AFSCME
Health & Safety Fact Sheet

ASPHALT

Asphalt is a dark brown or black substance derived from crude oil. It may be a solid, a semi-solid, or a liquid and is a strong adhesive.

Asphalt is often mistakenly confused with "tar," "coal tar," or "pitch" because the appearance is similar and the substances may be used interchangeably in many industrial processes. Tar and pitch are derived from coal products which are chemically and physically different.

Other names for asphalt include road tar, road binder, mineral pitch, petroleum pitch, petroleum asphalt, and seal-coating material.

Asphalt is used for road paving, roofing tar, roll-roofing, roofing felt, shingles, pipe covering, floor tile, waterproofing, and many other products and processes. Its use will determine what other substances are blended with it and what health and safety hazards are associated with it.

There are two primary types of asphalt:

- **Straight-run asphalt or asphalt cement:** Straight-run asphalt is used for paving roads, airport runways and parking lots. Because of its solid to semi-solid nature, it must first be "cut" with a solvent to bring it to a more liquid state; this is known as Cut Back Asphalt. Highway workers are most likely to use straight run asphalt.

- **Air-blown or oxidized asphalt:** Air-blown asphalt has a high softening point and is used primarily in roofing, pipe covering, and similar situations.

HAZARDS

There are two main hazards associated with asphalt:

- Fire and explosion hazards, and

- Health hazards associated with skin contact, eye contact, and/or inhalation of fumes and vapors

FIRE AND EXPLOSION HAZARDS

Most of the fire and explosion hazard associated with asphalt comes from the vapors of the solvent mixed into the asphalt, not the asphalt itself. The hazard is determined by the flammable or explosive nature of the solvent used and how fast it evaporates. The *flashpoint* (FP) of a chemical or mixture is the combined measure of this flammable or explosive potential. The flashpoint is the lowest temperature at which enough of the chemical evaporates to form a mixture with air which can be ignited by a spark. The lower the flash point, the higher the fire and explosion hazard. If the flash point is below the room temperature, the chemical is a potential bomb.

The flash point -- and therefore, the fire or explosion hazard -- can be determined, in part, by the type of asphalt used. There are three types of cut asphalt. The type and amount of solvent (or oil) added determines the properties of the final mix.

- *Rapid-Curing Asphalt* (RC) is blended asphalt which has been "cut" with a "low-flash" (highly flammable) petroleum solvent. This low flash solvent quickly evaporates, allowing the "RC" mixture to rapidly set and harden. Examples of solvents commonly used in "RC" mixtures include: *Benzene* (FP = 12°F), *Dioxin* (FP = 81-90°F); and *Naphtha* (FP = 107°F), (FP = 54°F), T*oluene* (FP = 40°F), *Xylene.*

- *Medium-Curing Asphalt (MC) is* blended asphalt which has been "cut" with a solvent with a flash point over 170°F.

- *Slow-Curing Asphalt (SC)* is blended asphalt which has been "cut" with a low-flash oil having a flashpoint of over 250°F.

The FP of the asphalt and solvent mix will be higher than the FP of the solvent alone. Remember, the lower the FP, the greater the explosion hazard. Table 1 illustrates the various grades of RC, MC, and SC asphalt mixes and their relative flash points.

FLASH POINT REQUIREMENTS

FOR ASPHALTIC MATERIALS*

Type and Grade of Material	Flash Point (deg.F)
Rapid-Curing Liquid Asphalt	
Grades RC-250, 800, and 3,000	80 +
Medium-Curing Liquid Asphalt	
Grade MC-70	100 +
Grades MC-250, 800, 3,000	150 +
Slow-Curing Liquid Asphalt	
Grade SC-70	150+
Grade SC-250	175 +
Grade SC-800	200 +
Grade SC-3,000	**225** +

****Adapted** from NSC **Data Sheet 1-215-80, Asphalt.***

HEALTH HAZARDS OF ASPHALT

- *Acute (short-term) health effects:* Skin or eye contact may cause inflammation and skin rashes, changes in skin coloration, and an acne-like condition at hair follicles and skin pores.

Asphalt fumes are created when asphalt is heated. Fumes contain very small, solid, airborne particles which are easily inhaled by the worker. Inhalation of asphalt fumes can cause irritation to the nose, throat and lungs. Fumes may also contain hydrogen

sulfide vapors, which are very toxic, as well as the vapors generated by the solvents used to "cut" the asphalt. (See below).

Exposure to sunlight or other ultraviolet light (such as welding) may make these skin conditions worse.

- *Chronic (long term) health effects:* Asphalt cement also causes rashes and other skin conditions, possibly including skin cancers. In addition, asphalt particles left on the hands may accidentally get into the eyes causing severe irritation to the eyes. Hot asphalt may also cause severe burns if splashed onto exposed skin.

ASPHALT -EXPOSURE LIMITS

- *The National Institute for Occupational Safety and Health* (NIOSH) has recommended that the Short Term Exposure Limit (STEL) for exposure to asphalt fumes should be set at 5 milligrams per cubic meter of air (mg/m^3) measured during any 15 minute period.

- *The Occupational Safety and Health Administration* (OSHA) has not adopted a standard for worker exposure to asphalt fumes despite the fact that the NIOSH recommendation was made in 1977.

- *The American Conference of Governmental Hygienists* (ACGIH) standard (Threshold Limit Value, or TLV) is 5 milligrams per cubic meter of air (mg/m^3) averaged over eight hours.

HEALTH HAZARDS OF SOLVENT VAPORS

Vapors from solvents that are used to "cut" asphalt can also present serious health hazards. The solvent vapors generated by heating asphalt are often more toxic than the asphalt fumes themselves. Solvents will evaporate out of the mix at a wide range of temperatures. Heating of the asphalt mix speeds up the evaporation process. The faster the solvent evaporates, the easier it is to inhale.

In order to understand the hazards of asphalt, it is necessary to know which solvent is used in the mixture, how fast the substance evaporates and how toxic the substance is.

The *boiling point* of a chemical determines how fast the substance evaporates. The lower the boiling point, the easier it evaporates and the easier it is to inhale. The *toxicity* of a substance refers to the effects of that substance on the human body. As indicated above, OSHA, NIOSH and ACGIH recommend exposure limits for chemicals. OSHA's standards are called PELs (Permissible Exposure Limits). OSHA's PELs arc enforceable by law in states where public employees are covered by OSHA or by OSHA-approved state plans. (Some state plans may have PELs which are more stringent than federal OSHA's PELs.).

ACGIH calls its limits TLVs (Threshold Limit Values). TLVs are only recommendations, not mandates.

In theory, a highly toxic chemical will have a very low PEL. In reality, however, many PELs are outdated and do not take into account new studies about health effects. Others are only based on a chemical's irritant properties instead of its ability to cause cancer or other serious health effects.

It is important to remember that a variety of sources must be checked to determine the toxicity of a chemical and discover the safest exposure limit. Remember, **legal does not mean safe**.

The names of the asphalt-cutting solvents, their boiling points and any exposure limits should be listed on the Material Safety Data Sheet. Listed below are three solvents commonly used in asphalts, their boiling points, health effects and exposure limits.

- *Benzene* (BP 176°F) is known to cause leukemia, a cancer of the white blood cells, and a serious blood disorder called aplastic anemia which can lead to leukemia. Benzene has also been shown to cause skin cancer in animal studies. The OSHA PEL has recently been changed to 1 part benzene per million parts air (ppm) with a 5 ppm STEL. This means that exposures must average 1 ppm over an eight hour day, but cannot average more than 5 ppm over any 15 minute period. The ACGIH TLV is still 10 ppm.

- *Dioxane* (BP 214°F) is very toxic to the liver and kidneys and has been shown to cause cancer in laboratory testing. OSHA PEL: 25 ppm, averaged over 8 hours; ACGIH TLV: 25 ppm.

- *Toluene* (BP 231°F) may cause kidney and liver damage in high concentrations, as well as a skin condition called dermatitis. It is safer to use than benzene. OSHA PEL: 100 ppm (averaged over an eight hour day), STEL: 150 ppm for 15 minutes. This means that the average exposure over an eight-hour work day cannot exceed 100 ppm and cannot average more than 150 ppm over any 15 minute period. ACGIH TLV: 100 ppm. STEL: 150 ppm.

Again, in order to understand the health effects of asphalt, it is important to find which solvent was used to "cut" the asphalt mix. Remember that an "RC" mix contains the most dangerous solvents; an "MC" is less dangerous, and an "SC" is the least dangerous of the asphalt mixes. All required and recommended exposure limits (OSHA, NIOSH and ACGIH) should be checked. Remember, the legal limit (OSHA PEL) is not necessarily the safe limit.

SAFE WORK PROCEDURES

1. **Training** All workers exposed to asphalt fumes should be trained about hazards and safe work procedures. This training should include specific information about the solvents used in mixing the asphalt.

2. **Material Safety Data Sheets (MSDSs**) should be made available to each employee assigned to work with or near asphalt processes. The MSDS should include specific information on the solvents present in the asphalt mix and should list all pertinent information including Flash Point, Boiling Point, acute and chronic effects of all chemical ingredients in the solution, protective equipment, as well as other fire and emergency cleanup information.

3. Engineering Controls

- *Substitution.* The best method of controlling exposure to asphalt fumes and solvent vapors is to substitute a safer asphalt mix. If explosion hazards are a problem in a paving operation, MC-250 may be substituted for RC-250. The flashpoint of the mix is nearly doubled, which means that the mix is less likely to ignite.

If the toxicity of the chemical is a problem, the employer may be able to order an asphalt mixture which contains a less toxic solvent (e.g. toluene for benzene).

Finally, if a less toxic solvent cannot be substituted in the mix, a less *volatile* solvent may be. Less volatile means that the boiling point of the new solvent will be higher, so less will evaporate into inhalable particles.

- *Enclosure.* Enclosing the process where the asphalt is used is not possible in road paving and roofing operations. However it may be possible for smaller operations such as pipe covering processes.

- *Mechanization and Automation.* Certain parts of asphalt processes may be mechanized. For example, stirring asphalt in a tar kettle exposes the worker to asphalt fumes, solvent vapors, and potentially severe burns; mechanical devices can accomplish this task without exposing the employee to such risks.

- *Local Exhaust Ventilation.* Local exhaust ventilation may be an effective way to control worker exposure to fumes and vapors, particularly in areas where enclosure of the operation is impossible.

- *General Dilution Ventilation.* General dilution ventilation involves flooding a work area with uncontaminated air in an attempt to remove contaminants from the workers' breathing zone. However the use of fans and blowers set up for this purpose, are often not adequate to remove the contaminants. This is generally not the most effective way of removing contaminants from the worker's breathing zone, but may be used to supplement local exhaust ventilation.

4. Respiratory Protection.

While engineering controls are the preferred method for controlling worker exposure to fumes and vapors, respirators should be worn where this is not possible. In selecting the proper respirator, it is important to know all of the hazards to which workers may be exposed. A NIOSH-approved dust respirator will control exposure to asphalt fumes, but will do nothing to protect the worker against exposure to the toxic vapors given off by the solvent in the mix. In situations where vapors are present, a full-face mask respirator with organic vapor and particulate cartridges should be used. Because of the possibility of eye irritation a half-face mask respirator would be inadequate.

IMPROPER USE OF RESPIRATORS IS DANGEROUS. The employer must have a

written respirator program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in OSHA standard 29 CFR 1910.134.

5. **Protective Clothing.** Protective clothing is necessary to protect workers from asphalt burns and irritation. In addition, many of the solvents used to cut asphalt are readily absorbed through unprotected skin into the bloodstream, where they can travel throughout the body and cause damage to many different organs.

   NIOSH recommends that workers wear thermally-insulated gloves, long sleeve shirts, long cuffless trousers and metal-toed safety shoes when working with hot asphalt. Clothing should be loose-fitting, collars should be closed, and sleeves rolled down. Safety shoes should be at least 15 centimeters (cm) high and should be laced so that no openings are left through which hot asphalt may reach the skin.

6. **Face and Eye Protection.** Face and eye protection are recommended whenever hot asphalt is used. A face shield (8" minimum) should be worn when handling heated asphalt if a full face respirator is not worn. When liquid asphalt is hand-sprayed on road surfaces as "tack coat" or "prime coat," spraying equipment should have flexible hoses and long handles.

7. **Barrier Creams and Lotions.** When applied to the skin, barrier creams and lotions leave a thin film, which acts as a barrier against skin irritants. They should not be substituted for protective clothing, but may be useful along with other protective measures.

8. **Fire and Explosion Hazards**
   - The solvents which make asphalt an RC, MC, or SC mixture will determine the flammability limits of the mixture. For example, RC-250, with a flashpoint near 80°F will generate flammable vapors at a much lower temperature than will MC-3000. Extreme caution must be exercised when heating RC mixes. **Smoking, lighted matches, torches, and other possible ignition sources must be kept away from areas where vapors are being produced.**

   - Welding and brazing on tar-kettles, tanks, or other vessels which either contain or have contained asphalt is DANGEROUS. Only qualified personnel should do such welding. The welder must be familiar with safe procedures for welding tanks that have contained flammable liquids.

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For more information about protecting workers from workplace hazards, please contact the AFSCME Research & Collective Bargaining Department, Health and Safety Program at (202) 429-1215. You can also contact our office located at 1625 L Street, NW Washington, DC 20036.