ASTEC

MEET THE NEIGHBORS

Everything you wanted to know about Hot Mix Asphalt facilities

ASPHALT

WHAT IS ASPHALT?

Liquid asphalt cement is a complex mixture of hydrocarbons. It may also be referred to as "binder" or bitumen (term commonly used outside North America). Some asphalt comes from natural asphalt lakes such as the La Brea Tar Pits. Most of the asphalt used in road building is actually a by-product of crude oil refining. Asphalt is left over after the lighter grades of oil are drawn off at the refinery. It can be further processed for use in paving mixtures or other industries such as roofing. Asphalt is a thermoplastic, which means it is hard at normal highway temperatures, but thick and sticky when heated. It is the material in pavement that coats aggregate and glues (or binds) the mix together. Eighty percent of asphalt used in the United States is for paving mixtures.

IS TAR THE SAME AS ASPHALT?

No. Tar is a black or brown liquid derived from the destructive distillation of organic matter. Though it can be produced from petroleum, it is most often from coal as a by-product of coke production. It was once used to seal roadways, roofing shingles, and wooden ship hulls. However, since the 1970s, asphalt has completely replaced the use of tar in paving mixtures.

WHAT IS ASPHALT PAVEMENT?

Pavement is a highly controlled mixture consisting of liquid asphalt cement and aggregate. Before being placed on a roadway, this mixture is referred to as hot mix asphalt (HMA), asphaltic concrete, or bituminous concrete. An HMA pavement mixture is about 95% aggregate and 5% asphalt cement.

IS ASPHALT A TOXIC HAZARD TO ANYTHING IN THE ENVIRONMENT?

No. Asphalt is insoluble and does not react with water. In fact, hot mix asphalt (HMA) has been used to line surfaces of fish hatchery ponds and community water reservoirs. For example, the Metropolitan Water District of Southern California has used hot mix asphalt liners in its reservoirs for over four decades. Asphalt is also used to seal potable water supply pipes. Another important use of hot mix asphalt is industrial retention ponds and landfill liners. Asphalt liners prevent harmful substances from leaching into the soil and possibly contaminating ground water.

FACILITIES

HOW IS HOT MIX ASPHALT (HMA) MADE?

Aggregate is divided and placed into bins according to size. Depending on the mixture of aggregate called for, the bins automatically meter out the right amount of each size needed onto a conveyor belt. The belt deposits the aggregate into a rotary dryer. This machine tumbles the aggregate through hot air to dry it thoroughly. A fuel burner is located at one end of the drum to provide a flame for heat. It is necessary to remove the moisture from the aggregate so the asphalt cement will stick to the rock. Remember, water and asphalt do not mix. After drying, the aggregate is sent to a mixing device where it is coated with heated asphalt cement and thoroughly mixed.

HOW MANY ASPHALT FACILITIES ARE THERE IN THE UNITED STATES?

According to the EPA estimates, there are approximately 3,600 operating Hot Mix facilities throughout the country.

WHY ARE SO MANY FACILITIES NEEDED?

Considering how large the United States is, there really are not a lot of facilities. This amounts to only one facility for every 983 square miles. Approximately ninety-four percent of the roads in the U.S. are paved with hot mix asphalt. Road maintenance and construction projects require over 550 million tons of hot mix asphalt each year. Hot mix must be used quickly after being loaded into the haul truck because it hardens as it cools. Cooling occurs during transport from the facility to the paving site. The haul distance needs to be as short as possible to minimize the amount of heat lost during transport because only "hot" hot mix asphalt can be worked (laid down by a paving machine and compacted by rollers). In addition, trucking is a large part of road maintenance and construction costs. Minimizing haul distances will result in lower road paving costs.

RECYCLING

CAN ASPHALT PAVEMENT BE RECYCLED?

Hot mix asphalt pavement is completely recyclable. Before repaving an existing road the upper asphalt surface is milled off. The removed material is called Reclaimed (or Recycled) Asphalt Pavement (RAP) and is added to new mix while it is being made at the asphalt facility. Recycling asphalt pavement reduces the quantity of new material required, lessens environmental impacts from the facility, and minimizes disposal of old pavement in community landfills. Asphalt pavement is the most widely recycled product in the U.S., both in terms of tonnage and percentage. Approximately 80% of the asphalt pavement removed from roadways during maintenance is recycled each year (approx 80.3 million tons). Other recyclable products, such as glass, rubber tires, and roofing shingles, can also be used in the production of hot mix asphalt. Paving mixtures containing RAP are referred to as recycled asphalt mix (RAM). Advances in technology are leading to increased RAP usage.

WHAT POLLUTANTS ARE EMITTED DURING THE DRYING PROCESS?

The burners of most aggregate dryers run on fuel oils or natural gas. These fuels are hydrocarbons (compounds containing hydrogen and carbon atoms) and produce carbon dioxide (CO_2) and water (H_2O) during complete combustion. However, no actual combustion process ever completely burns all of the fuel. Thus, the exhaust stream will include moisture, particulate matter, products of combustion, and unconsumed nitrogen and oxygen molecules from the air. The products of combustion generally include carbon monoxide (CO), oxides of nitrogen (NOx), sulfur dioxide (SO_2), and hydrocarbons. These hydrocarbons can fall into several categories, including volatile organic compounds (VOCs). All of these pollutants are measured in the exhaust stream in parts per million (ppm). Pollutant emission rates depend on fuel type and aggregate source, as well as plant design. Modern asphalt facility burners are extremely clean burning and, therefore, typically produce only very slight amounts of VOCs.

HEALTH

IS AN HMA FACILITY A LARGE SOURCE OF EMISSIONS?

No. In fact, studies show that emissions from the HMA industry have decreased over 97% since 1970 despite a 250% increase in production. All emissions from HMA facilities are well below the established threshold limit values (TLVs) set forth by the American Conference of Governmental Industrial Hygienists (ACGIH). The EPA delisted HMA facilities from the MACT (Maximum Available Control Technology) standard in February 2002 because such facilities are not major sources of air pollutants. The HMA industry continues to develop new technologies to minimize emissions during mix production and paving operations.

DO HMA FACILITIES CAUSE CANCER?

Extensive testing has been conducted on asphalt fumes, both from paving and roofing applications. NIOSH (National Institute of Occupational Safety and Health) concluded in their December 2000 report that based on their data there is insufficient evidence to associate lung cancer with paving asphalt fumes.

IF THERE IS NOT CANCER DANGER, WHY HAVE THERE BEEN SO MANY STUDIES?

Hundreds of tests have been conducted primarily because of the apparent similarity of asphalt and tar. What the tests have proven is that these are two completely different materials from completely different sources and with completely different health effects. Coal tar does have some harmful health effects. Those same effects have not been found to be associated with asphalt.

WHAT IS "PARTICULATE MATTER"?

Particulate matter ("PM") is a term used to denote microscopic liquid or solid particles much smaller than the diameter of human hair. Particle size is measured in microns, which is equal to one-millionth of a meter. Particulate matter results from the drying process at an HMA facility. In the case of HMA facilities, the particulate is almost entirely stone dust. Stone dust is a valuable part of the product that the facility owner does not want to lose. It is collected by a baghouse and returned to the mixer for inclusion in the paving materials.

CLEAN AIR

WHAT IS A BAGHOUSE?

A baghouse is a large filtering device that removes particulate matter in the process air from HMA production. A large fan on the outlet end of the baghouse pulls dirty air from the drum into the filter unit. Hundreds of long cylindrical cloth bags hang in rows within the filter section. The air is pulled through the bags and dust particles collect on the bags' outer surface. Filtered air is released into the atmosphere through the exhaust stack. Collected dust is frequently removed from the bags and conveyed to the mixer to be added to the asphalt pavement mixture. Baghouses filter out virtually all of the particulate from the air stream (over 99.9%). The Clean Air Act states that HMA facilities cannot emit more than 0.04 grains (grain = 1/7000th of a pound) of particulate matter per dry standard cubic foot of air. Most baghouses routinely emit less than half of the allowable particulate matter.

ARE HOT MIX ASPHALT FACILITY EMISSIONS REGULATED?

The Clean Air Act of 1990 requires that all stationary emission sources obtain air permits in order to operate, including hot mix production facilities. An air permit contains the operating conditions that must be met by the facility. Particulate emissions and opacity are regulated on a federal basis, though many states have implemented tighter requirements. Individual states and local authorities regulate other pollutants, including the products of combustion. Facilities must maintain extensive records to demonstrate compliance with those regulations. This includes production and fuel consumption rates from which emission levels can be calculated. Failure to comply with operating permit conditions results in fines and/or facility shut down.

ARE HOT MIX FACILITIES TESTED?

Federal requirements in the Clean Air Act mandate that all permitted emission sources must be stack tested within 180 days of startup. Subsequent testing requirements are determined by individual states and permitting authorities. For example, some states require yearly testing while others may only require the initial test as long as permit operating conditions are met.

PERMITS

WHERE CAN HOT MIX FACILITIES BE LOCATED?

While zoning ordinances vary significantly across the U.S., most facilities must be placed on property zoned heavy industrial. In addition, the majority of facilities must obtain special land use permits. Such permits contain specific requirements with which the facility must comply. These many include operating hours and noise levels to name a few.

WHAT CAUSES THE ODORS ASSOCIATED WITH THE PRODUCTION OF HMA?

The most common odor detected at a hot mix facility comes from the hydrocarbons driven off the liquid asphalt cement. Overheating the hot mix materials during the drying process is the primary cause. As fuel has become more and more expensive, most owners and operators have become more aware of the cost of overheating materials and have learned to control temperature with greater precision. The fumes, known as "blue smoke", have a characteristic petroleum-type odor. Blue smoke forms as the hydrocarbons condense in the ambient air. Its formation is highly dependent on temperature and the facility configuration. Minimizing opportunities for the fumes to enter the ambient air and lowering mix/storage temperatures decreases odor levels from the facility.

WHAT ARE THE DIFFERENT TYPES OF FACILITIES IN USE TODAY?

Modern hot mix asphalt facilities fall into two categories: batch and drum mix facilities. As the name implies, batch facilities make individual batches of material. All the ingredients for the batch are fed into a mixer. When mixing is complete, the mixer is emptied, most often into a waiting haul truck. Batch facilities usually have smaller hourly production capacities than drum mix facilities. They are suitable for small production runs or frequent changes in mix type.

Drum mix facilities operate on a continuous basis. The mix is stored in storage silos and discharged into haul trucks as needed. They can be either parallel-flow or counterflow, which is an indication of the material flow versus the airflow within the drum. Material moves in the same direction as the airflow in a parallel-flow drum whereas the material moves against the airflow in a counterflow drum. Modern drum mix facilities almost exclusively include counterflow drums. This is because they use less fuel and generate lower hydrocarbon emissions than parallel-flow drums.

PAVEMENT

ARE ALL PAVEMENTS THE SAME?

No. Hot mix asphalt mixtures are designed according to the traffic they will handle. Therefore, an interstate paving mixture will be very different from one used for a residential driveway. Differences may include types and sizes of aggregate as well as the grade of liquid asphalt cement selected.

IS THE BINDER USED IN PAVEMENT THE SAME AS IN ROOF APPLICATIONS?

No, though they are both by-products of petroleum refining. Paving asphalts are typically softer so that they are more pliable than roofing asphalts. Also, liquid cements at HMA facilities are not heated to temperatures as high as in roofing applications. That means that emissions and odors produced by paving operations are not the same as those produced by roofing.

CAN HOT MIX ASPHALT BE USED FOR ANYTHING OTHER THAN ROADWAYS?

Yes! Hot mix asphalt is used in a variety of applications. Because it is a non-toxic, impermeable material, hot mix asphalt is commonly used to line fish hatchery ponds, commercial water reservoirs, and industrial retention ponds. It is also used to pave recreational paths (for running & bicycling), golf cart paths, airport runways, and tennis courts. Hot mix asphalt has been used in commercial livestock applications such as paving feedlots and lining barn and poultry house floors for easy cleaning. Additional uses include creation of sea walls and dikes to manage beach erosion.

WHAT CAUSES NOISES ASSOCIATED WITH THE PRODUCTION OF HMA?

There are a few common sources of noise emanating from a hot mix facility. Some are derived directly from the hot mix production components, including the burner and exhaust stack. Others are generated from movement of the product, including trucks and loaders. Recent advancements in HMA production equipment design have drastically reduced sound levels. Astec has worked to reduce sound from the hot mix process by providing quieter components on a facility. Likewise, some facility owners have initiated on-site quiet operations and practices for movement of the product. It is often possible to participate in conversations using normal speaking tones while adjacent to most facility components at new facilities.

COMPONENTS

WHAT HAPPENS IF THE ASPHALT SPILLS?

Asphalt cement is hard at ambient temperatures and liquid only when heated. It is kept hot at an HMA facility so that is can be mixed with the aggregate to form pavement. Should the asphalt cement spill onto the ground, it will harden because it is no longer being heated. Once completely set, it can be picked up and disposed of. For additional safety, asphalt storage tanks, as well as the facility fuel tanks, are typically housed within a concrete wall to contain spills should they ever occur.

WHAT EQUIPMENT MAKES UP A HMA FACILITY?

There are several components found at HMA facilities, whether they are a batch or continuous mix plant. Aggregate is separated according to size and fed, usually by a front-end loader, into cold feed bins. These bins are used to meter the virgin aggregate to the dryer. The dryer is used to drive off the surface moisture and heat the aggregate in preparation for mixing with the asphalt cement. Mixing may occur within a variety of devices, depending on the type of facility. Environmental controls include a baghouse, which is typically preceded by a primary collector such as a cyclone or inertial separator. Dust augers return the collected particulate matter to the mixer. Liquid asphalt cement is stored in heated tanks that are connected via piping to the mixer. Finished mix is held in storage silos, which are typically insulated and heated to main product temperature until it is loaded into a haul truck. Mix can often be stored for days before discharge.

WILL AN HMA FACILITY AFFECT GROUNDWATER?

No. HMA facilities do not generate industrial wastewater, as water is not required during the production process. Storm water discharge permits and retention ponds may be required in some locations to handle runoff from rainfall. Stack emissions from a facility do not contaminate groundwater.

WHAT ABOUT TRUCK TRAFFIC?

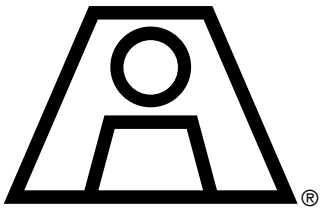
Materials used to produce hot mix asphalt are typically delivered to the production facility via truck. Rail lines are used in some locations. Paving mixtures are transported to the construction site via truck. The actual quantity of trucks entering and leaving the facility is dependent on the production requirements for active paving projects.

DO HMA FACILITIES OPERATE CONTINUALLY?

No. While HMA facilities can operate on a continual basis, mix production is highly dependent on weather conditions and product demand for paving projects. Facilities operate at their highest capacity during the summer, with those located in cold climates shutting down during winter months. Routine equipment maintenance is typically scheduled during the shut down. Some facilities may operate at night as many paving projects on busy thoroughfares must occur when there will be the least commuter impact.

WHAT ARE SOME BENEFITS OF HMA?

There are many benefits to using hot mix asphalt. Road construction and reconditioning projects can be completed faster and at lower cost when paving with asphaltic concrete. Studies show that asphalt pavements have a lower life cycle cost (cost of installation and maintenance over the life of the product) than concrete pavement and are engineered to last decades with little to no maintenance. This generates savings to taxpayers for road construction and maintenance projects in a community. Hot mix pavements are smoother to drive on, which results in greater fuel efficiency, less vehicular wear and tear, and a quieter ride.



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