CDC Workplace Safety and Health

WORKPLACE SOLUTIONS

From the National Institute for Occupational Safety and Health

Reducing Worker Exposure to Asphalt Fumes from Roofing Kettles

Summary

Roofers, particularly kettle operators, may be exposed to asphalt fumes when asphalt is heated in roofing kettles for built-up roof construction. Asphalt fumes have been associated with a number of health risks. NIOSH examined two engineering controls for reducing exposure to asphalt fumes: fume-suppressing asphalt and afterburner and loader systems.

Description of Exposure

An estimated 46,000 roofing contractors work in the United States. These contractors are primarily small businesses that specialize in residential roofing [NRCA 2000]. Approximately 50,000 on-roof workers are exposed to asphalt fumes [AREC 1999].

Studies of roofers show an excess of lung, bladder, brain, liver, and digestive system cancers among roofers and workers in other occupations with the potential for exposure to asphalt [NIOSH 2003]. The extent to which these findings may be caused by asphalt fume exposure is unknown. Asphalt fumes have been reported to cause coughing and headaches and to irritate the mucous membranes of the eyes, nose, and respiratory tract. Observations of acute irritation in workers from airborne and dermal exposures to asphalt fumes and aerosols and the potential for chronic health effects, including cancer, warrant continued diligence in the control of exposures [NIOSH 2001].

In 2003, NIOSH published a technical report on current practices used to reduce exposure during the application of hot asphalt to roofs. Two control methods identified for further evaluation were (1) substituting fume-suppressing asphalt for conventional asphalt and (2) using afterburner and loader systems to reduce asphalt-fume emissions. NIOSH conducted field studies to evaluate the effectiveness of these engineering controls.

Surveys were conducted during the construction of built-up roof (BUR) systems, which account for approximately 14% of the new retrofit markets for low-slope roofs [NRCA 2003]. BUR systems are layers or plies of organic (e.g., cellulose), fiberglass or polyester felt sealed together with hot asphalt heated in kettles (see Figure 1). The layers protect against moisture penetration and, combined with the sealing ability of asphalt, make BUR systems excellent for waterproofing flat or low-sloped roofs. On-roof workers such as those who apply the hot asphalt to the felt plies are exposed to asphalt fumes. Kettle operators are exposed to the highest concentrations of fumes on most BUR jobs.

Asphalt roofing kettles normally consist of a round-bottomed steel vessel with a heating unit composed of propane-fired burners. The kettles come in capacities of 25 to 1,500 gallons. Kettle operators maintain the appropriate

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Figure 1. Applying hot asphalt to fiberglass felt.

Figure 2. Kettle Operator. *Courtesy of Thomas R. Shanahan, National Roofing Contractors Association.*

supply of hot asphalt at the correct temperature for application on the roof during construction of BURs (see Figure 2). The type of asphalt used and the application temperature vary depending on factors such as the slope of the roof being built.

Controls

Fume-Suppressing Asphalt

Fume-suppressing asphalt (also known as low-fuming asphalt) contains a small amount of a polymer that, when heated, floats to the surface creating a skim layer on the asphalt in the kettle. This layer may reduce the emission of asphalt fumes from the kettle. Between 1999 and 2001, NIOSH conducted four evaluations for controlling worker exposure to asphalt fumes during the use of fume-suppressing asphalt. The studies showed that when fume-suppressing asphalt was used, exposures to contaminants in the asphalt fumes were greatly reduced (by 70%–83%) for kettle operators. However, it was not certain whether exposures were reduced for roof-level workers who usually did not work near the kettle.

Afterburner and Loader Systems

Afterburner systems reduce the amount of fumes emitted and reduce worker exposures by burning asphalt fumes from the surface of the asphalt in the kettle. This system may also be used with loading devices that allow the kettle operator to add asphalt without opening the kettle lid and releasing fumes. During six NIOSH field studies, the afterburner and loader systems may have reduced the kettle operators' exposures to asphalt fumes, but variables such as work practices made it difficult to interpret the results. When conditions were well controlled, the contaminants were reduced by 73%–88%. Experience has shown that any afterburner and/or loader system must be carefully designed to avoid causing ignition of asphalt fumes and explosions or fires in the kettle or kettle area.

Recommendations

The surveys showed that the way workers performed their duties greatly influenced the effectiveness of the control measures. NIOSH recommends the following work practices and engineering controls to reduce workers exposure to asphalt fumes.

Asphalt and Kettle Selection

- Use fume-supressing asphalt instead of conventional asphalt, or kettles with afterburner and loader systems when feasible. Follow the manufacturers' recommendations for work practices when using fume-suppressing asphalt. Because of safety concerns potentially associated with the use of kettle afterburner and/or loader systems, the manufacturers' use, maintenance, and work practice recommendations should be strictly followed.

- Use kettles of appropriate size for the job. If kettles are too small, they will have to be opened more frequently to add asphalt, which increases worker exposure.
- Make sure the lid fits tightly. Close the lids during normal operations when asphalt is not being added.
- When opening the kettle lid to refill the kettle, fill to the maximum fluid level and complete other tasks such as skimming and taking temperature readings. This will reduce the number of times the lid must be opened.
- Chop the asphalt kegs into easy-to-handle pieces before opening the kettle lid to reduce the time the lid must be kept open when refilling.

Placing the Kettle at the Worksite

- Set the kettle on a level area to avoid spilling or tipping the kettle.
- Place the kettle where the kettle operator and other on-roof workers will be least exposed to the fumes—for example, downwind from the workers.
- Always place the kettle with the inside of the lid facing away from the building (allowing fumes to be released away from the building when the lid is open).
- Place the kettle away from air intake vents, doors, and windows to minimize the risk of exposing building occupants to asphalt fumes.
- Restrict access to the area immediately around the kettle. Mark the area with warning tape, traffic cones, and/or signs. The restricted area should be large enough for the kettle operator to work as well as reduce the exposure of other on-roof workers by keeping them away from the kettle.

Maintaining Asphalt Temperature in the Kettle

- Maintain the lowest possible asphalt temperature in the kettle within the manufacturers' recommended temperature range. Always keep the temperature of the asphalt in the kettle at least 25 °F below the maximum heating temperature specified by the manufacturer. Recommended application temperatures and maximum heating temperatures can be found on keg labels or bills of lading for asphalt delivered by tanker.
- Before starting the job, look at all temperature-related equipment such as thermometers and automatic shut-off mechanisms to make sure they are in good working order.
- Calibrate the kettle thermometers and thermostats at least monthly or as recommended by the manufacturer.
- Take manual temperature readings using a stem thermometer inserted just below the surface of the asphalt.

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For More Information

Work practices during the use of fume-suppressing asphalt can be found at the following Web site: www.owenscorning.com/trumbull/health/practices.asp.

Additional information about asphalt fume exposures during the application of hot asphalt to roofs and methods to control the exposures can be found in *Asphalt Fume Exposures During the Application of Hot Asphalt to Roofs: Current Practices for Reducing Exposures*, [DHHS(NIOSH) Publication No. 2003–112], (www.cdc.gov/niosh/docs/2003-112). For copies of the NIOSH field reports this document is based on, contact NIOSH at

NIOSH
Publications Dissemination
4676 Columbia Parkway
Cincinnati, OH 45226–1998

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DEPARTMENT OF HEALTH AND HUMAN SERVICES
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National Institute for Occupational Safety and Health
4676 Columbia Parkway
Cincinnati, OH 45226–1998