

**AN EVALUATION OF  
PAVEMENT DRESSING CONDITIONER**

*Prepared for*

**TOWN OF POMFRET**

*Application on*

**LONGMEADOW DRIVE  
POMFRET CONNECTICUT**

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## 1. Abstract

On July 11<sup>th</sup> & July 12<sup>th</sup>, 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 rejuvenator 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 (PAHs), 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 circle roads are accesses. 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 1<sup>st</sup> 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 1<sup>st</sup> 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.

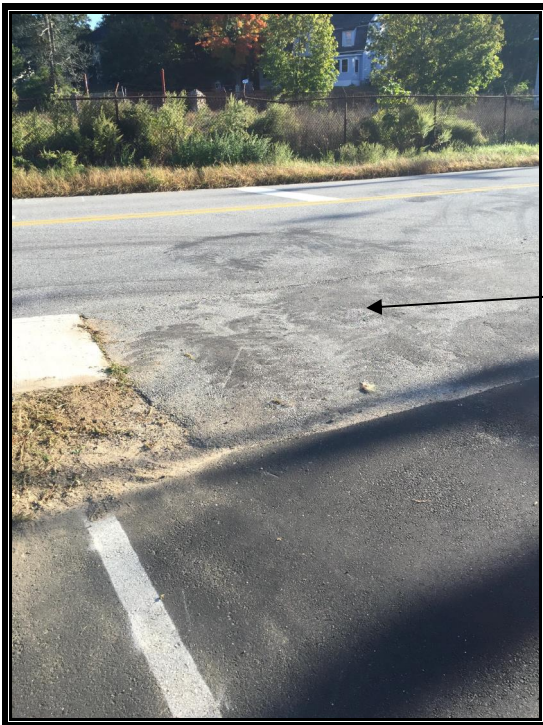


Photo #3: Tracking from new paving

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 1<sup>st</sup> inspection.

### 3. Additional Site Observations

KEA was retained by the Town of Pomfret on August 16<sup>th</sup> to evaluate the PDC application and a second site investigation was conducted on September 8<sup>th</sup>. 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 that did not appear to be covered at the time of the application. 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.

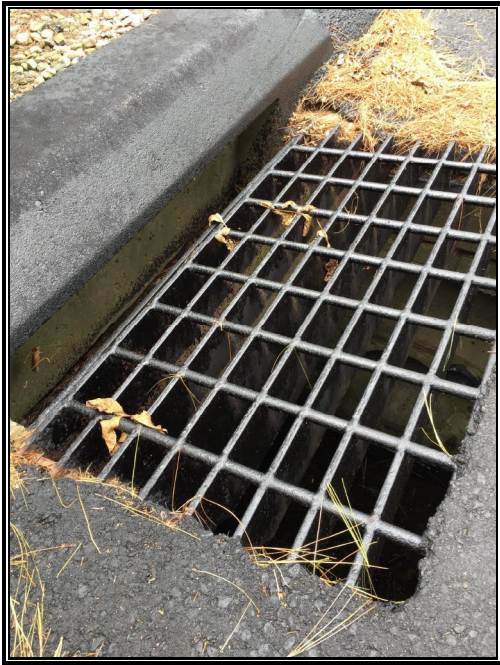


Photo #4  
PDC overspray onto catch  
basin frame and grate

Photo #5  
PDC overspray into  
catch basin throat



In addition to the application of the pavement rejuvenator, it is our understanding that there have been questions 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<sup>1</sup>. 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 has been identified as a source of Polycyclic Aromatic Hydrocarbons (PAHs), which if ingested may result in elevated risks of lung, skin, bladder and respiratory cancers<sup>2</sup>.

\*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**

Polycyclic Aromatic Hydrocarbons are also known as polycyclic aromatic compounds, polyaromatic hydrocarbons, or as polynuclear aromatics. PAHs are a group of over 100 different chemicals consisting of carbon and hydrogen in fused-ring structures and occur naturally in the environment (ATSDR-Barton Springs Health Consultation 2003). Polycyclic aromatic hydrocarbons are found in coal and petroleum, but they are also products of incomplete combustion, of either natural or anthropogenic (man-made) origin. Anthropogenic sources to the environment are more abundant than natural sources and include burning of wood, coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. The most prevalent natural sources are forest fires and volcanoes (National Research Council, 1983).

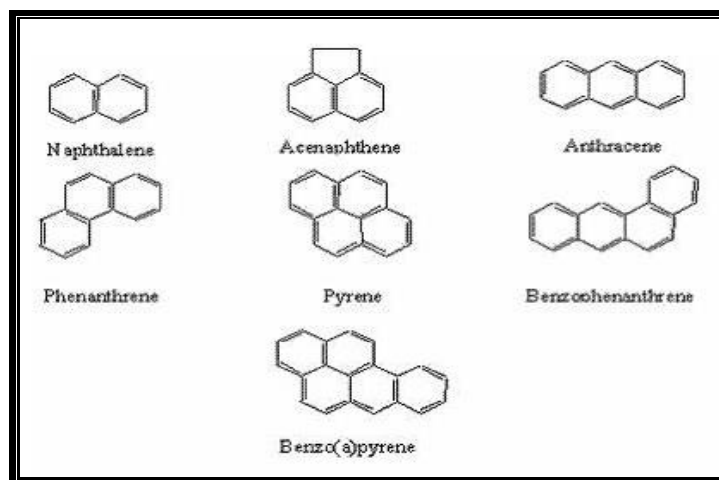


Figure 2: Common Polycyclic Aromatic Hydrocarbons

Due to their potential toxicity<sup>1</sup> 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 ó note proximity to storm drain.

Coal tar sealcoats, which contain 20-35 percent coal tar or coal tar pitch, is commonly applied to parking areas and driveways. Numerous studies have suggested that incidental ingestion of PAHs occur as a consequence of dusts generated from coal tar sealed pavements<sup>3/4</sup> and as a result



some cities and states have banned the use of coal tar sealants altogether with recommendations for alternatives<sup>5</sup> such as asphalt, acrylic or agricultural based sealants.

The potential for ingestion or exposure of PAHs 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<sup>6</sup>. Short term exposure may be the result of release of PAHs 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<sup>7</sup>.

Most people are exposed to volatilized PAHs when they breathe smoke, auto emissions or industrial exhausts (most exhausts contain some type of PAH compounds). 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 major highways or 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 blackening agent 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 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 Safety Data Sheet for the product (attachment 2) 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 (PAHs). 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 product related to health effects of exposure. They provide hazard evaluation related to the product 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 11<sup>th</sup> and 12<sup>th</sup> by a trained operator through Surtreat Technologies. Prior to application of the product, the cleaning of the roadways in accordance to the manufacturer's 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 well within the specified parameters.

## **8. 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 some reportedly experienced some ill effects as a result. 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; we are not aware of vomiting, diarrhea or confusion. KEA was not able to find any documentation of long term health concerns 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<sup>8</sup> in environments subjected to coal tar exposure, PAHs typically exhibit low water solubility<sup>11</sup> 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 due to the application of this product.

The final concern of residents is the fate and transport of PAHs 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<sup>9</sup>. The toxicity can be attributed to particles of coal tar base sealants being worn followed by particulate transport via stormwater runoff.

## **9. Conclusions**

Although the nausea and other reactions experienced by 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 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 wells.

With regard to typical pavement sealcoat products, none of them offers a guarantee or warranty. 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 PAHs into the environment. There is no arguing the acute and chronic health effects of coal tar and the associated PAH content from this application.

PDC is not a sealcoat product and although it contains a coal tar constituent there are no studies and no 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 to restore the original flexible properties and will not crack as it moves 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 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 as a 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. There is no evidence to suggest that this product is prone to frictional mobilization and PAH transport into the environment.

## **10. Concerns and Recommendations**

As discussed, PDC does not exhibit the same properties as a typical pavement sealer and at this time there do not appear to be concerns of pollutant generation by dust migration. However, there are several concerns and they are as follows:

- 1) It is our understanding that this product was applied to extend the life of the pavement for another several years and at some point in the future the Town of Pomfret has intentions to resurface the road. 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 typically a dust generating operation and as discussed, the mechanism for transport of PAHs 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 of the existing drainage structures and installation of new curbing.
- 2) With regard to the health implications from the volatilization of the product, the Town may consider having some air quality testing conducted. However, extracting or detecting volatile PAHs in air may present problems as some PAHs are known to be susceptible to oxidation by ozone and other oxidants present in the air during the collection process<sup>10</sup>. 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) Our biggest concern with the application of the product is the evidence of overspray onto and possibly *into* 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 the frames, grates and throats of the basins, overspray into the basins through the grates could potentially have been deposited onto 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 26 grates the potential of overspray into the basins would be approximately 0.9 gallons total for all 26 basins. 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. Overspray into the throats of the basins was noted in several structures and we were informed that product on the remaining grates was applied by roller after installing fabric beneath the catch basin grates.
- 4) If transport of the product into the drainage system remains a concern, we would recommend sampling each 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 of sediment, 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.

It is our opinion that the product as installed does not present a health hazard to the residents of Longmeadow. However, if concerns of the residents continue the recommendations listed would be appropriate measures to take as further reassurance.

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**ATTACHMENT 1**

**PDC PATENTS**

# 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 sur-

face 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.

Product	AROMATIC SOLVENTS					Flash Pt. °F. TCC	KB Value	Mixed Aniline Pt. °F.
	API Gravity @ 60° F.	Specific Gravity 60/60° F.	Distillation Range °F.					
			IBP	50%	DP			
Hi-Sol <sup>TM</sup> 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

<sup>TM</sup> = 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, multi-cyclic 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
$\alpha$ -Methylnaphthalene	1-10
$\beta$ -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

TABLE I-continued

Major components of bituminous pavement rejuvenator	
Compounds:	Percent by weight
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 I

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.
D-20	Distillation to:	Percent by Weight
	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 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., 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.

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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-identified 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

Issued: Apr. 28, 1987

Appl. No.: 757,895

Filed: Jul. 23, 1985

[51] Int. Cl.<sup>5</sup> ..... 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 pave-  
ment 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 (initial boiling 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 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.

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

[22] Filed: Jul. 23, 1985

[51] Int. Cl.<sup>4</sup> ..... 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

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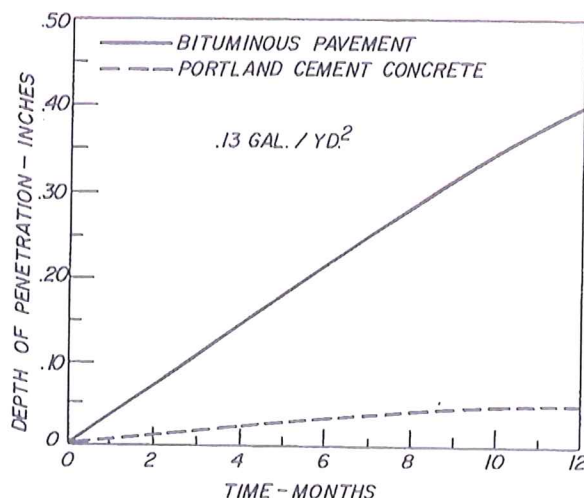
Primary Examiner—Sadie L. Childs

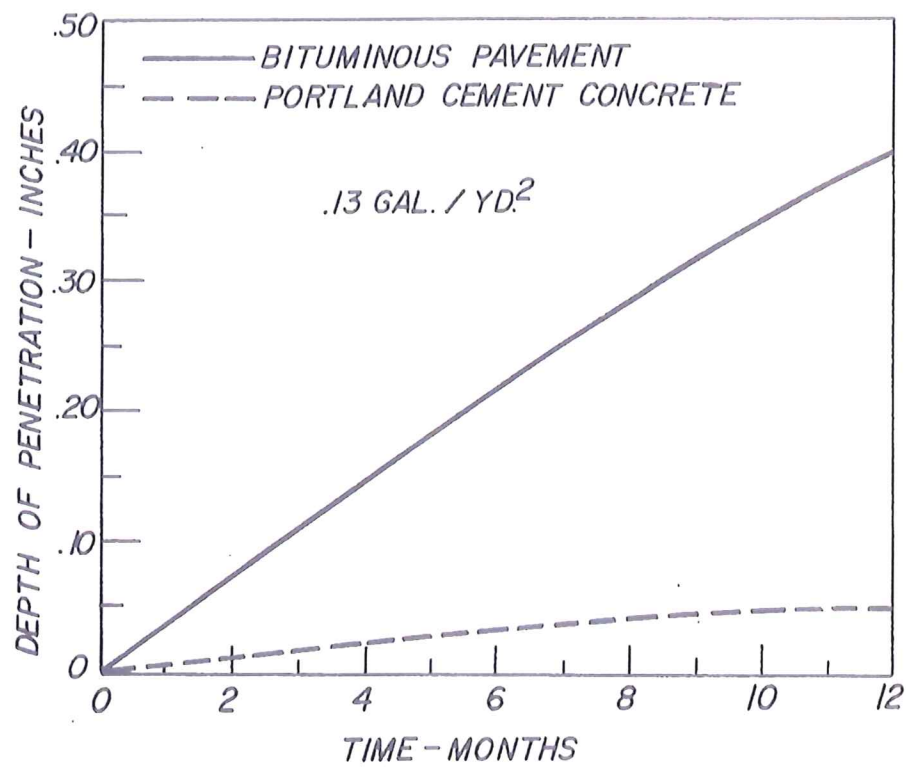
Attorney, Agent, or Firm—Herbert J. Zeh, Jr.; Donald  
M. MacKay

[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







US005580603A

**United States Patent** [19][11] **Patent Number:** **5,580,603****McGovern**[45] **Date of Patent:** **Dec. 3, 1996**

[54] **PAVEMENT REJUVENATOR AND DRESSING  
CONDITIONER WITH BLACKENING  
AGENT** 3,261,269 7/1966 McGovern ..... 94/23  
4,661,378 4/1987 McGovern ..... 427/138

[75] **Inventor:** Edward W. McGovern, Pittsburgh, Pa.*Primary Examiner*—Janyce Bell[73] **Assignee:** K.A.E. Paving Consultants, Inc.,  
Pittsburgh, Pa.*Attorney, Agent, or Firm*—Webb Ziesenheim Bruening  
Logsdon Orkin & Hanson, P.C.[21] **Appl. No.:** 429,578[57] **ABSTRACT**[22] **Filed:** Apr. 27, 1995[51] **Int. Cl.<sup>6</sup>** ..... 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

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.

[56] **References Cited****U.S. PATENT DOCUMENTS**

3,221,615 12/1965 McGovern ..... 94/23

**12 Claims, No Drawings**

\* ADDITION OF BLACKENING AGENT



# 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**  
**PDC MATERIAL SAFETY DATA SHEETS**

## Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and  
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Dizziness  
Gastric or intestinal disorders when ingested.  
Nausea in case of ingestion.  
Acne  
Disorientation  
Unconsciousness

· **Hazards**

Danger of circulatory collapse.  
Danger of convulsion.  
Danger of disturbed cardiac rhythm.  
Danger of impaired breathing.  
Possible risk of irreversible effects.  
May cause cancer.  
May be harmful if inhaled.

· **4.3 Indication of any immediate medical attention and special treatment needed**

If necessary oxygen respiration treatment.  
Monitor circulation, possible shock treatment.  
Medical supervision for at least 48 hours.

### SECTION 5: Firefighting measures

· **5.1 Extinguishing media**

· **Suitable extinguishing agents:**

Foam  
Fire-extinguishing powder  
Carbon dioxide  
Gaseous extinguishing agents

· **For safety reasons unsuitable extinguishing agents: Water**

· **5.2 Special hazards arising from the substance or mixture**

Formation of toxic gases is possible during heating or in case of fire.

· **5.3 Advice for firefighters**

· **Protective equipment:**

Wear self-contained respiratory protective device.  
Wear fully protective suit.

· **Additional information**

Cool endangered receptacles with water in flooding quantities.  
Eliminate all ignition sources if safe to do so.

### SECTION 6: Accidental release measures

· **6.1 Personal precautions, protective equipment and emergency procedures**

Use respiratory protective device against the effects of fumes/dust/aerosol.  
Particular danger of slipping on leaked/spilled product.  
Wear protective equipment. Keep unprotected persons away.  
Ensure adequate ventilation  
Keep away from ignition sources.

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Protect from heat.

· **6.2 Environmental precautions:**

Do not allow to enter sewers/ surface or ground water.

Inform respective authorities in case of seepage into water course or sewage system.

Prevent from spreading (e.g. by damming-in or oil barriers).

· **6.3 Methods and material for containment and cleaning up:**

Absorb with non-combustible liquid-binding material (sand, diatomite, acid binders, universal binders).

Dispose contaminated material as waste according to item 13.

Send for recovery or disposal in suitable receptacles.

Used rags or other cleaning materials should be soaked with water and placed in a sealed container.

· **6.4 Reference to other sections**

See Section 7 for information on safe handling.

See Section 8 for information on personal protection equipment.

See Section 13 for disposal information.

### SECTION 7: Handling and storage

· **7.1 Precautions for safe handling**

Prevent formation of aerosols.

Avoid splashes or spray in enclosed areas.

Use only in well ventilated areas.

Rags, metal wools / cuttings / shavings and waste papers soaked with product must be placed in a sealed metal container rated for flammable waste.

· **Information about fire - and explosion protection:**

Keep ignition sources away - Do not smoke.

Protect against electrostatic charges.

Fumes can combine with air to form an explosive mixture.

Flammable gas-air mixtures may form in empty receptacles.

Keep respiratory protective device available.

· **7.2 Conditions for safe storage, including any incompatibilities**· **Storage:**· **Requirements to be met by storerooms and receptacles:**

Store in a cool location.

Provide ventilation for receptacles.

Avoid storage near extreme heat, ignition sources or open flame.

· **Information about storage in one common storage facility:**

Store away from foodstuffs.

Store away from oxidising agents.

· **Further information about storage conditions:**

Store in cool, dry conditions in well sealed receptacles.

Protect from heat and direct sunlight.

Photoreactive.

· **7.3 Specific end use(s)** No further relevant information available.

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## SECTION 8: Exposure controls/personal protection

· Additional information about design of technical facilities: No further data; see item 7.

### · 8.1 Control parameters

· Ingredients with limit values that require monitoring at the workplace:

#### 65996-93-2 Pitch, coal tar, high-temp.

PEL (USA)	Long-term value: 0,2 mg/m <sup>3</sup>
REL (USA)	Long-term value: 0,1* mg/m <sup>3</sup> *Cyclohexane-extrble.fraction;PocketGuide Apps.A+C
TLV (USA)	Long-term value: 0,2 mg/m <sup>3</sup> BEIp
EL (Canada)	Long-term value: 0,2 mg/m <sup>3</sup> soluble aerosol; ACGIH A1; IARC 1
EV (Canada)	Long-term value: 0,2 mg/m <sup>3</sup> as total benzene-soluble compounds

#### 64742-95-6 Solvent naphtha (petroleum), light arom.

PEL (USA)	Long-term value: 50 ppm (Stoddard Solvent) mg/m <sup>3</sup>
TLV (USA)	Long-term value: 100ppm (Stoddard Solvent) mg/m <sup>3</sup>

#### 91-20-3 naphthalene

IOELV (EU)	Long-term value: 30 mg/m <sup>3</sup> , 10 ppm
PEL (USA)	Long-term value: 50 mg/m <sup>3</sup> , 10 ppm
REL (USA)	Short-term value: 75 mg/m <sup>3</sup> , 15 ppm Long-term value: 50 mg/m <sup>3</sup> , 10 ppm
TLV (USA)	Long-term value: 52 mg/m <sup>3</sup> , 10 ppm Skin; BEI
EL (Canada)	Short-term value: 15 ppm Long-term value: 10 ppm Skin; IARC 2B
EV (Canada)	Short-term value: 78 mg/m <sup>3</sup> , 15 ppm Long-term value: 52 mg/m <sup>3</sup> , 10 ppm

#### 92-52-4 biphenyl

PEL (USA)	Long-term value: 1 mg/m <sup>3</sup> , 0,2 ppm
REL (USA)	Long-term value: 1 mg/m <sup>3</sup> , 0,2 ppm
TLV (USA)	Long-term value: 1,3 mg/m <sup>3</sup> , 0,2 ppm
EL (Canada)	Long-term value: 0,2 ppm
EV (Canada)	Long-term value: 1,3 mg/m <sup>3</sup> , 0,2 ppm

#### 218-01-9 chrysene

PEL (USA)	Long-term value: 0,2 mg/m <sup>3</sup> see Coal Tar Pitch Volatiles
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REL (USA)	Long-term value: 0,1* mg/m <sup>3</sup> *Cyclohexane-extrble.fraction;PocketGuide Apps.A+C
TLV (USA)	L, BEIp
EL (Canada)	IARC 2B

**1319-77-3 cresol (mix)**

IOELV (EU)	Long-term value: 22 mg/m <sup>3</sup> , 5 ppm
PEL (USA)	Long-term value: 22 mg/m <sup>3</sup> , 5 ppm Skin
REL (USA)	Long-term value: 10 mg/m <sup>3</sup> , 2,3 ppm
TLV (USA)	Long-term value: 20* mg/m <sup>3</sup> Skin;*as inhalable fraction and vapor
EL (Canada)	Long-term value: 10 mg/m <sup>3</sup> Skin
EV (Canada)	Long-term value: 22 mg/m <sup>3</sup> , 5 ppm Skin

**91-57-6 2-methylnaphthalene**

TLV (USA)	Long-term value: 3 mg/m <sup>3</sup> , 0,5 ppm Skin
EL (Canada)	Long-term value: 0,5 ppm Skin
EV (Canada)	Long-term value: 0,5 ppm Skin

**108-95-2 phenol**

IOELV (EU)	Short-term value: 16 mg/m <sup>3</sup> , 4 ppm Long-term value: 8 mg/m <sup>3</sup> , 2 ppm Skin
PEL (USA)	Long-term value: 19 mg/m <sup>3</sup> , 5 ppm Skin
REL (USA)	Long-term value: 19 mg/m <sup>3</sup> , 5 ppm Ceiling limit: 60* mg/m <sup>3</sup> , 15,6* ppm *15-min; Skin
TLV (USA)	Long-term value: 19 mg/m <sup>3</sup> , 5 ppm Skin; BEI
EL (Canada)	Long-term value: 5 ppm Skin
EV (Canada)	Long-term value: 19 mg/m <sup>3</sup> , 5 ppm Skin

**91-22-5 quinoline**

WEEL (USA)	Long-term value: 0,001 ppm Skin
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**1330-20-7 xylene**

IOELV (EU)	Short-term value: 442 mg/m <sup>3</sup> , 100 ppm Long-term value: 221 mg/m <sup>3</sup> , 50 ppm Skin
PEL (USA)	Long-term value: 435 mg/m <sup>3</sup> , 100 ppm
REL (USA)	Short-term value: 655 mg/m <sup>3</sup> , 150 ppm Long-term value: 435 mg/m <sup>3</sup> , 100 ppm
TLV (USA)	Short-term value: 651 mg/m <sup>3</sup> , 150 ppm Long-term value: 434 mg/m <sup>3</sup> , 100 ppm BEI
EL (Canada)	Short-term value: 150 ppm Long-term value: 100 ppm
EV (Canada)	Short-term value: 650 mg/m <sup>3</sup> , 150 ppm Long-term value: 435 mg/m <sup>3</sup> , 100 ppm

- DNELs No further relevant information available.
- PNECs No further relevant information available.

**Ingredients with biological limit values:****65996-93-2 Pitch, coal tar, high-temp.**

BEI (USA)	- Medium: urine Time: end of shift at end of workweek Parameter: 1-Hydroxypyrene with hydrolysis (nonquantitative)
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**218-01-9 chrysene**

BEI (USA)	- Medium: urine Time: end of shift at end of workweek Parameter: 1-Hydroxypyrene with hydrolysis (nonquantitative)
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**108-95-2 phenol**

BEI (USA)	250 mg/g creatinine Medium: urine Time: end of shift Parameter: Phenol with hydrolysis (background, nonspecific)
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**1330-20-7 xylene**

BEI (USA)	1,5 g/g creatinine Medium: urine Time: end of shift Parameter: Methylhippuric acids
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- **Additional information:** The lists valid during the making were used as basis.

**8.2 Exposure controls****Personal protective equipment:****General protective and hygienic measures:**

The usual precautionary measures are to be adhered to when handling chemicals.  
Keep away from foodstuffs, beverages and feed.

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Immediately remove all soiled and contaminated clothing.

Wash hands before breaks and at the end of work.

Do not inhale gases / fumes / aerosols.

Avoid contact with the eyes and skin.

Pregnant women should strictly avoid inhalation or skin contact.

· **Respiratory protection:**

Use suitable respiratory protective device when high concentrations are present.

Use suitable respiratory protective device when aerosol or mist is formed.

For spills, respiratory protection may be advisable.

NIOSH or EN approved organic vapor respirator equipped with a dust/mist prefilter should be used.

· **Protection of hands:**



Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation. Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation.

· **Material of gloves**

The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.

· **Penetration time of glove material**

The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

· **Eye protection:**



Safety glasses

· **Body protection:** Oil resistant protective clothing

· **Limitation and supervision of exposure into the environment**

No further relevant information available.

· **Risk management measures**

See Section 7 for additional information.

No further relevant information available.

### SECTION 9: Physical and chemical properties

· **9.1 Information on basic physical and chemical properties**

· **General Information**

· **Appearance:**

Form: Viscous liquid

Colour: Black

· **Odour:** Aromatic

· **Odour threshold:** Not determined.

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· pH-value:	Not determined.
· Change in condition	
Melting point/Melting range:	Not Determined.
Boiling point/Boiling range:	302° F / 150 °C
· Flash point:	Flash Point Range: 125-135 ° F / 52-57 °C.
· Flammability (solid, gaseous):	Not applicable.
· Auto/Self-ignition temperature:	Not determined.
· Decomposition temperature:	Not determined.
· Self-igniting:	Product is not self-igniting.
· Danger of explosion:	Product is not explosive. However, formation of explosive air/vapour mixtures are possible.
· Explosion limits:	
Lower:	0,5 Vol %
Upper:	6 Vol %
· Vapour pressure at 20 °C:	3 hPa
· Density at 20 °C:	1,04 g/cm <sup>3</sup>
· Relative density	Not determined.
· Vapour density at 20 °C	> 1 g/cm <sup>3</sup>
· Evaporation rate	Not determined.
· Solubility in / Miscibility with water:	Not miscible or difficult to mix.
· Partition coefficient (n-octanol/water):	Not determined.
· Viscosity:	
Dynamic:	Not determined.
Kinematic:	Not determined.
· 9.2 Other information	No further relevant information available.

### SECTION 10: Stability and reactivity

- 10.1 Reactivity
- 10.2 Chemical stability
- Thermal decomposition / conditions to be avoided: Keep away from heat and direct sunlight.
- 10.3 Possibility of hazardous reactions
  - Flammable.
  - Reacts with strong oxidising agents.
  - Used empty containers may contain product gases which form explosive mixtures with air.
  - Can form explosive mixtures in air if heated above flash point and/or when sprayed or atomised.
  - Toxic fumes may be released if heated above the decomposition point.
- 10.4 Conditions to avoid
  - Keep ignition sources away - Do not smoke.

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- Store away from oxidising agents.
- **10.5 Incompatible materials:** No further relevant information available.
- **10.6 Hazardous decomposition products:**
  - Carbon monoxide and carbon dioxide
  - Sulphur oxides (SO<sub>x</sub>)
  - Nitrogen oxides (NO<sub>x</sub>)
  - Hydrocarbons

## SECTION 11: Toxicological information

- **11.1 Information on toxicological effects**
- **Acute toxicity:**

- **LD/LC50 values relevant for classification:**

**65996-93-2 Pitch, coal tar, high-temp.**

Oral	LD50	1800 mg/kg (rat)
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**64742-95-6 Solvent naphtha (petroleum), light arom.**

Oral	LD50	>6800 mg/kg (rat)
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Dermal	LD50	>3400 mg/kg (rab)
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Inhalative	LC50/4h	>10,2 mg/l (rat)
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**91-20-3 naphthalene**

Oral	LD50	490 mg/kg (rat)
------	------	-----------------

Dermal	LD50	5000 mg/kg (rat)
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- **Primary irritant effect:**
- **on the skin:** Slight irritant effect on skin and mucous membranes.
- **on the eye:** Slight irritant effect on eyes.
- **Sensitisation:** No sensitising effects known.
- **Additional toxicological information:**

The product shows the following dangers according to the calculation method of the General EU Classification Guidelines for Preparations as issued in the latest version:

Toxic and/or corrosive effects may be delayed up to 24 hours.

May cause genetic defects.

May cause cancer.

Suspected of damaging fertility or the unborn child.
- **Acute effects (acute toxicity, irritation and corrosivity):**

Harmful if swallowed.

Harmful if inhaled.
- **Repeated dose toxicity:**

Repeated exposure may cause skin dryness or cracking.

May cause damage to organs through prolonged or repeated exposure.
- **CMR effects (carcinogenicity, mutagenicity and toxicity for reproduction):**

Muta. 1B, Carc. 1B, Repr. 2

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## SECTION 12: Ecological information

### · 12.1 Toxicity

#### · Aquatic toxicity:

Toxic for aquatic organisms

65996-93-2 Pitch, coal tar, high-temp.

LC50 (static) .01 mg/l (daphnia)

### · 12.2 Persistence and degradability No further relevant information available.

### · 12.3 Bioaccumulative potential No further relevant information available.

### · 12.4 Mobility in soil No further relevant information available.

#### · Ecotoxicological effects:

· Remark: Toxic for fish

#### · Additional ecological information:

#### · General notes:

Water hazard class 2 (German Regulation) (Self-assessment): hazardous for water

Do not allow product to reach ground water, water course or sewage system, even in small quantities.

Danger to drinking water if even extremely small quantities leak into the ground.

Also poisonous for fish and plankton in water bodies.

Toxic for aquatic organisms

Due to available data on eliminability/decomposition and bioaccumulation potential prolonged term damage of the environment can not be excluded.

### · 12.5 Results of PBT and vPvB assessment

#### · PBT:

65996-93-2 Pitch, coal tar, high-temp.

#### · vPvB: Not applicable.

### · 12.6 Other adverse effects No further relevant information available.

## SECTION 13: Disposal considerations

### · 13.1 Waste treatment methods

#### · Recommendation

Must not be disposed together with household garbage. Do not allow product to reach sewage system.

Can be burned with household garbage after consulting with the waste disposal facility operator and the pertinent authorities and adhering to the necessary technical regulations.

The user of this material has the responsibility to dispose of unused material, residues and containers in compliance with all relevant local, state and federal laws and regulations regarding treatment, storage and disposal for hazardous and nonhazardous wastes. Residual materials should be treated as hazardous.

#### · Uncleaned packaging:

· Recommendation: Disposal must be made according to official regulations.

(Contd. on page 15)

# Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and  
OSHA GHS








Printing date 16.10.2014

Revision: 16.10.2014

Trade name: Asphalt Rejuvenator

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## SECTION 14: Transport information

· 14.1 UN-Number	UN1136
· DOT, ADR, IMDG, IATA	
· 14.2 UN proper shipping name	Coal tar distillates, flammable
· DOT	1136 COAL TAR DISTILLATES, FLAMMABLE,
· ADR	ENVIRONMENTALLY HAZARDOUS
· IMDG	COAL TAR DISTILLATES, FLAMMABLE, MARINE
· IATA	POLLUTANT
· 14.3 Transport hazard class(es)	COAL TAR DISTILLATES, FLAMMABLE
· DOT	
 	
· Class	3 Flammable liquids.
· Label	3
· ADR	
 	
· Class	3 (F1) Flammable liquids.
· Label	3
· IMDG	
 	
· Class	3 Flammable liquids.
· Label	3
· IATA	
	
· Class	3 Flammable liquids.
· Label	3
· 14.4 Packing group	
· DOT, ADR, IMDG, IATA	III
· 14.5 Environmental hazards:	
· Marine pollutant:	Yes
	Symbol (fish and tree)
· Special marking (ADR):	Symbol (fish and tree)

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## Safety Data Sheet

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- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>· 14.6 Special precautions for user</li> <li>· Danger code (Kemler):</li> <li>· EMS Number:</li> <li>· 14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code</li> <li>· Transport/Additional information:</li> <li>· ADR</li> <li>· Limited quantities (LQ)</li> <li>· Excepted quantities (EQ)</li> <li>· Transport category</li> <li>· Tunnel restriction code</li> <li>· IMDG</li> <li>· Limited quantities (LQ)</li> <li>· Excepted quantities (EQ)</li> <li>· UN "Model Regulation":</li> </ul> | <ul style="list-style-type: none"> <li>Warning: Flammable liquids.</li> <li>30</li> <li>F-E, S-E</li> <li>Not applicable.</li> <li>5L</li> <li>Code: E1</li> <li>Maximum net quantity per inner packaging: 30 ml</li> <li>Maximum net quantity per outer packaging: 1000 ml</li> <li>3</li> <li>D/E</li> <li>5L</li> <li>Code: E1</li> <li>Maximum net quantity per inner packaging: 30 ml</li> <li>Maximum net quantity per outer packaging: 1000 ml</li> <li>UN1136, COAL TAR DISTILLATES, FLAMMABLE, ENVIRONMENTALLY HAZARDOUS, 3, III</li> </ul> |
|--|--|

### SECTION 15: Regulatory information

- 15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture
- United States (USA)
- SARA

#### · Section 355 (extremely hazardous substances):

108-95-2	phenol
129-00-0	pyrene

#### · Section 313 (Specific toxic chemical listings):

91-20-3	naphthalene
120-12-7	anthracene, pure

#### · TSCA (Toxic Substances Control Act):

All ingredients are listed.

#### · Proposition 65 (California):

#### · Chemicals known to cause cancer:

91-20-3	naphthalene
218-01-9	chrysene
91-22-5	quinoline
71-43-2	benzene

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# Safety Data Sheet

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· **Chemicals known to cause reproductive toxicity for females:**

None of the ingredients are listed.

· **Chemicals known to cause reproductive toxicity for males:**

71-43-2 benzene

· **Chemicals known to cause developmental toxicity:**

71-43-2 benzene

· **Carcinogenic Categories**

· **EPA (Environmental Protection Agency)**

Present in trace quantities: Polycyclic aromatic hydrocarbons, benzene, toluene, ethylbenzene

D

· **IARC (International Agency for Research on Cancer)**

65996-93-2 Pitch, coal tar, high-temp.

1

91-20-3 naphthalene

2B

218-01-9 chrysene

2B

· **TLV (Threshold Limit Value established by ACGIH)**

65996-93-2 Pitch, coal tar, high-temp.

A1

91-20-3 naphthalene

A4

· **NIOSH-Ca (National Institute for Occupational Safety and Health)**

65996-93-2 Pitch, coal tar, high-temp.

218-01-9 chrysene

· **Canada**

· **Canadian Domestic Substances List (DSL)**

All ingredients are listed.

· **Canadian Ingredient Disclosure list (limit 0.1%)**

65996-93-2 Pitch, coal tar, high-temp.

218-01-9 chrysene

· **Canadian Ingredient Disclosure list (limit 1%)**

91-20-3 naphthalene

120-12-7 anthracene, pure

· **Information about limitation of use:**

Workers are not allowed to be exposed to the hazardous carcinogenic materials contained in this preparation. Exceptions can be made by the authorities in certain cases.

· **Other regulations, limitations and prohibitive regulations**

This product has been classified in accordance with hazard criteria of the Controlled Products Regulations and the SDS contains all the information required by the Controlled Products Regulations.

· **Substances of very high concern (SVHC) according to REACH, Article 57**

65996-93-2 Pitch, coal tar, high-temp.

120-12-7 anthracene, pure

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## Safety Data Sheet

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· 15.2 Chemical safety assessment: A Chemical Safety Assessment has not been carried out.

### SECTION 16: Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

#### · Relevant phrases

- H226 Flammable liquid and vapour.
- H228 Flammable solid.
- H302 Harmful if swallowed.
- H304 May be fatal if swallowed and enters airways.
- H315 Causes skin irritation.
- H332 Harmful if inhaled.
- H340 May cause genetic defects.
- H350 May cause cancer.
- H351 Suspected of causing cancer.
- H361d Suspected of damaging the unborn child.
- H373 May cause damage to organs through prolonged or repeated exposure.
- H400 Very toxic to aquatic life.
- H410 Very toxic to aquatic life with long lasting effects.
  
- R20 Harmful by inhalation.
- R22 Harmful if swallowed.
- R38 Irritating to skin.
- R40 Limited evidence of a carcinogenic effect.
- R45 May cause cancer.
- R48/21 Harmful: danger of serious damage to health by prolonged exposure in contact with skin.
- R50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
- R63 Possible risk of harm to the unborn child.
- R65 Harmful: may cause lung damage if swallowed.
- R66 Repeated exposure may cause skin dryness or cracking.

#### · Abbreviations and acronyms:

ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)  
 IMDG: International Maritime Code for Dangerous Goods  
 DOT: US Department of Transportation  
 IATA: International Air Transport Association  
 GHS: Globally Harmonised System of Classification and Labelling of Chemicals  
 ACGIH: American Conference of Governmental Industrial Hygienists  
 EINECS: European Inventory of Existing Commercial Chemical Substances  
 ELINCS: European List of Notified Chemical Substances  
 CAS: Chemical Abstracts Service (division of the American Chemical Society)  
 NFPA: National Fire Protection Association (USA)  
 HMIS: Hazardous Materials Identification System (USA)  
 WHMIS: Workplace Hazardous Materials Information System (Canada)  
 DNEL: Derived No-Effect Level (REACH)  
 PNEC: Predicted No-Effect Concentration (REACH)  
 LC50: Lethal concentration, 50 percent  
 LD50: Lethal dose, 50 percent  
 Flam. Liq. 3: Flammable liquids, Hazard Category 3  
 Flam. Sol. 2: Flammable solids, Hazard Category 2  
 Acute Tox. 4: Acute toxicity, Hazard Category 4

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**Safety Data Sheet**  
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and  
OSHA GHS

Printing date 16.10.2014

Revision: 16.10.2014

**Trade name: Asphalt Rejuvenator**

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Skin Irrit. 2: Skin corrosion/irritation, Hazard Category 2  
Muta. 1B: Germ cell mutagenicity, Hazard Category 1B  
Carc. 1B: Carcinogenicity, Hazard Category 1B  
Carc. 2: Carcinogenicity, Hazard Category 2  
Repr. 2: Reproductive toxicity, Hazard Category 2  
STOT RE 2: Specific target organ toxicity - Repeated exposure, Hazard Category 2  
Asp. Tox. 1: Aspiration hazard, Hazard Category 1  
Aquatic Acute 1: Hazardous to the aquatic environment - Acute Hazard, Category 1  
Aquatic Chronic 1: Hazardous to the aquatic environment - Chronic Hazard, Category 1  
Aquatic Chronic 2: Hazardous to the aquatic environment - Chronic Hazard, Category 2

**Sources**

SDS Prepared by:

ChemTel Inc.

1305 North Florida Avenue

Tampa, Florida USA 33602-2902

Toll Free North America 1-888-255-3924 Intl. +01 813-248-0573

Website: [www.chemtelinc.com](http://www.chemtelinc.com)

**ATTACHMENT 3**

**TURPENTINE MATERIAL SAFETY DATA SHEETS**



# Turpentine



Printed: 10/14/2009  
Revision: 11/13/2008  
Supersedes Revision: 06/05/2008  
Date Created: 06/05/2008

## 1. Product and Company Identification

**Product Code:** 1683.1  
**Product Name:** Turpentine  
**Manufacturer Information**  
**Company Name:** W. M. Barr  
2105 Channel Avenue  
Memphis, TN 38113  
**Phone Number:** (901)775-0100  
**Emergency Contact:** 3E 24 Hour Emergency Contact (800)451-8346  
**Information:** W.M. Barr Customer Service (800)398-3892  
**Web site address:** www.wmbarr.com  
**Preparer Name:** W.M. Barr EHS Dept (901)775-0100  
**Synonyms**  
QGT69, QGT69L

## 2. Composition/Information on Ingredients

Hazardous Components (Chemical Name)	CAS #	Concentration	OSHA PEL	ACGIH TLV
1. Turpentine (Gumspirits; Supfate wood turpentine)	8006-64-2	100.0 %	100 ppm	20 ppm

## 3. Hazards Identification

### Emergency Overview

Danger! Flammable. Harmful or fatal if swallowed. Skin and Eye Irritant. Vapor Harmful.

### OSHA Regulatory Status:

This material is classified as hazardous under OSHA regulations.

### Potential Health Effects (Acute and Chronic)

#### INHALATION ACUTE EXPOSURE EFFECTS:

May cause dizziness, headache, watering of the eyes, irritation of the respiratory tract, nausea, depression of the central nervous system, and serious irritation to the kidneys. Severe overexposure may cause unconsciousness.

#### SKIN CONTACT ACUTE EXPOSURE EFFECTS:

This material is a skin irritant.

#### EYE CONTACT ACUTE EXPOSURE EFFECTS:

This material is a severe eye irritant.

#### INGESTION ACUTE EXPOSURE EFFECTS:

Harmful or fatal if swallowed. May cause nausea, vomiting, gastrointestinal irritation, and diarrhea.

#### CHRONIC EXPOSURE EFFECTS:

Reports have associated repeated and prolonged overexposure to solvents with neurological and other physiological damage. May cause jaundice, bone marrow damage, liver damage, anemia, nausea, skin irritation, headache, dizziness, some loss of memory, heart palpitations, and kidney damage, central nervous system damage, mental confusion, convulsions, coma, and death.

## 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 off ignition sources; keep flames, 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.

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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.		

**Stability:** Unstable [ ] Stable [X]

No data available.

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

carbon monoxide and carbon dioxide

Hazardous Polymerization: Will occur [ ] Will not occur [ X ]

## Conditions To Avoid - Hazardous Polymerization

No data available.

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:

<b>Sec.302:</b>	EPA SARA Title III Section 302 Extremely Hazardous Chemical with TPQ. * indicates 10000 LB TPQ if not volatile.
<b>Sec.304:</b>	EPA SARA Title III Section 304: CERCLA Reportable + Sec.302 with Reportable Quantity. ** indicates statutory RQ.
<b>Sec.313:</b>	EPA SARA Title III Section 313 Toxic Release Inventory. Note: -Cat indicates a member of a chemical category.
<b>Sec.110:</b>	EPA SARA 110 Superfund Site Priority Contaminant List

### TSCA (Toxic Substances Control Act) Lists:

<b>Inventory:</b>	Chemical Listed in the TSCA Inventory.
<b>5A(2):</b>	Chemical Subject to Significant New Rules (SNURS)
<b>6A:</b>	Commercial Chemical Control Rules
<b>8A:</b>	Toxic Substances Subject To Information Rules on Production
<b>8A CAIR:</b>	Comprehensive Assessment Information Rules - (CAIR)
<b>8A PAIR:</b>	Preliminary Assessment Information Rules - (PAIR)
<b>8C:</b>	Records of Allegations of Significant Adverse Reactions
<b>8D:</b>	Health and Safety Data Reporting Rules
<b>8D TERM:</b>	Health and Safety Data Reporting Rule Terminations
<b>12(b):</b>	Notice of Export

### Other Important Lists:

<b>CWA NPDES:</b>	EPA Clean Water Act NPDES Permit Chemical
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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:

☒ Yes ☐ No Acute (immediate) Health Hazard  
☒ Yes ☐ No Chronic (delayed) Health Hazard  
☒ Yes ☐ No Fire Hazard  
☐ Yes ☒ No Sudden Release of Pressure Hazard  
☐ Yes ☒ 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.

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**ATTACHMENT 4**

**US ARMY CORPS OF ENGINEERS DOCUMENTATION**



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