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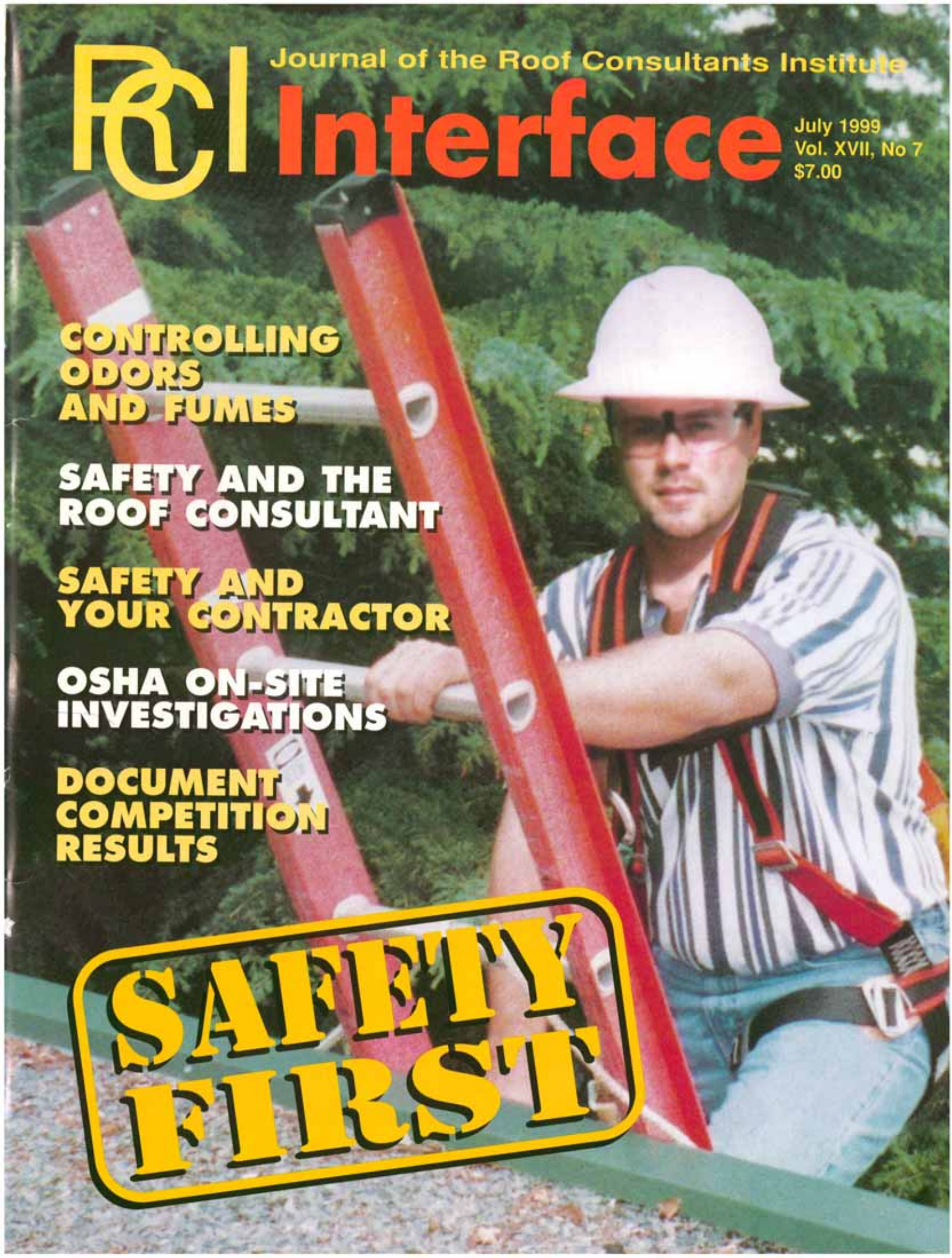

CONTROLLING ODORS AND FUMES

SAFETY AND THE ROOF CONSULTANT

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OSHA ON-SITE INVESTIGATIONS

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SAFETY FIRST

Controlling Odors/Fumes

During the Application of Heated Bituminous Roofing Materials

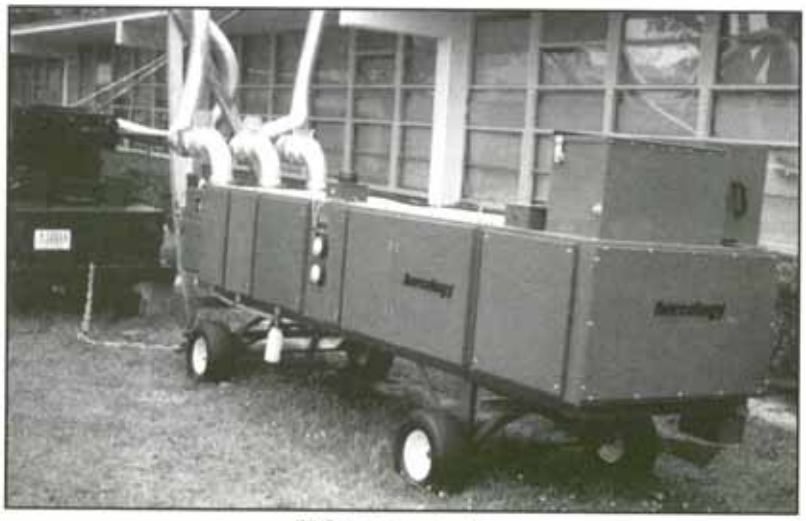
By Karl Schaack

The process of installing roofing materials utilizing heated bitumens has been performed for many years and is expected to continue for many more years to come. A concern for many is the exposure to odors during heating or application of the bitumen. Some fear that chronic overexposure to fumes during the heating of coal-tar pitch may be harmful. OSHA has established standards for workers regarding the permissible exposure levels (PEL) applicable to hot-applied roofing using coal-tar pitch. These standards are listed in Volume I of "General Industry Standards and Interpretation," under Subpart Z, Section 19100.1000 and 1910.1002.[1] Current studies have been inconclusive regarding the carcinogenicity of heated asphalt. Some of the acute effects due to the exposure include headaches, eye and throat irritation, and coughing. Several precautions, procedures, and types of equipment can be used during the heating of bitumen that can minimize and possibly alleviate the effects of odors on building occupants, the general public, and workers.

WORK GUIDELINES

There are several guidelines which can be implemented during the heating and application of bitumen that can assist in the control and reduction of fuming and odor production. Several of these guidelines are simply basic knowledge and good work habits that are often overlooked.

The proper size kettle should be used to heat bitumen. When a certain production (amount of roof to be installed) of bitumen is anticipated for a specific project, a kettle of sufficient capacity should be used by the contractor. An under-sized kettle will most likely result in the kettle being overloaded with bulk pieces of bitumen and the heat being increased to melt the bitumen to "keep up with" production. Proper project planning and correctly-sized kettles will allow for gradual heating increases during the initial firing of the kettle and consistent temperatures throughout the heating period.



FRS 6000 in operation.

Workers must allow ample time for slow, gradual firing of the kettle. The kettle and bitumen should be brought slowly up to the desired temperature. The bitumen should not be heated above the recommended temperatures (finished blowing temperature for asphalt and maximum heating temperature for coal-tar pitch).

The kettle used to heat bitumen needs to be in good working condition. Calibrated thermometers should be used by the operator regularly to verify temperatures. The kettle should have thermostatic heating controls and circulating devices for the bitumen. These instruments allow for consistent heating of bitumen in the kettle and eliminate hot and cold spots. The exterior shell of the kettle should be kept free of excessive bituminous accumulations. As the kettle heats up, these deposits will begin to liquefy and emit fumes. The lid on the kettle should be tight fitting. It should be kept closed except when performing necessary functions, such as adding solid bitumen pieces, skimming debris off the molten bitumen surface, etc. An improperly-fitting lid allows fumes and heat to escape; consequently, more heat is required to achieve proper temperatures, which will exacerbate fuming conditions.

Any moisture that may collect within the kettle should be removed prior to the initial firing. Moisture which typically collects on the tops of bitumen kegs should also be removed prior to placing the solid bitumen in the kettle. Moisture introduced during the heating process creates excessive and unnecessary fuming and may cause explosive splashing as the moisture is immediately transformed to steam. The stored kegs of bitumen should be protected to eliminate the exposure to rain.

The kettle should be placed at the perimeter of the building away from intakes, louvers, windows, and doors. Kettles should not be placed in courtyards or other enclosed areas that may not

Louver intake in wall covered with plastic sheeting to prevent fume infiltration.

have adequate air transfer. If kettles are positioned adjacent to operable windows or doors, these openings should be temporarily barricaded. The opening and closing of doors and windows can create a suction effect, drawing fumes into the building. When possible, the kettle should be positioned down wind from the structure so that winds can carry fumes away from the building. Large, industrial fans positioned adjacent to the kettle may redirect fumes away from the building. However, they can cause swirling wind effects that allow fumes to carry backwards.

Insulated piping, luggers, mop carts, and other bitumen-dispensing devices should be used to minimize heat loss at the roof level. Bitumen is often "overheated" to compensate for heat loss due to ambient temperatures, poorly-operating equipment, or long distances to the point of application.

Using tankers alleviates the need for kettles and the subsequent action of opening lids to load solid pieces of bitumen. Tankers are self-contained units which produce less detectable fuming compared to individual kettles.

At the roofing elevation and during the bitumen application, certain precautions should be taken to avoid odor infiltration into building spaces. Louvers on building walls or roof-top mechanical equipment intakes can be temporarily closed with polyethylene sheeting. Temporary vertical extension shafts can be constructed and fitted onto intakes to draw "fresh" air from a level above the fumes. Equipment can be scheduled and systematically shut down during the bitumen application process. Other roof openings, such as gravity vents or non-functioning ventilators, may also be avenues of odor migration. "Negative" interior building pressures can draw in outside air mixed with fumes if specific conditions are present.

EQUIPMENT

Various proprietary pieces of equipment have been used or are currently available where the primary purpose is to reduce odors during the use of heated bitumen. These devices are based on two concepts: 1) incineration or 2) filtration technique.

INCINERATION METHOD

Reeves Roofing Equipment, Inc. of Helotes, Texas supplies two devices for the control of fumes and odors during the heating of bitumen. These devices are called "Afterburner" and "Safety Loader" and are fitted to traditional kettles.[2] The Afterburner is a steel tubular device that is fitted to the top, positioned in the middle of the kettle lid, and functions similar to a flue. A propane-fueled burner is connected to the base of the Afterburner. As the bitumen is heated, the fumes rise toward the lid of the kettle and into the throat of the Afterburner. The fumes then pass by the burner and reportedly 81% of the particulate matter and 77% of the hydrocarbons burn off. The incinerated air then passes through the top of the After-burner into the atmosphere.

The Safety Loader is a kettle accessory that consists of an enclosed rotating drum fitted onto the front of the kettle lid. The Safety Loader has a door that opens to reveal a "shelf" on which bitumen pieces are placed. The shelf is covered in the back and "sealed-off" from the inside of the kettle. After the bitumen pieces are placed on the shelf, the door is closed and a crank is turned to rotate the shelf. This action deposits the solid pieces into the molten bitumen. This device alleviates the need to raise the kettle lid or otherwise expose the molten bitumen, consequently minimizing the release of fumes. Both the Afterburner and Safety Loader are installed on each lid of a multi- or single-lid kettle for optimum results.

The Garlock Equipment Company of Minneapolis, Minnesota manufactures a device called "Fume Guard Asphalt Fume Elimination System."[3] It is a self-contained unit mounted on a portable trailer. This system also operates on the incineration principle. The unit is connected to a kettle via flexible hoses. Fumes that are created in the kettle during the process of heating asphalt are drawn by a suction fan from the kettle into the cabinet of the unit. The drawn material (gaseous mixture of gases, smoke, airborne oils, and particulates) is mixed with ambient air and then subjected to elevated temperatures, approximately 1500 degrees Fahrenheit. The aromatic elements are reportedly burned off, and the heated air is discharged through an exhaust vent. Independent test results indicate the Volatile Organic Compounds (VOCs) and Polynuclear Aromatic Hydrocarbons are reduced to a non-detectable level by either sensory or mechanical measurement means.

Cleasby Manufacturing Company, Inc. of California has also introduced a similar piece of equipment called the "Emissions Eliminator."[4] This equipment is mounted on a small trailer. It has an exhaust hood that is powered by a 490 cfm fan that draws the fumes from the kettle. The fumes are drawn through flexible metallic (duct) hose to an afterburner. The vapors are then burned off and released as a clear and odorless exhaust.

FILTRATION TECHNIQUE

National Metal and Fabrications, Inc. of Boardman, Ohio provides a piece of equipment called the "FRS-6000" Fume

Recovery System.[5] The FRS-6000 is a mobile cabinet assembly comprised of a series of filters. Flexible hoses connect the bitumen fuming source to intake ports on the FRS-6000. A compressor on the unit draws the fumes from the source though the flexible hose and into the filter chamber. The air passes through a series of filters and is exhausted from the unit. Reportedly, 99% of the particulate matter is removed after the filtration process. The unit has the capability of filtering four independent sources. Multiple kettles are commonly attached to the apparatus. A specially-fabricated lid is fitted to the kettle. The customized lid has an outward swinging door at the front through which to load the pieces of bitumen into the kettle. The flexible hoses are attached to the top of the customized lid. When the apparatus is functioning, the door on the lid can be opened with very little, if any, emission of fumes. An additional hose can be positioned at the roof level where bitumen is deposited from the pipe and into a lugger. At the roof level, a hood-like device is attached to a stand and positioned above the lugger or device in which the bitumen is deposited. A flexible hose is attached to the top of the hood. As the bitumen is discharged from the pipe and into the holding device, the fumes are drawn into the hood and into the filtration cabinet. A hose can also be attached to a tanker.

Air Purification of Houston, Texas manufactures a similar unit identified as the "Enviro Pro BURVOC Fume Removal System."[6] This is a self-contained unit mounted on a trailer. It operates on a multi-filtration system and reportedly produces 99.97% clean air after the filtration process. The filters in these filtration systems are changed and/or cleaned at various stages during the process, depending on the amount and type of bitumen used.

Water collecting on top of asphalt kegs.

Water collecting on top of coal-tar pitch containers.

Other devices have been used to eliminate fumes during the heating of bitumen. A misting apparatus set up adjacent to the kettle has been used in the past. A mist is produced and sprayed into the fumes produced from the kettle, becoming "attached" to minute particles within the fumes. The mist masks elements which cause the odors. The droplets develop an electrostatically-charged film which attracts the offensive, odor-causing molecules. The molecules attach to the droplets and become neutralized by oils contained within the droplets. The oils contained within the droplets are natural, non-toxic, and generally non-threatening to the environment.

MATERIAL SELECTION

Another option for reducing or eliminating fumes due to heating of bitumen is to select alternative materials. A "low fuming" type of coal-tar bitumen was introduced in the early 1970s.[7] This material conforms to ASTM Standard D-450, Type III. This coal-tar bitumen is created by further processing and formulating the Type I variant. A percentage of the volatile components attributed to fume creation was removed from the Type I variant. Tests have reportedly indicated that Type III coal-tar bitumen has significantly less fumes during proper heating procedures. However, due to problems associated with long-term performance of this product, the Type III coal-tar bitumen was discontinued in early 1996.

Insulation boards and sheet membrane materials are commonly attached to the substrate with hot applied bitumens. Insulation boards can be anchored to the substrate using mechanical fasteners. In addition, insulation boards can be adhered to the substrate or other board stock insulation using cold process bituminous-based or spray foam-based adhesives. Sheet materials can be adhered to the substrate also using the same type of cold process adhesives or with torch/heat welding methods. Although these alternate materials eliminate fumes associated with heating of bitumen, other concerns are introduced. These include odors from the adhesives and fire-related issues.

SUMMARY

Although those in the roofing industry do not ordinarily associate odor controls with asphalt (compared with coal-tar pitch), the general public does not typically differentiate between the two, and both are considered disruptive when detected. Project personnel (specifier, contractor, and owner's representative) should implement the necessary procedures, protocol, and equipment that are currently available in order to achieve the desired end result while minimizing the nuisances and disruptions associated with this type of work. Although the information outlined herein is presented to assist personnel in minimizing disruptive odors, it goes without saying that workers should use the necessary personal protective equipment (i.e., long-sleeved shirts, respirators, creams, etc.) to reduce the possible effects from exposure during the use of hot-applied bituminous materials.

Enviro Pro BURVOC in operation.

RESOURCES:

1. Koppers Industries, "Guidelines: Health, Safety & Environment for Coal Tar Built-up Roofing," 1993.
2. Reeves marketing/technical literature.
3. Garlock marketing/technical literature.
4. Cleasby marketing/technical literature.
5. National Metal and Fabrications, Inc. marketing/technical literature.
6. Air Purification of Houston marketing/technical literature.
7. Koppers marketing/technical literature.

ABOUT THE AUTHOR

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