHôs attention in the summer of 2016. Town officials contracted with a company which offered to use a road ñrejuvenatorò which is a new description for such products. Inspection of the ingredients found it to contain a high percentage of coal tar. DPH contacted the USGS researchers who have been investigating coal tar-based sealants and they came to Connecticut to set up testing of the treated roads. This testing is ongoing and DPH will update our website once it is complete. However, the public health concerns and need to test could have been avoided had the town chosen an asphalt-based sealant.

Going Forward

Homeowners in Connecticut looking to reseal their driveway can only buy the safer, asphalt-based product at hardware stores. However, road resurfacing and repair contractors are in some cases still using coal tar-based products. It is important for towns to inquire what product the contractor intends to use and if it is coal tar-based, request the asphalt sealant instead. If questions arise regarding specific products (such as the ñroad rejuvenatorò example above), feel free to contact me or Gary Ginsberg at 860-509-7740, before it is applied.

cc: Suzanne Blancaflor, M.S., M.P.H., Chief
Environmental Health Section