

Recommended Practices for Controlling Asphalt Fume Exposures during Hot Asphalt Roofing Jobs



Introduction

Controlling worker exposures to asphalt fumes and particulates should be a priority on every hot asphalt roofing job. Although inhalation exposures to fumes in hot asphalt roofing work are, on average, at or below recommended health-based limits, higher exposures are not uncommon, especially for kettle operators but also, to a lesser extent, on the roof. In addition, asphalt fumes can condense onto the skin, and some of the chemicals in asphalt can be absorbed through the skin. ARMA and NRCA recommend the use of good temperature management and practical exposure control practices to reduce potential health and safety risks, minimize odor complaints, and improve working conditions while ensuring a quality roof installation.

Effective Temperature Management

Temperature control is essential on every hot asphalt roofing job for three reasons: (1) hot asphalt roof construction requires that the asphalt be applied within a specified temperature range in order to reduce the risk of roof failure or reduced service life; (2) overheating the asphalt can cause kettle fires or explosions; and (3) health scientists agree that heating asphalt to higher temperatures results in significantly higher worker exposures to fumes – scientific studies indicate that, at the temperatures needed for commercial application of hot asphalt, roofer exposure to asphalt fumes can be cut in half by reducing temperatures by 50°F [28°C]. Effective temperature management involves the following steps:

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- At the start of every job the supervisor or foreman should identify two important temperature targets: (1) the maximum kettle temperature, and (2) the recommended application temperature.
 - The maximum kettle temperature is intended primarily to minimize the risks of kettle fires and explosions that can occur if asphalt is overheated. In the great majority of cases, the maximum kettle temperature will be 550°F [288°C] as recommended in the current ASTM specification for roofing asphalt (ASTM D312-15).
 - The recommended application temperature refers to the temperature of the asphalt taken at the point of application on the roof (such as the mop bucket or mechanical spreader). On built-up roofing (BUR) jobs, the recommended application temperature is the “equiviscous temperature,” or EVT, and the application temperature target is expressed as $EVT \pm 25^{\circ}F$ [$EVT \pm 14^{\circ}C$]. EVTs can vary. On jobs involving hot application of other asphalt roofing products such as modified bitumen and fleece-backed membranes, observe the application temperature specified by the product manufacturer.
- The job supervisor or foreman should always assign the kettle operator and a member of the rooftop crew to work together to help ensure that the proper asphalt temperatures are maintained in the kettle and at the point of application on the roof.
 - Prior to the beginning of the job, the supervisor or foreman should inform the kettle operator and responsible member of the rooftop crew of the asphalt application temperature and maximum kettle temperature which will be used for the job.
 - The responsible member of the rooftop crew should take temperature readings from the application equipment (mop buckets or the reservoirs of mechanical asphalt spreaders and asphalt felt-laying machines) as needed to ensure that proper application temperature is being maintained, and report the readings to the job supervisor or foreman. **NOTE:** Temperatures should be taken after the application equipment has been in use long enough to reach the same temperature as the asphalt. Temperatures should be measured with a properly calibrated immersion probe or kettle thermometer. If a thermocouple or thermometer is used, it should be inserted into the asphalt long enough to reach a constant temperature. The use of infrared thermometers is not recommended because they measure surface rather than internal temperature, which is necessary for proper EVT application.
- The kettle operator should always keep the kettle temperature below the maximum kettle temperature. However, based on the readings at the point of application, the kettle operator should wherever possible reduce the kettle temperature even further, and set it at the lowest temperature that maintains the recommended application temperature.
- The kettle operator should observe the following guidelines to monitor the temperature of the asphalt in the kettle:
 - Always skim the asphalt in the kettle before taking temperature readings to avoid stagnant layers. Do not skim if using a fume-suppressing asphalt.
 - If the kettle is controlled manually, monitor the temperature of the asphalt at least every 30 minutes.
 - Take manual temperature readings using a stem thermometer inserted just below the surface of the asphalt. Avoid hot spots inside the kettle such as the heating coil.
 - Verify temperature readings with the temperature gauge on the kettle by using a hand-held immersion probe (thermocouple or thermometer).
- All members of the crew working with hot asphalt should follow simple steps to minimize heat loss. By keeping heat loss to a minimum, the kettle can be operated at a lower temperature while maintaining the recommended temperature at the point of application.
 - On the roof, always keep the lids closed on reservoirs of luggers, mechanical asphalt spreaders, and asphalt felt-laying machines except when necessary to re-fill them.
 - When transferring hot asphalt from the hot lugger to mop carts, spreaders or felt-laying machines on the roof, use the lugger’s draw-off valve/spigot at the proper height to avoid splash hazards and reduce heat loss.
 - Keep the kettle lid closed except when performing necessary operations such as refilling the kettle, skimming, and taking temperature readings. This not only reduces heat loss but also reduces fume exposures from the kettle.
 - Minimize the frequency of kettle lid opening by:
 - Filling the kettle to the maximum recommended fill level (usually within 4 to 6 inches of the top).
 - Chop the asphalt keg into small, manageable pieces before the refill operation to allow the asphalt to melt more quickly.
 - When reloading, spread the asphalt chunks throughout the kettle so they will melt evenly and rapidly. This prevents “cold spots” which can cause the temperature control feature of the kettle to keep the burners fired, resulting in overheating.
 - Combine tasks so the lid does not need to be opened more often than necessary: For example, when the lid is opened for reloading, skim the asphalt as needed and take a manual temperature reading.

Job-SetUp

- **Choice of Asphalt:** Wherever possible, always choose an asphalt that meets ASTM D312-15 specifications.

CAUTION: If an asphalt not complying with ASTM D312-15 specifications is used, it is critical to recognize that ASTM D312-15 specifies a minimum flashpoint of 575°F [302°C]. Noncompliant asphalts – including asphalts meeting previous versions of ASTM D312, and other ASTM and manufacturer specifications, as well as Canadian and other international standards – may allow lower flashpoints. The new 550°F [288°C] maximum kettle temperature specified in ASTM D312-15 would pose significant safety risks if used for asphalts with flashpoints below 575°F [302°C]. Kettle temperatures should be maintained at least 25°F [14°C] below the flashpoint whenever using noncompliant asphalts with flashpoints lower than 575°F [302°C].
- **Kettle Size:** Always use a kettle with a capacity appropriate to the job. Kettles that are too small must be refilled more often. In addition, introducing cold asphalt into an undersized kettle can have a bigger impact on the overall asphalt temperature in the kettle, making control more difficult.
- **Prevent Overheating:** Whenever available, choose kettles that –
 - are insulated, and
 - have working thermometers, thermostatic controls, and automatic shutoff mechanisms.
- **Reduce Heat Loss:** Whenever possible –
 - choose kettles with higher pumping speeds that reduce heat loss during transfer;
 - insulate the hot pipe; and
 - use insulated rooftop containers such as the lugger and reservoirs on asphalt spreaders and felt-laying machines.
- **Kettle/Tanker Location:** Consider the following factors:
 - **Distance to Roofing Work:** Reducing the distance from kettle/tanker to point of application minimizes heat loss, permitting the kettle to be operated at lower temperature.
 - **Prevailing Wind Direction:** Whenever practical, place the kettle/tanker downwind from the building being roofed to reduce worker exposure and odor complaints.
- **Kettle Orientation:** For the same reasons, always locate the kettle so that, when open, the inside of the kettle lid faces away from the building being roofed.
- **Restrict access to the area surrounding the kettle/tanker** using warning tape, traffic cones, and/or signs. The restricted area should be large enough to keep the public and other employees away from contact with the kettle/tanker and to allow sufficient space for the kettle/tanker operator to work.
- **Work with building management to ensure that appropriate measures are taken to prevent asphalt fumes from entering the building through windows and other air intakes, for example, by covering or closing such intakes and/or temporarily shutting down the heating and ventilation system.**
- **Kettle Maintenance:**
 - Inspect thermometers, thermostats and automatic shutoffs before each job and daily when in use.
 - Calibrate these devices in accordance with manufacturer instructions. If manufacturer recommendations are unknown, calibrate at least monthly.
 - Make sure the kettle lid fits tightly.
- **Poorly Ventilated Spaces:** For work in partially confined or poorly ventilated spaces (such as under eaves), consider using fans to blow asphalt fumes away from the work area. Fans should be electrically grounded and kept out of walking paths and areas where contact with hot asphalt may occur. Inspect fans and other devices daily when in use.
- **SDSs and Manufacturer Recommendations:** Observe recommended precautions for asphalt and non-asphalt components of the product in SDSs and product installation guides.

Work Practices for Reducing Worker Asphalt Exposures

- Kettle operators should work upwind of the kettle opening wherever possible.
- Workers applying hot asphalt on the roof should work upwind of fume sources whenever possible. Rooftop fume sources include hot luggers, mop carts, spreaders, felt-laying machines and roof surfaces where hot asphalt is being applied.

- On re-roofing jobs involving the removal of an existing asphalt roof, observe the equipment and work practice recommendations in the companion ARMA/NRCA publication: "Recommended Practices for Controlling Asphalt Exposures during Tear-Offs of Asphalt Roofs"

Fume Emission Controls

Where feasible and appropriate for the job, use one or more of the following controls:

- **Fume-Suppressing Asphalt:** These products, which are made by adding small amounts of polymer to the asphalt, have been shown by the National Institute for Occupational Safety and Health (NIOSH) to reduce worker fume exposure and energy loss.
- **Wax Modified Asphalt:** Some BUR asphalts on the market are formulated for application at temperatures lower than standard products. This allows the kettle to be operated at lower temperatures, resulting in reduced fume emissions both at the kettle and on the roof.
- **Kettle Engineering Controls:** Kettles can be equipped with several different types of emission control systems, including:
 - loading devices allowing the kettle to be refilled without opening the lid; or
 - afterburner and filtration systems which burn or condense fumes collected from the headspace inside the kettle.

Regardless of which system is used, manufacturer instructions on use and maintenance of the equipment must be strictly followed to minimize fire and explosion risks.

Protective Clothing and Equipment

All employees working with hot asphalt should wear:

- Goggles or safety glasses with side shields; consider safety glasses that have added protection from airborne emissions, such as foam padded safety glasses.
NOTE: Kettle operators should wear full-face shields attached to their hard hats over their safety goggles/safety glasses.

- Nonskid shoes with leather uppers that cover the ankles
- Long cuff-less pants
- A long-sleeved shirt made from cotton or other materials that will not melt. Do not wear materials, such as nylon and polyester, which can melt.
- Leather or thick cotton gloves with cuffs tight at the wrist
- Hard hats where designated by the site safety plan.

Personal Hygiene Practices

- Work clothing that comes into contact with asphalt fumes should be removed as soon as possible after each workday, should be kept separate from other clothing, and should not be re-worn unless laundered.
- Workers should wash exposed areas of the skin with soap and water as soon as possible after each shift and, if possible, before eating, drinking, smoking, chewing tobacco or gum, applying cosmetics, or using toilet facilities. Fuels, solvents and other industrial chemicals should never be used to clean condensed fumes or asphalt from the skin.
- Employees should not eat, drink, smoke, chew tobacco or gum, apply cosmetics, or have open or exposed food and beverages, in areas where fumes are present or may have condensed on surfaces.

Education and Training

- In addition to complying with the provisions of the OSHA Hazard Communication Standard, contractors should ensure that workers assigned to jobs involving potential asphalt fume exposure in hot asphalt roofing operations are adequately educated about all health and safety hazards of working with hot asphalt during roofing, including burn and fall hazards. This document addresses fume-related hazards and workers should also be specifically trained in the operational practices, protective equipment and precautions recommended here.

If you need more information, or have any questions or concerns, please feel free to contact us:



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