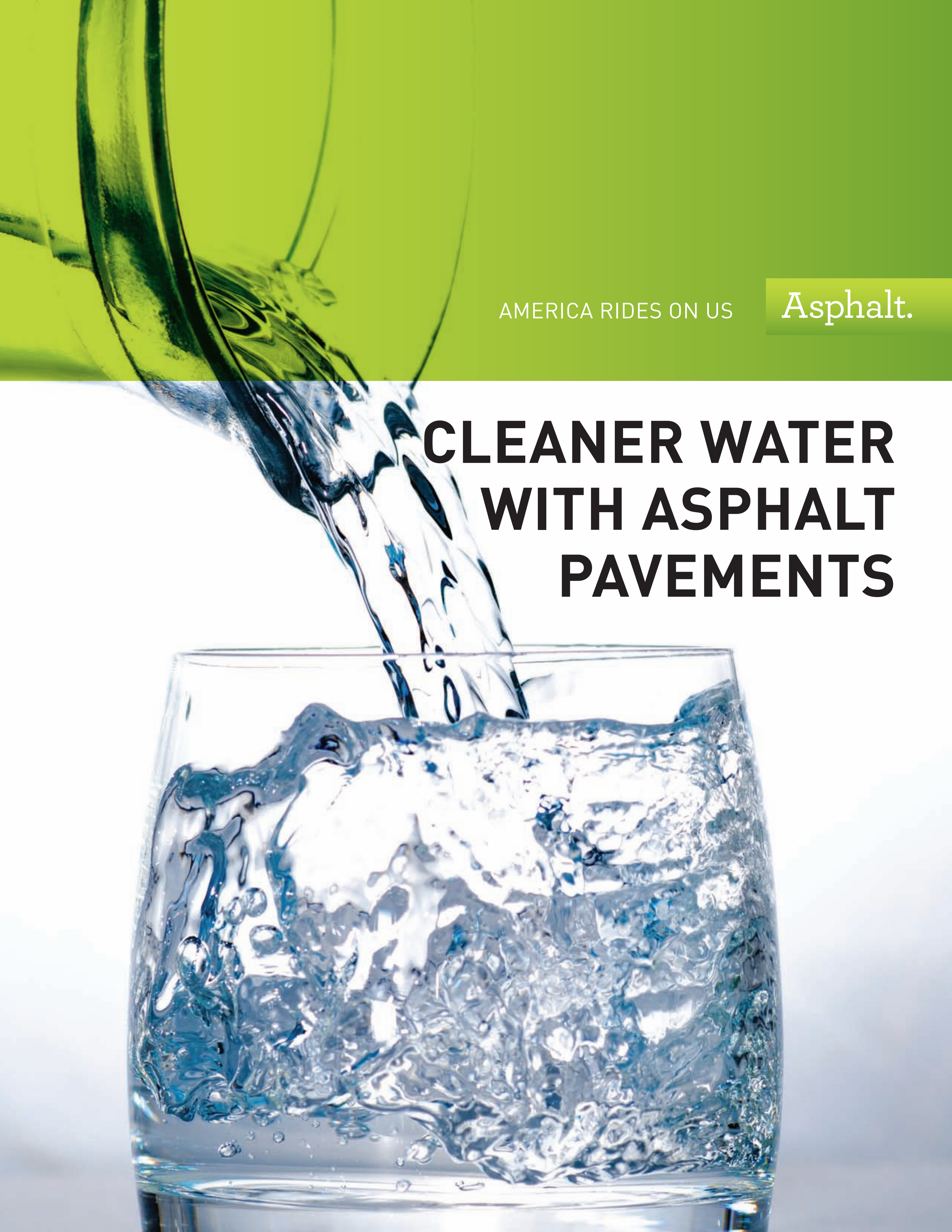
AMERICA RIDES ON US

Asphalt.

CLEANER WATER WITH ASPHALT PAVEMENTS



CLEANER WATER WITH ASPHALT PAVEMENTS?

Asphalt.

Yes, indeed! New research is standing the conventional wisdom on its head.

Because asphalt is impervious to water as well as many other substances, it has been beneficially used by humans for thousands of years. Noah waterproofed the Ark with asphalt. Deposits of asphalt on the Pacific coast near Santa Barbara were used by native Americans to make their canoes waterproof.

But, can today's asphalt pavements – made of 5 percent asphalt cement, a petroleum product, and 95 percent stone – really provide cleaner water? The answer, although it may not be intuitively obvious, is **YES**. As chemists and engineers know, petroleum-based products do not always look or behave like crude oil; in fact, the list of petroleum-based products includes balloons, aspirin, ice cube trays, toothpaste, and some shampoos.[1]

Read on to find out how asphalt contributes to a cleaner environment. And visit AsphaltRoads.org for even more info.

ASPHALT LINERS

Drinking Water
Today, asphalt liners for reservoirs in California store drinking water safely for millions of people.[2] The Metropolitan Water District of Southern California has been using asphalt pavement-lined water reservoirs for more than four decades. At this writing (2011), the Devil's Canyon Reservoir for storing drinking water is under construction with a 19-inch-thick asphalt liner. On completion, the facility will hold 800 acre-feet of water. In Northern California, the East Bay Municipal Utility District has also been using asphalt liners for reservoirs since the 1950s.

Fish Hatcheries
Fish hatcheries, where the young fry are highly sensitive to chemicals or other contamination, are also lined with asphalt. State fish and wildlife agencies in Oregon and Washington began using asphalt pavements to line their fish rearing ponds in 1987. Typically half an acre in area, the ponds are home to Chinook salmon and other fry for about 18 months before the fish are released into rivers and streams. The asphalt liners allow the fish and game experts to precisely monitor and control the environment during the delicate stages of incubation and early growth for various fish species. Both states' agencies are pleased with the effectiveness of the liners and plan to use them for additional fish hatcheries in the future.

Water Pipes and Industrial Ponds
Products derived from asphalt binders are also used to line water pipes that supply potable drinking water.

Proper Retention
In industrial retention ponds, asphalt pavement keeps liquid industrial waste material from percolating into the soil. This gives industry time to treat the liquid waste, and if needed, provides a platform for moving the material to a processing location. Similarly, asphalt is often used to line and/or cap hazardous waste sites – preventing rainwater from percolating through the hazardous waste and keeping materials from leaching into groundwater.

HIGHWAYS: THE NEW LINEAR WATER TREATMENT SYSTEMS

The Marine Science Institute (MSI) analyzed runoff from pavements in a 1997 study, *Impact of Runoff From Asphaltic Products on Stream Communities In California.*[3] The study concluded that pollutants from pavement stormwater runoff were associated with vehicle emissions, crankcase oil drippings,

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1 HTTP://WWW.SAVEANDCONSERVE.COM/2007/05/PETROLEUM_BASED_PRODUCTS_A_LONG_LIST.HTML

2 HTTP://WWW.APACA.ORG/FAQ/#3

3 COOPER SD, KRATZ KW (1997) IMPACT OF RUNOFF FROM ASPHALTIC PRODUCTS ON STREAM COMMUNITIES IN CALIFORNIA. MARINE SCIENCE INSTITUTE, UNIVERSITY OF CALIFORNIA, SANTA BARBARA, CA (GOVERNMENT REPORTS ANNOUNCEMENTS & INDEX (GRA&I) ISSUE 15), FROM: HTTP://WWW.INCHEM.ORG/DOCUMENTS/CICADS/CICADS/CICAD59.HTM

industrial operations, and so forth – not with the pavements themselves. The Institute found that polycyclic aromatic hydrocarbons (PAHs) were not found in pavement stormwater runoff and that there was no difference in upstream versus downstream heavy-metal concentrations from pavement runoff. Further research has supported the conclusion that pollutants in runoff from asphalt pavements are produced by the vehicles that use the pavements, not by the asphalt pavements themselves.

SOME ASPHALT PAVEMENTS ACTUALLY IMPROVE STORMWATER RUNOFF

Pavement engineers use specialized asphalt surfacings called open-graded friction courses (OGFCs) or permeable friction courses (PFCs) to drain water off highways and runways. (OGFC and PFC mean the same thing, so we'll use the terms interchangeably.) These surfacings have a high level of interconnected voids. The precipitation drains vertically through the OGFC to an impermeable, underlying layer and then laterally to the edge of the pavement.

Recent studies show that an open-graded surface can actually improve the quality of runoff from pavements. During rainstorms, pollutants can wash off the pavement and accumulate in the roadway's right-of-way, and/or eventually make their way to surface water discharges.

In a study by the Texas Department of Transportation, researchers observed reductions in pollutants of up to 90 percent when comparing highways with open-graded surfaces to conventional pavements. They pointed out that "in fact, the improvement in water quality attributed to the switch to PFC was equal or better than the reduction in concentration occurring in the vegetated buffer strip in runoff from the conventional asphalt pavement."[4]

PAHs, which are associated with heavy oils, were not detected at the roadside when looking at stormwater runoff from either conventional or open-graded asphalt pavements. The researchers also measured total suspended solids (including lead and other metals) and found that runoff from the OGFC surfaces contained significantly less of these pollutants. These findings indicate that open-graded surfaces can be used to turn highways into linear water treatment facilities. Table 1 provides a compilation of pollutant reduction efficiency using porous pavements.

Bonus benefits from OGFCs/PFCs include reducing noise pollution from highways and improving visibility by reducing splash and spray from trucks. Studies by state transportation agencies identify a reduction of vehicle accidents, when OGFCs or PFCs have been placed under certain circumstances.[7]

TABLE 1 — COMPILATION OF POLLUTANT REDUCTION EFFICIENCY USING POROUS OR OPEN-GRADED FRICTION COURSE PAVEMENTS

Reference	**Percent Reduction**					
	Total Suspended Solids	Total Copper	Total Lead	Total Zinc	Chemical Oxygen Demand	Total Petroleum Hydrocarbons
Barrett et al[4]	94	75	93	76	46	
Pagotto et al[5]	81	33	78	66	0	92
Ranchet[6]	7	62	NA	67	NA	47

[4] BARRETT, M., KEARFOTT, P., MAINA, JR., J. (2006) STORMWATER QUALITY BENEFITS OF A POROUS FRICTION COURSE AND ITS EFFECT ON POLLUTANT REMOVAL BY ROADSIDE SHOULDERS. *WATER ENVIRONMENT RESEARCH,* VOLUME 78, NUMBER 11, NOVEMBER 2006 , PP. 2177-2185(9)

ALSO ACCESSIBLE ON-LINE AT:
HTTP://WWW.PSPARCHIVES.COM/PUBLICATIONS/OUR_WORK/STORMWATER/LID/PAVING_DOCS/POROUS%20FRICTION%20COURSE%20POLLUTANT%20REMOVAL-BARRETT%202006%20.PDF

[5] PAGOTTO, C., M. LEGRET AND LE CLOIREC, P. (2000) COMPARISON OF THE HYDRAULIC BEHAVIOUR AND THE QUALITY OF HIGHWAY RUNOFF WATER ACCORDING TO THE TYPE OF PAVEMENT. *WATER RESOURCES,* VOL. 34, NO. 18, PP. 4446-4454.

[6] RANCHET J. (1995) IMPACTS OF POROUS PAVEMENTS ON THE HYDRAULIC BEHAVIOUR AND THE CLEANSING OF WATER (IN FRENCH). TECHNIQUES SCIENCES ET MEATHODES 11, PP. 869-871.

[7] SEE: OPEN GRADED FRICTION COURSE: A SOLUTION TO SAFETY AND NOISE PROBLEMS (2010) HMAT VOL. 15, PP. 23-25. ACCESSIBLE ON-LINE AT: HTTP://WWW.NXTBOOK.COM/NXTBOOKS/NAYLOR/NAPS0510/INDEX.PHP?STARTPAGE=23&QS=ACCIDENTS#/22

POROUS PAVEMENT ELIMINATES STORMWATER RUNOFF AND IMPROVES WATER QUALITY

Full-depth porous asphalt pavements provide pavements for parking and roads while also serving as stormwater storage and infiltration systems. Their open-graded surfaces allow rainwater to pass into an underlying stone recharge bed with a high level of voids. The stone recharge bed temporarily stores stormwater as it infiltrates into the soil below. Full-depth porous asphalt pavements are recognized by the United States Environmental Protection Agency as a best management practice for stormwater management. See Figure 1 for a cross section.

Full-depth porous pavements can reduce or even eliminate the need for other stormwater management structures such as retention ponds. Another benefit of porous pavements is the ability of these systems to mitigate vehicle metals and oil drippings. Villanova University reviewed the stormwater quality findings on their porous pavement systems and found reductions in PAHs, even when they added oil to the system.[8] The University of New Hampshire has also evaluated porous pavements and has found a reduction of more than 90 percent in total suspended solids, total petroleum hydrocarbons, and zinc when porous pavements were used to enhance stormwater runoff quality.[9] Table 2 provides a compilation of pollutant reduction efficiency using porous pavements.

FIGURE 1 — SCHEMATIC OF A POROUS PAVEMENT

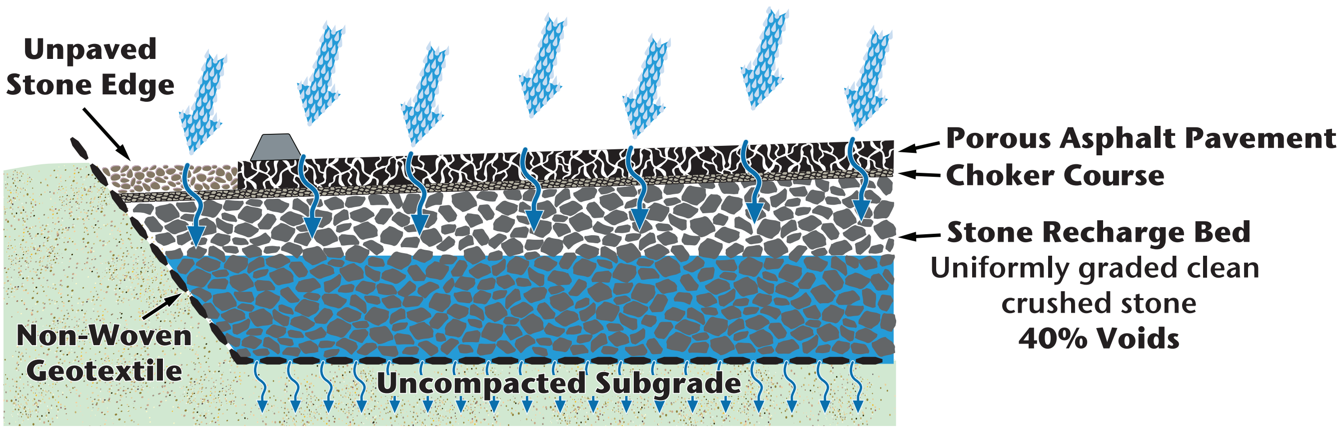

TABLE 2 — COMPILATION OF POLLUTANT REDUCTION EFFICIENCY USING POROUS PAVEMENTS

Reference	Percent Pollutant Removal					
	Total Suspended Solids	Total Nitrogen	Total Phosphorus	Lead	Zinc	Total Petroleum Hydrocarbons in the Diesel Range
Prince William Site[10]	95	85	65	98	99	--
Rockville Site[10]	82	80	65	--	--	--
University of New Hampshire[11]	99	--	38		96	99

[8] SEE SECTION 2.3 OF: HTTP://WWW3.VILLANOVA.EDU/VUSP/OUTREACH/PDF/THESIS/BARBIS-09.PDF

[9] HTTP://WWW.UNH.EDU/UNHSC/SITES/UNH.EDU.UNHSC/FILES/DOCS/UNHSC_PA_COLDCLIMATE.PDF

[10] WHITNEY, B. AND T. SCHUELER. 1997. *NATIONAL POLLUTANT REMOVAL PERFORMANCE DATABASE FOR STORMWATER BMPS.* ELLICOTT CITY, MD: CENTER FOR WATERSHED PROTECTION.

[11] UNIVERSITY OF NEW HAMPSHIRE STORMWATER CENTER (2007). *UNIVERSITY OF NEW HAMPSHIRE STORMWATER CENTER 2007 ANNUAL REPORT.* DURHAM, NH: UNIVERSITY OF NEW HAMPSHIRE STORMWATER CENTER

POROUS PAVEMENTS: NOT JUST FOR PARKING LOTS

Often specified for stormwater management of parking lots, the industry is seeing more roadway applications of full-depth porous pavements. One example can be found in the "green" community of Pringle Creek, Oregon. All the roads in this community were designed with porous asphalt pavement. In Pelham, New Hampshire, there is another example of full-depth porous asphalt roads. In this community, the roadways, driveways, and walkways are all designed with full-depth porous asphalt pavement.[12] Washington State has also investigated the use of porous pavements in a slightly different approach; a preliminary study where porous asphalt pavement was used for the shoulders of heavily-traveled roadways showed almost a 90 percent reduction in both stormwater runoff and pollutant loads.[13] This shoulder application, similar to the use of PFCs on driving surfaces, again demonstrates the exceptional ability of this design to reduce stormwater pollutant loads.

LEACHATE FROM RECYCLING IS NON-EXISTENT

Does either asphalt pavement or reclaimed asphalt pavement (RAP) leach petroleum? The answer to this question is **NO**. Asphalt pavement's inert quality has been observed in a number of studies. In 2002, Kriech et al.[14] conducted a laboratory study to determine 29 PAHs in leachate water of six paving asphalt and four roofing asphalt samples. Samples were leached according to US Environmental Protection Agency (EPA) methods. Results indicated that none of the paving samples tested leached any of the 29 PAHs. Similarly, Brantley and Townsend[15] performed a series of leaching tests on samples of reclaimed asphalt from facilities in Florida. None of 16 EPA priority pollutant PAHs were detected in the water from of any of these samples. These authors pointed out that during normal use of pavement, the asphalt may come in contact with vehicle exhaust, lube oils, gasoline, and metals from brake pads. And yet, no PAHs were detected.

SUMMARY / CONCLUSIONS

Asphalt pavement, which has been used extensively throughout the United States and Europe for over a hundred years, is a tried and true road pavement material. But in this day of increased environmental attention, the green benefits of 100 percent recyclable asphalt pavement might be surprising to some. For improved stormwater management, clean drinking water, and reduced roadside pollution, asphalt pavements are clean and environmentally beneficial. Additionally, smooth asphalt pavements save fuel – potentially billions of gallons every year.[16] And asphalt pavement has a small carbon footprint, especially compared to other paving materials.[17]

For all the right reasons, asphalt is the green pavement choice.

FOR MORE INFORMATION, CONTACT US

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[12] HTTP://WWW.UNH.EDU/NEWS/CJ_NR/2009/DEC/BP07STORM.CFM

[13] HTTP://WWW.WSDOT.WA.GOV/RESEARCH/REPORTS/400/429.1.HTM

[14] KRIECH AJ, KUREK JT, OSBORN LV, WISSEL HL, SWEENEY BJ (2002) DETERMINATION OF POLYCYCLIC AROMATIC COMPOUNDS IN ASPHALT AND IN CORRESPONDING LEACHATE WATER. POLYCYCLIC AROMATIC COMPOUNDS, 22(3–4):517–535.

[15] BRANTLEY AS, TOWNSEND TG (1999) LEACHING OF POLLUTANTS FROM RECLAIMED ASPHALT PAVEMENT. ENVIRONMENTAL ENGINEERING SCIENCE, 16(2):105–116. / PUBLICALLY-AVAILABLE PUBLICATION AT: HTTP://WWW.HINKLEYCENTER.COM/IMAGES/STORIES/PUBLICATIONS/TOWNSEND_98-2.PDF

[16] HTTP://ASPHALTROADS.ORG/IMAGES/DOCUMENTS/ASPHALT_SMOOTHNESS_MATTERS_DOWNLOADABLE.PDF

[17] HTTP://ASPHALTROADS.ORG/WHY-ASPHALT/CARBON-FOOTPRINT.HTML