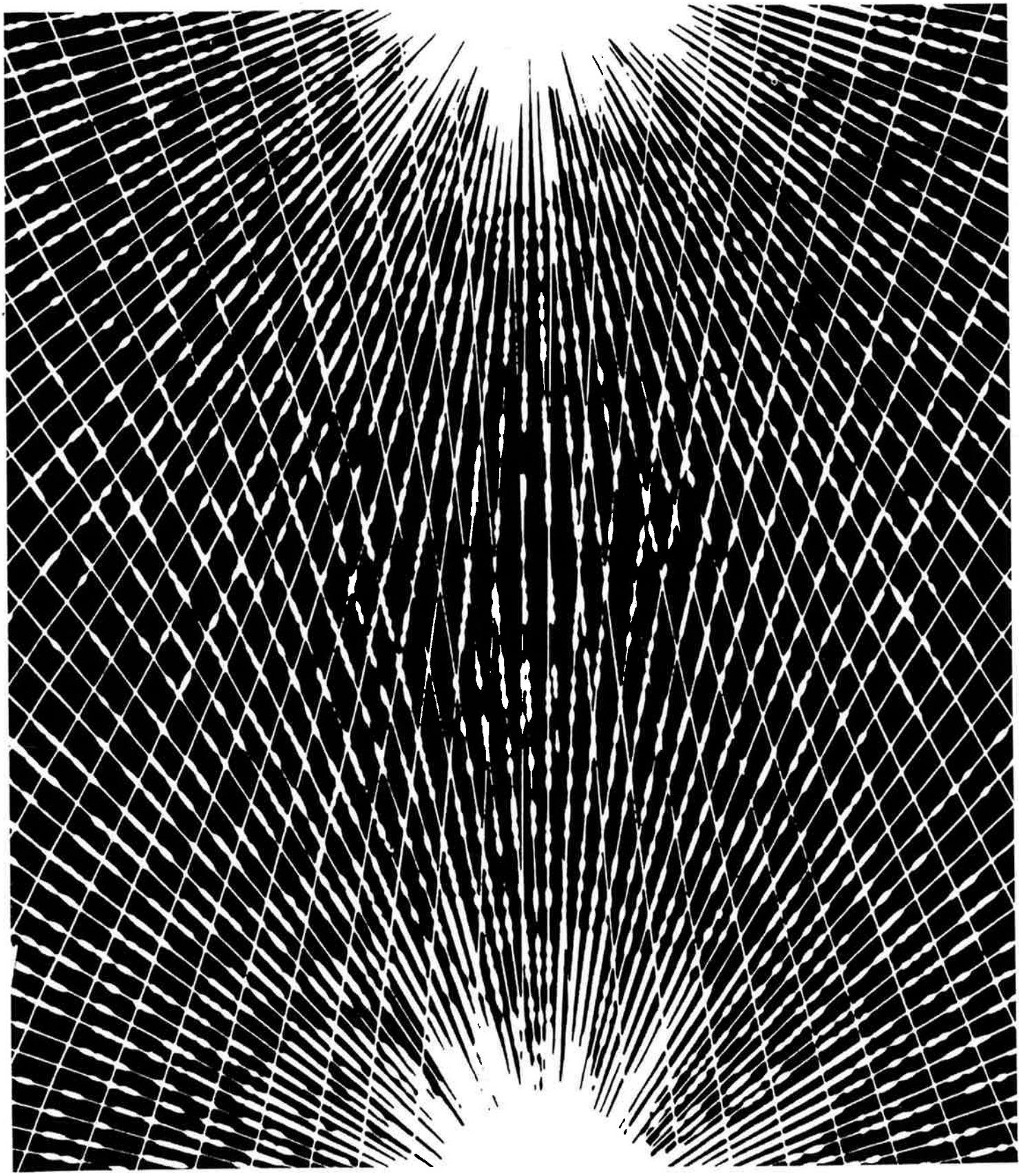
# SAFE STORAGE AND HANDLING OF HOT ASPHALT



**ASPHALT INSTITUTE**

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# FOREWORD

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# SAFE STORAGE AND HANDLING OF HOT ASPHALT

## 1 INTRODUCTION

Although the long-term safety record for handling and storing hot asphalt is good, there have been accidents causing property damage, bodily injury and loss of life.

This publication deals primarily with safety measures aimed at preventing various types of accidents such as explosions, fires, body burns, hazardous vapor build-up, and spills.

## 2 FIRE AND EXPLOSION HAZARDS

### *Flash Point*

The American Society for Testing and Materials (ASTM D 92) states: "The lowest temperature at which application of the test flame causes the vapors above the surface of the liquid to ignite is taken as the flash point."

The Cleveland Open Cup Test (ASTM D 92) is normally used to determine the flash point of asphalt cements and slow-curing cut-backs, but the Pensky-Martens Closed Cup Test (ASTM D 93) is also used occasionally. Medium and rapid-curing cutbacks are tested for flash point by the Tag Open Cup Test (ASTM D 1310).

### *Fire Triangle*

Three elements are required before combustion can occur: fuel, oxygen and a source of ignition. The three elements are commonly called the sides of the "fire triangle," as shown in Figure 1. If any one of the three sides is missing, combustion cannot take place. For combustion to be possible the concentration of fuel in vapor form must not be too low or too high. Enough oxygen must be available and there must be an ignition source; e.g., spark, flame, auto-ignition (spontaneous combustion), etc.

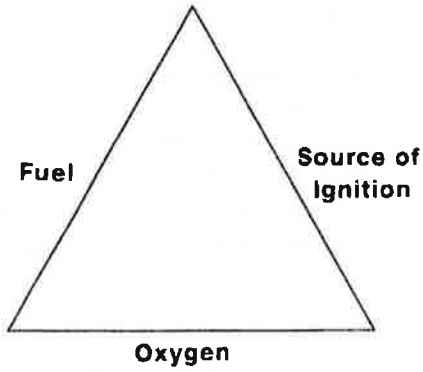



**Figure 1—The Fire Triangle.**

### *Combustibility*

Asphalt will support combustion if overheated in the presence of an adequate air (oxygen) supply. Some asphalt cements and air-blown asphalts are not combustible until heated above 232°C (450°F). The combustibility of cutback asphalts* varies with the type and amount of solvent. Therefore, rapid-curing cutbacks are the most susceptible to combustion because their solvents have flash points near those of gasoline

*Asphalt cement which has been liquefied by blending with petroleum solvents (also called diluents); i.e., the rapid-curing (RC) and medium-curing (MC) cutbacks.

and naphtha. Medium-curing cutbacks contain solvent with a flash point near that of kerosene. Slow-curing cutbacks contain oil of lower volatility and higher flash point as solvent, and therefore these cutbacks are the least susceptible to combustion. (See *Specifications for Paving and Industrial Asphalts* (SS-2), Asphalt Institute.

Emulsified asphalts are not generally combustible unless heated to the extent that the water content is boiled off. Combustion can then take place if the remaining asphalt is overheated sufficiently. Some emulsions are manufactured using solvent in addition to water; these may be more easily ignited when the water content is boiled off.

# 3 HOT-ASPHALT STORAGE TANKS

## Tank Description

Typically, a hot-asphalt storage tank comprises a cylindrical shell with a conical roof. The shell of a large tank holding 39,700 $m^3$ (250,000 barrels) may measure 61 m (200 ft) in diameter and 14.6 m (48 ft) in height. The tank roof is fitted with a vent, gauge hatch covers and manway covers. The exterior of the tank may be covered with insulation.

At stationary asphalt plants, hot asphalt is generally stored in insulated, horizontal, cylindrical tanks. An example would be a 75.7 $m^3$ (20,000 gal) tank with exterior dimensions of 3.36 m (11 ft) diameter and 10.36 m (34 ft) length. Trailer-mounted horizontal tanks are used for portable asphalt plants. A 37.9 $m^3$ (10,000 gal) tank would have a 2.44 m (8 ft) diameter and 9.1 m (30 ft) length.

## Tank Heating Equipment

Asphalt storage tanks are equipped with steam heating coils, hot oil coils, or gas-fired (or electric) heaters. To minimize the chance of leaks, heating coils should have only welded joints. Heating coils should be located near the tank bottom to improve heating and circulation in the bottom layers of asphalt. Tanks and coils should be checked frequently to detect leakage.

Toward controlling the tank temperature, temperature readings should be regularly recorded. The readings should be made with a device that accurately records temperatures representative of the stored asphalt. Readings should not be taken near the heating coils, shell or tank bottom.

The asphalt level in the tank at all times must be kept at a minimum of 200 mm (8 in.) above fired heating coils to prevent coil areas from over-heating and possibly igniting the asphalt.

## Storage Temperatures

From a safety standpoint, it is desirable to store asphalt at a temperature as far as possible below the flash point. However, it should be recognized that the values reported by the flash point tests are specific to the test procedures employed and not necessarily representative of the vapor space atmospheres existent in storage.

Table 1 contains the recommended storage temperatures for various types and grades of asphalt. The guidelines are not intended to establish a rigid standard, but to indicate temperatures for good practice that also allow for practical product storage, needs of pumpability, and compliance with applicable environmental standards.

Tanks should not be operated in a range in which the temperature fluctuates above and below the boiling point of water. Fluctuations are conductive to the accumulation and rapid vaporization of water; these conditions often result in frothovers. Where tank contents are continuously above 100°C (212°F) and operate on a frequent cycle of filling and emptying, there is less opportunity for water accumulation by condensation.

## Water

Water may enter an asphalt storage tank by accidental injection, leaks from steam heating coils, rainwater entering open or badly-fitting gauge hatch and manway covers, and condensation. Condensation forms on the inside of the roof and upper shell when the temperature is below 100°C(212°F).The condensate may drain down the inside of the tank shell to the bottom of the tank. Water may also accumulate in the

## TABLE 1—GUIDELINE TEMPERATURES FOR STORAGE AND HANDLING OF ASPHALT PRODUCTS

| Type & Grade | Spec. Ref. | Min. Flash °C (°F) | (Storage) Temperature °C (°F) |
|---|---|---|---|
| AC-2.5 | AASHTO M226 | 163 (325) | 160 (320) |
| -5 | ASTM D 3381 | 177 (350) | 166 (330) |
| -10 | | 219 (425) | 174 (345) |
| -20 | | 232 (450) | 177 (350) |
| -40 | | 232 (450) | 177 (350) |
| AR-1000 | AASHTO M226 | 205 (400) | 163 (325) |
| -2000 | ASTM D 3381 | 219 (425) | 168 (335) |
| -4000 | | 227 (440) | 177 (350) |
| -8000 | | 232 (450) | 177 (350) |
| -16000 | | 238 (460) | 177 (350) |
| Pen 40-50 | AASHTO M20 | 232 (450) | 177 (350) |
| 60-70 | ASTM D 946 | 232 (450) | 177 (350) |
| 85-100 | | 232 (450) | 177 (350) |
| 120-150 | | 219 (425) | 177 (350) |
| 200-300 | | 177 (350) | 168 (335) |
| MC-30 | AASHTO M82 | 38 (100) | 54 (130) |
| -70 | ASTM D 2027 | 38 (100) | 71 (160) |
| -250 | | 66 (150) | 91 (195) |
| -800 | | 66 (150) | 99 (210) |
| -3000 | | 66 (150) | 99 (210) |
| RC-70 | AASHTO M81 | — — | 71 (160) |
| -250 | ASTM D 2028 | 27 (80) | 91 (195) |
| -800 | | 27 (80) | 99 (210) |
| -3000 | | 27 (80) | 99 (210) |
| SC-70 | | 66 (150) | 71 (160) |
| -250 | ASTM D 2026 | 79 (175) | 91 (195) |
| -800 | | 93 (200) | 99 (210) |
| -3000 | | 107 (225) | 99 (210) |
| All Grades of Emulsified Asphalt | AASHTO M140 & 208<br>ASTM D 977 & 2397 | — — | 82 (180) |
| Damp A | AASHTO M115 | 175 (350) | 182 (360) |
| B | ASTM D 449 | 205 (400) | 210 (410) |
| C | | 205 (400) | 218 (450) |
| Primer | AASHTO M116 | — — | 54 (130) |
| | ASTM D 41 | — — | 54 (130) |
| Underseal | AASHTO M238<br>ASTM D 3141 | 218 (425) | 232 (450) |
| Membrane | AASHTO M239<br>ASTM D 2521 | 218 (425) | 232 (450) |
| B-U Roofing I | ASTM D 312 | 225 (437) | 191 (375) |
| II | | 225 (437) | 218 (425) |
| III | | 225 (437) | 232 (450) |
| IV | | 225 (437) | 246 (475) |
| Residual Fluxes | Industry Sources | 260 (500) | 177 (350) |
| | | 288 (550) | 191 (375) |

cool layers of asphalt that develop at the bottom of a tank that has been inactive for a long time, or in its piping. The water may accumulate even though the body of the asphalt is kept above the boiling point of water.

When water is mixed with hot asphalt, either by accidental injection or by mechanical agitation, steam will develop rapidly. The result could be violent asphalt foaming, or rupture of the seam between the roof and shell from increased pressure. To minimize water accumulation, hatches should be kept closed and roofs checked to ensure that they are intact. Tank connections and draw-offs should be located near the tank bottom. Adding or withdrawing asphalt from an inactive tank should be started at low pumping rates after accumulated water has been drained.

## Hydrocarbons

If an asphalt storage tank is used to hold a petroleum product other than asphalt, light hydrocarbons may be left behind when the product is pumped out. Light hydrocarbons may also enter a hot asphalt tank from unit startup and upsets, and from interconnecting line leaks.

Additionally, light hydrocarbons may be carried over in the asphalt which has been transferred from a vacuum distillation unit. The hydrocarbons in the form of gases such as butane may not be detected by testing, because of losses during sampling and loading of the test apparatus.

Hydrocarbons may also originate from the asphalt itself. Asphalt fumes escape from the hot stored material and form condensate that accumulates on the underside of the storage tank roof, especially near and in the vents. The asphalt fumes that pass through the vents may also condense and form deposits in the insulation on the exterior of the tank roof. Under certain conditions (described later in this publication) the asphalt accumulated on the underside of the roof can release hydrocarbons into the vapor space. The accumulated hydrocarbons may be sufficient for combustion even though the asphalt temperature is well below its flash point.

## Hydrogen Sulfide

Hydrogen sulfide is a product of the reaction between hydrogen and sulphur naturally present in asphalt. At low concentrations, hydrogen sulfide normally has a disagreeable odor characteristic of rotten eggs. The rate at which hydrogen sulfide evolves from asphalt into a vapor space increases with temperature. Even low rates of evolution can lead to high concentrations of hydrogen sulfide in small confined spaces, over a period of time. High concentrations of hydrogen sulfide are not readily noticed because the odor is masked by that of the hot hydrocarbons, and because hydrogen sulfide cannot be quantitatively assessed by odor.

Experience has shown that there is little danger to persons gauging or sampling asphalt storage tanks. Hydrogen sulfide in dangerous concentrations has been measured inside asphalt storage tanks, but measurements a foot or more away from hatch openings have not shown hazardous levels. As a precaution, however, persons should stand upwind of hatches, keep their faces at least two feet outside hatch openings, and avoid breathing vapors when opening hatch covers.

## Iron Sulfide

Hydrogen sulfide can react with the iron in an asphalt storage tank to form iron sulfide. The asphalt deposits on the underside of a storage tank roof form a cover over water and rust (see Figure 2). Since air is excluded below the surface of the asphalt deposits, conditions there are ideal for iron

**Cone Roof Asphalt Tank**

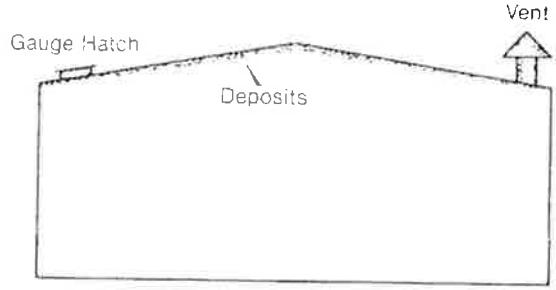



**Figure 2—Tank Deposits.**

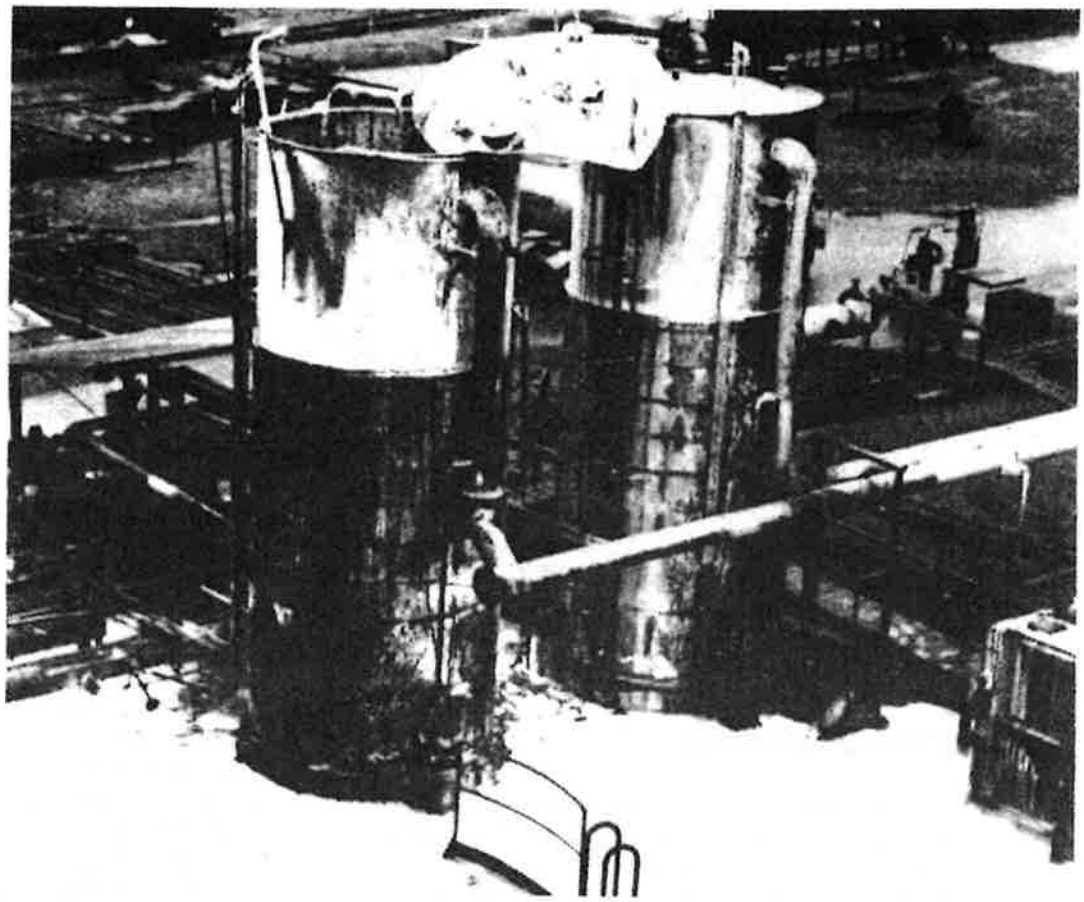


**Figure 3—Aftermath of Tank Fire.**

sulfide to form—if hydrogen sulfide is present. If the asphalt deposits subsequently crack, then the iron sulfide may be exposed to air. Because iron sulfide is pyrophoric (capable of igniting spontaneously in air), the adjacent asphalt deposits may begin to smolder.

Asphalt deposits have been found to ignite from pyrophoric iron sulfide at 191°C (375°F). (The exact critical temperature is not known.) Smoldering asphalt deposits release hydrocarbons into the vapor space along with carbon dioxide, carbon monoxide and water vapor. At the same time, smoldering asphalt deposits consume oxygen from the vapor space.

When concentrated hydrocarbons in the vapor space of an asphalt storage tank provide sufficient fuel, and smoldering asphalt deposits inside the tank act as a source of ignition, two sides of the fire triangle are formed. Heat from the spontaneous combustion of exterior roof insulation saturated by vent fumes may be another source of ignition for the hydrocarbons inside the tank vapor space. Then, only oxygen is needed inside the tank to form the third side of the fire triangle. But the smoldering asphalt deposits consume oxygen and release carbon dioxide, carbon monoxide and water vapor. Therefore, the actual amount of oxygen present inside the tank is normally insufficient to support combustion. However, if air is admitted to the tank from a vent during rapid drawdown of the asphalt, or if air enters the tank from cross-ventilation between an open gauge hatch or manway cover, enough oxygen may be supplied to support combustion. Once combustion begins in a hot asphalt storage tank, an explosion and fire may result (see Figure 3).

## *Fire Preventive Measures*

Because of differences in asphalt tank storage facilities and operating procedures, an all-inclusive guide to preventing tank fires is beyond the scope of this publication. The following general guidelines, however, are recommended for use:

1. Clean roof vents periodically to prevent accumulation of asphalt deposits from vapor condensation.
2. Use mushroom or cone-shaped vents (Figure 4) to minimize deposit build-up and vent plugging.
3. Prevent insulation near roof vents from becoming saturated with deposits caused by escaping asphalt fumes. Keep filters clean.
4. Provide only one vent for each tank.
5. Keep gauge hatches and manway covers closed.
6. Do not blow out asphalt lines with air, and do not blow air into asphalt tanks when the asphalt temperature is above 205°C (400°F).
7. Blanket the tank vapor space with an inert gas. An oxygen content of about five percent will help prevent the formation of pyrophoric iron sulfide.

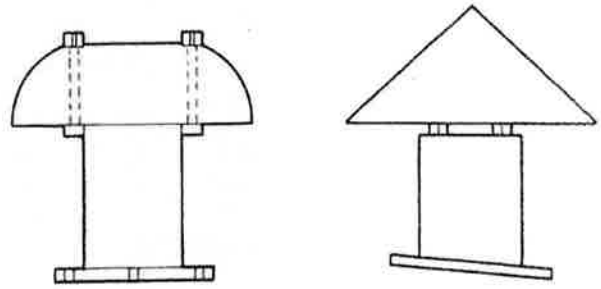


**Figure 4—Mushroom-Shaped and Cone-Shaped Vents.**

## Fire-Fighting

If an asphalt tank explosion occurs, it may be followed by a tank fire. The explosion will probably cause roof failure or produce other openings in the tank that can be used for extinguishing the blaze. Extreme care must be exercised in applying water or foam to burning asphalt. The precise method to be used depends on a number of factors, such as the tank size and number of openings. These can only be determined at the fire scene.

Advice should be sought from the local fire department concerning measures for fire prevention and provisions for fire-fighting at any particular installation.

For further information refer to the American Petroleum Institute Publication 2021, *Guide for Fighting Fires In and Around Petroleum Storage Tanks.*

# 4 TANK CARS AND TRUCKS

## General

Vehicles transporting asphalt should be properly vented. Refer to *Recommended Regulatory Standard for Vehicles for Flammable and Combustible Liquids,* National Fire Protection Association, No. 385. Transportation regulations are defined in *Code of Federal Regulations No. 49,* Parts 171 through 179.

## Tank Cars

Before beginning unloading operations on asphalt tank cars, they should be spotted on a level track with brakes set and wheels blocked. Derails should be placed at each end of the operational track. Warning signs and flags should be placed around the working area.

Asphalt tank cars are equipped with steam coils or electrical heating systems. Before a tank car is heated, steam coil outlets should be examined for any trace of petroleum product, since it could indicate a leak. Steam should not be applied to a leaking coil until it has been repaired. Also, before a tank car is heated, the unloading line should be connected to avoid spills. ***Caution:*** Before the outlet valve cap (Figure 5) is removed, the valve rod handle should be operated to ensure that the valve is seated. Both heating and unloading lines should have flexible sections to allow for misalignment and slight movement of the tank car. Tank car vents should be opened before heating to prevent pressure build-up in case of malfunctioning relief valves.

Connections for steam inlets and outlets on tank cars are identified with markings. The connections should be checked to ensure that steam is applied only at the inlet.

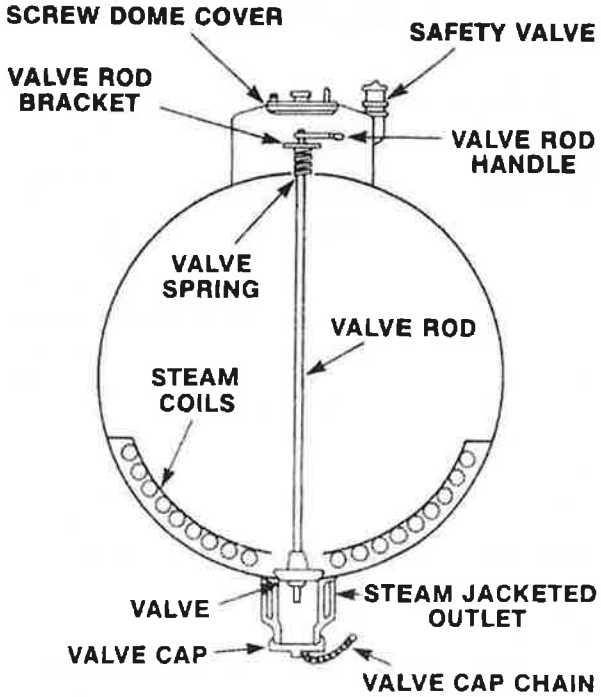



**Figure 5—Section Through Asphalt Tank Car.**

Before admitting steam to the coils, the steam outlet valves should be completely open. Steam to the heating coils should be admitted slowly to avoid breaks from rapid expansion.

It is suggested that when opening dome covers and outlet caps, workers use face shields, goggles, and sturdy gloves. They should stand upwind to one side to avoid any possible injury from spray, gases, or fumes. Dome covers should be kept open during heating to prevent pressure build-up, and later when the asphalt is removed from the tank car. During rain the cover should be opened at an angle over the dome to keep out water. While the asphalt is being heated it should be examined periodically through the dome for excessive foaming, steam bubbles and a rumbling sound that could indicate a steam leak. The temperature of the asphalt should be checked periodically to ensure its not being heated above the temperature specified.

## Tank Trucks

For tank trucks, no electrical bond is required between the fill stem and the truck when loading or unloading asphalt. However, some agencies require bonding if the previous load in the tank truck was rapid-curing or medium-curing cutback. During loading and unloading the truck brakes should be set to prevent movement, and the engine turned off to prevent ignition in case of overflow or hose rupture.

Oil-fired truck burners for heating asphalt should not be lighted at the loading rack. There must be enough asphalt in the truck to cover the heating flues by at least 200 mm (8 in.). Also, burners should be extinguished and allowed to cool before discharge is commenced.

Because pressure inside a tank truck can spray out hot asphalt, it is suggested that persons open dome covers and outlet caps slowly, while wearing face shields, goggles and sturdy gloves. They should stand upwind to one side to avoid hot gases and fumes, and to prevent being struck by a cover or hot asphalt spray. Tank-truck unloading line caps should not be removed without first checking that the unloading valve is closed.

## Entering Confined Spaces

Standard procedures and special precautions must be established and then followed by persons entering confined spaces used for storing asphalt such as tank cars and trucks, and storage tanks at refineries and asphalt plants.

A tank that has held asphalt should not be entered unless it has been allowed to cool to ambient temperature, and tested for the presence of oxygen, hydrogen sulfide, hydrocarbons, etc., to make certain that the atmosphere is safe. Continuous ventilation must be supplied whenever persons are in the tank.

If a tank must be entered during an emergency—before the atmosphere can be tested—a self-contained or air-supplied breathing apparatus with a full face-piece operated in a pressure-demand or other positive mode is advised. Respiratory equipment should be approved by the National Institute for Occupational Safety and Health or by the U.S. Bureau of Mines. Persons using respiratory equipment should not enter a tank unless they are fitted with a safety harness and a lifeline attended by an individual

## TABLE 2—GUIDE FOR LOADING ASPHALT PRODUCTS

| Last Product In Tank | Product to be Loaded | | | |
|---|---|---|---|---|
| | Asphalt Cement | Cutback Asphalt | Cationic Emulsion | Anionic Emulsion |
| **Asphalt Cement** | OK to Load | OK to Load | Empty to no Measurable Quantity | Empty to no Measurable Quantity |
| **Cutback Asphalt** | Empty* | OK to Load | Empty to no Measurable Quantity | Empty to no Measurable Quantity |
| **Cationic Emulsion** | Empty* | Empty to no Measurable Quantity | OK to Load | Empty to no Measurable Quantity |
| **Anionic Emulsion** | Empty* | Empty to no Measurable Quantity | Empty to no Measurable Quantity | OK to Load |
| **Crude Petroleum and residual fuel oils** | Empty* | Empty to no Measurable Quantity | Empty to no Measurable Quantity | Empty to no Measurable Quantity |
| **Any product not listed above** | Tank must be cleaned | Tank must be cleaned | Tank must be cleaned | Tank must be cleaned |

* Any material remaining will produce dangerous conditions

equipped with self-contained or air-supplied breathing apparatus readily available for emergency rescue or assistance.

## *Contamination*

Tank cars and trucks may be used for transporting a variety of petroleum products. Field observations and test results have shown that contamination of materials frequently takes place. Contamination not only increases the possibility that the asphalt will not meet material specifications, but also increases the danger of fire or explosion. Light hydrocarbons, for example, may be present in a tank car or truck from the remains of previous loads or from diesel oil or solvent used to clean and flush the previous contents. To minimize the potential hazard, asphalt products should be loaded in accordance with Table 2. Tanks should be emptied to 0.5 percent of capacity or less, as listed in the table.

## *Spills or Leaks*

Asphalt escaping from its container should be stopped at the source as soon as possible. Sources of ignition should be eliminated, and persons not using protective equipment should be excluded from the area until clean-up has been completed. Asphalt spills should be contained by diking or impounding if needed. Removal of asphalt spills that do not solidify on cooling may require the use of an absorbent such as sand, earth or sawdust. If asphalt enters water-courses or sewers, the authorities concerned should be notified. Uncontaminated asphalt may be recovered for use, and absorbents containing asphalt should be removed to an approved disposal facility.

# 5 HANDLING HOT ASPHALT

## General

Many of the metal surfaces in asphalt plants and in roofing or processing operations exceed 65°C (150°F), and frequently are well over 93°C (200°F). Asphalt temperatures commonly exceed 149°C (300°F) as used in these areas. Exposed lines or surfaces can burn flesh on momentary contact—65°C (150°F) or higher. Also, similar hazards exist in other areas; around dryers, boiler houses, asphalt receiving and handling areas, and similar.

Therefore:

- Be aware of burn hazards in the workplace.
- Wear appropriate protective clothing.
- Follow proper safety procedures. Use catwalks, screens, barrier guards and shields to protect from steam, hot asphalt, hot surfaces, and similar dangers.

## Protective Clothing

Asphalt cements and oxidized asphalts require heating to high temperatures for transfer and application. The resultant high temperature materials can cause severe burns, and precautions are necessary to prevent injury to personnel. Emulsified and cutback asphalts may also be heated sufficiently to cause severe burns on contact. When handling heated asphalt, chemical goggles and a 200 mm (8 in.) minimum-sized face-shield should be used. Loose clothing in good condition should be worn with collars closed and cuffs buttoned at the wrist. Gloves with gauntlets that extend up the arm should be worn loosely so that they can easily be flipped off if covered with hot asphalt. Boots with tops at least 150 mm (6 in.) high should be worn, and these should be laced without openings through which asphalt could reach the skin. Pants without cuffs should extend over the tops of the boots. Long handled sprayers with flexible hoses should be used when emulsified asphalts are applied by hand for tack coats, or when cutback asphalts are applied by hand for prime coats.

## Roofing Kettles and Hoisting Equipment

Asphalt kettles should be leveled and set securely to prevent being upset. Cold asphalt should be added to kettles in small pieces to prevent hot asphalt from splashing out. Asphalt kettles should be operated at the lowest practical temperature, under 260°C (500°F) with the lids closed whenever possible. Workers near asphalt kettles should stand upwind to avoid smoke and fumes.

Pumping hot asphalt from a kettle to temporary storage on a roof and recirculating the asphalt to the kettle for reheating, is a safe and efficient way of moving the molten material (see Figure 6). If hoisting must be done instead of pumping, however, the hoisting equipment should be checked to make certain that it is well secured. Lines should be examined for excess wear and for strong attachment of the safety hooks that carry buckets. The buckets should never be completely filled with hot asphalt. They should be hoisted carefully to prevent swinging and collision with other objects. A tag line may be required to control a bucket during hoisting. Persons must maintain a safe distance from the bucket to avoid exposure to hot asphalt spills.

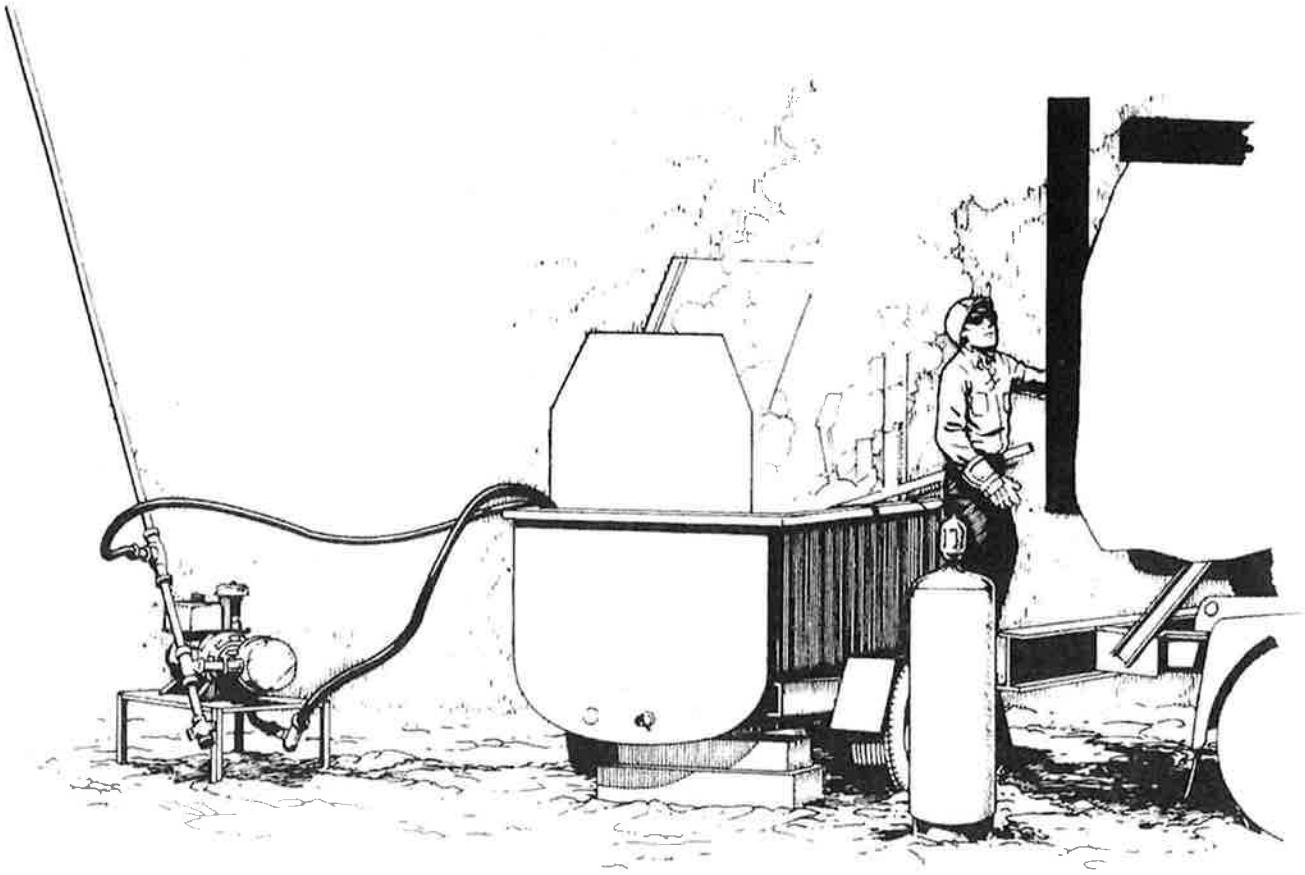


**Figure 6—Roofing Kettle Operation.**

# 6 FIRE PREVENTION AND CONTROL

## *General*

Since asphalt products are often stored and handled at elevated temperatures, fire prevention is extremely important. One of the greatest hazards in handling hot asphalt is exposure to a source of ignition. Sources of ignition, such as sparks of electrical or other origin, open flames or incandescent material (lighted cigarette) should be prohibited or otherwise strictly controlled in the vicinity of asphalt operations.

## *Distributors*

Asphalts that are applied while at temperatures above flash point are especially vulnerable to combustion. For example, applying a prime coat with a distributor involves using cutback asphalt heated above its flash point. If a fire is initiated at the spray bar it may spread thorugh accumulated asphalt deposits on the distributor chassis and destroy the vehicle. Therefore, asphalt distributors should be kept clean and free from asphalt accumulations.

Spray-bar fires have been started by pieces of burning material (from the torch used to light the burners) falling unnoticed on to the spray bar. To eliminate this risk the torch head should be carefully made. A woven wick bound with wire or wire gauze is suitable.

Before spraying begins, the burners must be shut off. If practical, the hot parts of the burner should be permitted to cool.

Exterior parts of distributor truck exhaust systems should be kept clean by wire brushing to remove debris that could ignite and fall in the path of the spray bar.

When spraying is in progress, there is always the danger of fire from a cigarette or match thrown down by a passerby, even if the work crew is alert. It is advisable to post a suitable warning that spraying operations are underway with the traffic signs indicating road-work ahead.

A distributor spray-bar fire can be put out if quickly dealt with in the early stages. The spray bar must be shut off at the earliest possible moment by closing the spray valve or, if necessary, by stopping the pump. To help ensure success, the distributor crew should be trained to put out this type of fire. Dry chemical or carbon dioxide extinguishers should be stored in the cleanest place on the vehicle, preferably in the cab. A spare extinguisher should also be available in case the first fails to operate.

### Asphalt Kettles

Asphalt kettles should normally be heated outdoors to prevent an accumulation of vapors. However, if kettles must be used indoors, they should be provided with hoods and exhaust fans to remove the vapors. Fuel supply lines and hoses should be inspected frequently to avoid leaks and subsequent danger from fire.

Whenever asphalt kettles are being used they should be attended by an operator, and the temperature controlled by thermostat or monitored by frequent temperature measurements. The level of the asphalt in a kettle must always be at least 200 mm (8 in.) above the flues whenever the heaters are operating. If the asphalt temperature approaches the specified maximum, the heater must be shut off so that the limit will not be exceeded. If cooling is required and outage permits, adding pieces of unmelted asphalt to the kettle will lower the temperature.

Asphalt containing moisture may froth over from the kettle when heated, causing burns to workers; and it may catch fire if it comes into contact with a source of ignition. To prevent foaming, kettles should be dry before being filled with asphalt. Silicone anti-foaming agents will also help to control foaming.

Dry chemical or carbon dioxide fire extinguishers must always be available, and should be checked frequently to ensure that they are in good working condition.

Asphalt kettles should be cleaned periodically to remove accumulations of asphalt that could serve as fuel if a fire erupts. Highly-volatile flammable solvents such as gasoline should not be used for cleaning. Kerosene, heating oil or diesel oil may be used, but only in well-ventilated areas. The cleaning solvents should be stored only in containers approved or listed by a recognized testing agency.

### Empty Tanks

Before welding or other work is to be done on a tank that has contained asphalt, a qualified inspector using suitable instruments should test the atmosphere in the tank for combustible vapors and oxygen. The tank should be ventilated, filled with water, or filled with inert gas—as appropriate—before work begins. While welding or other hot work is being accomplished, frequent checks should be made of the tank atmosphere to verify that conditions remain safe. Fire extinguishers should be available and a fire-watcher trained to use them should be posted at the work site.

## 7 FIRST AID

### General

Whenever a person is injured from exposure to asphalt fumes, cold asphalt, or hot asphalt, obtain first aid/medical attention as soon as possible. To prevent the possibility of future medical complications, have the victim examined by a physician even if the injury does not appear to be serious.

### Asphalt Fumes

- If overcome by fumes, move to fresh air.
- Administer oxygen if breathing is difficult.
- Start artificial respiration if breathing stops.
- Have victim examined by a physician.

## *Cold Asphalt*

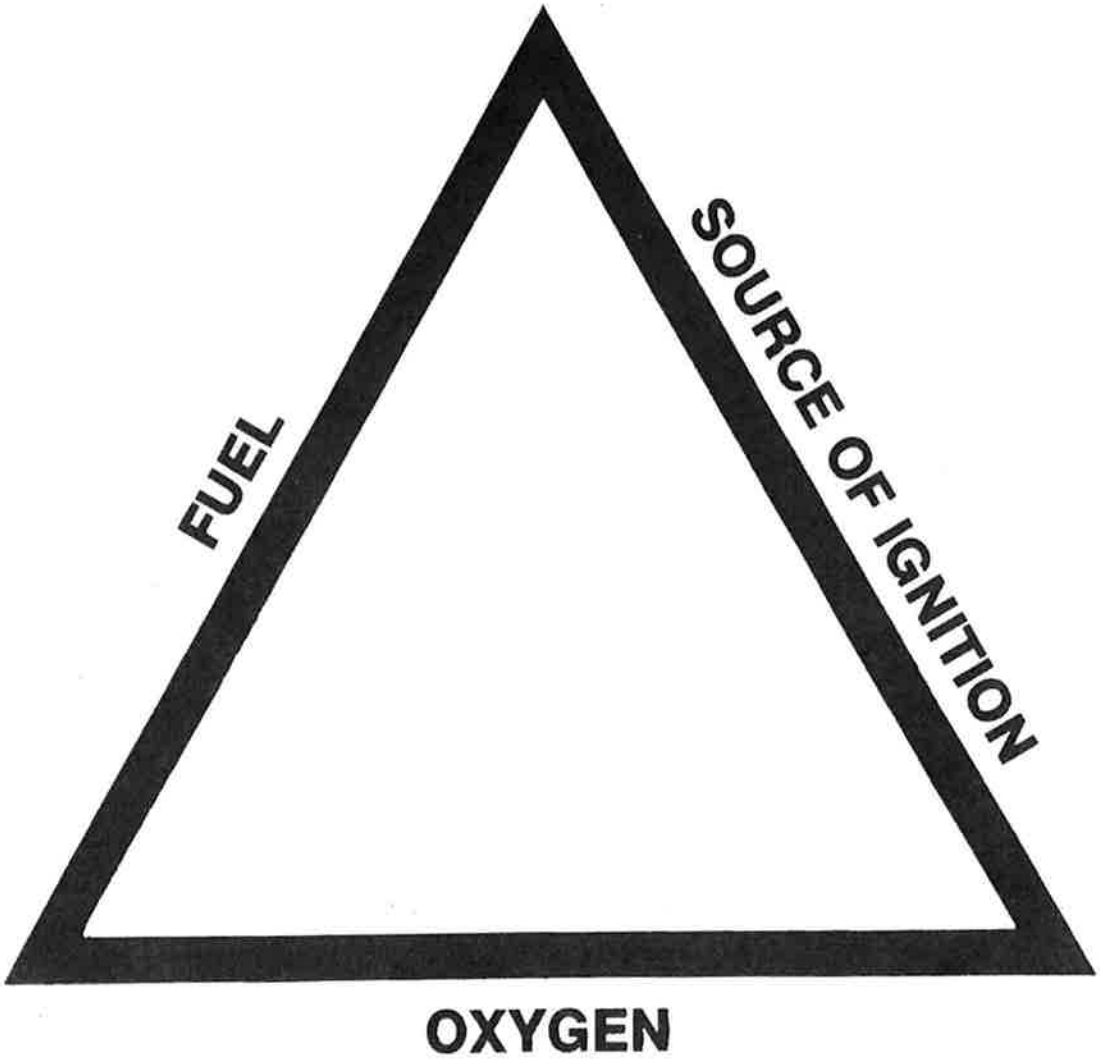
- Remove cold asphalt from skin with waterless hand cleaner (warm mineral oil 43°C (110°F) has also been used).
- Wash skin thoroughly with soap and water.
- Remove contaminated clothing, and shower at once.
- Flush out eye contamination for at least 5 minutes with water, lifting upper and lower eyelids occasionally.
- Have victim examined by a physician.

## *Hot Asphalt*

- Apply cold water or ice pack to asphalt skin burns.
- If burns cover more than 10 percent of body (about equal to surface of one arm or one half a leg) apply lukewarm water, or warmer if needed to alleviate pain, but heat in the asphalt must be removed as rapidly as possible.*
- Do not remove asphalt from skin.
- Do not bandage burn.
- Have victim examined by a physician.

*Advice from a physician.

# FIRE TRIANGLE




**ALL THREE FACTORS MUST BE PRESENT FOR A FIRE TO OCCUR**