

Some Questions And Answers About Short-Term Non-Occupational Exposures To Asphalt Fumes Created During Roofing Jobs

#### **INTRODUCTION**

Asphalt was first used in the manufacture of roofing products in the late 19th Century. Since that time, the use of asphalt has grown and today it is one of the most important materials used to make roofing products and systems. These include asphalt shingles, polymer modified bitumen membranes, built-up roofing systems, roll roofing, saturated felt underlayments and a variety of roof coatings, sealants, adhesives, caulks and primers.

Fumes can be generated when asphalt is heated to a sufficiently high temperature. About 94% of the asphalt roofing products made in North America today are applied "cold" (at ambient temperatures without heating – such as asphalt shingles) and do not create fumes when applied. However, hot asphalt is still used in the application of built-up roofing and certain modified bitumen roof systems.

Despite the diluting effects of air currents and distance, occupants of nearby buildings and others in the vicinity of hot asphalt work may notice an asphalt odor and have questions or concerns. This brochure has been prepared specifically to answer the questions asked most frequently about short-term non-occupational exposures.

#### **WHAT IS ASPHALT?**

Asphalt is a dark brown to black material with cement-like qualities made by refining petroleum crude oils. It can range in appearance from a thick sticky liquid to a heavy brittle solid. Asphalt is not a single chemical, but a complex mixture containing thousands of different chemicals.

#### **ARE ASPHALT AND COAL TAR THE SAME?**

No. Asphalt is often referred to as "tar," but the two materials are very different. Even though they may appear identical to the untrained eye and both can be used effectively in similar roofing systems, they have much different chemical compositions and potential health effects. Coal tar can be highly irritating to the skin and upper respiratory system and has been classified as carcinogenic (cancer causing) by the International Agency for Research on Cancer (IARC). Coal tar was once widely used in roofing but its use declined over the past several decades. Asphalt has not been classified as carcinogenic by IARC.

#### WHAT ARE ASPHALT FUMES?

When asphalt is heated, some of its chemical constituents are converted to vapors and released into the air. As these vapors cool, some of them condense into tiny liquid droplets. Scientists today typically use the term "asphalt fumes" to refer to the vapors and droplets that are released from heated asphalt.

#### HOW ARE PEOPLE EXPOSED TO ASPHALT FUMES?

Fumes from hot asphalt can be inhaled into the lungs or can condense onto exposed areas of the skin.

### WHAT SHORT-TERM HEALTH EFFECTS ARE ASSOCIATED WITH ASPHALT FUME EXPOSURES?

Exposure to asphalt fumes for short periods of time can be associated with irritation of the eyes and upper respiratory tract (i.e., the nose and throat). Irritation, if it does occur, is usually mild and temporary. Other effects sometimes reported by workers include headache, nausea, decreased appetite, fatigue, skin irritation, and acute lower respiratory tract (i.e. lungs) effects such as coughing, wheezing and shortness of breath.

#### DOES EXPOSURE TO ASPHALT FUMES CAUSE MORE SERIOUS LONG-TERM EFFECTS?

Scientific investigations into possible health effects from long-term worker exposures to asphalt fumes have centered on potential cancer effects and, to a lesser degree, on chronic lower respiratory tract irritation effects such as bronchitis. At the present time, evaluations by most scientific or governmental bodies have not found that exposures to asphalt fumes are associated with serious chronic health effects.

# HAVE ANIMAL STUDIES BEEN DONE TO DETERMINE WHETHER ASPHALT FUMES CAUSE CANCER?

Scientists use studies in animals to test for the potential for cancer in people, and several studies of this type have been done for asphalt fumes:

- Two National Institute for Occupational Safety and Health (NIOSH) studies in the 1980s found tumors in the skin of mice treated with fumes obtained from asphalts using a laboratory fume-generation procedure. Subsequent research revealed that the laboratory-generated fumes used in these mouse "skin-painting" studies are chemically different from the fumes created by hot asphalt under actual operating conditions in the field.
- A recent German study of rats exposed by inhalation to field-like asphalt fumes found no cancers caused by exposure.

# WHAT DO STUDIES OF ASPHALT ROOFING WORKERS TELL US ABOUT POTENTIAL CANCER EFFECTS?

Because asphalt has been widely used for many years, a number of studies of asphalt workers have been conducted. While the studies vary widely in scientific quality, a number have found excess lung cancer rates in roofers. However, the studies do not clearly establish a link between fumes from hot asphalt and lung cancer. Recent scientific analyses have shown that other factors may explain the excess lung cancer rate, including coal tar, which was widely used in roofing in previous years, as well as asbestos and tobacco smoking. A 2002 Georgetown University study of Owens Corning asphalt production and asphalt roofing product manufacturing workers found that there was no relationship between lung cancer risk and exposure to asphalt fumes.

#### DO ASPHALT FUMES CONTAIN CARCINOGENS?

Asphalt contains low levels of polynuclear aromatic hydrocarbons (PAHs), some of which are classified as known or probable carcinogens. When asphalt is heated, some of these PAHs can be released as part of asphalt fumes. These compounds are also universally found in urban, rural and remote environments. They come from sources such as forest fires, many types of industrial operations, barbequing, burning wood in a fireplace, and even from cooked meats and volcanoes. Again, most scientific reviews have not found asphalt fumes to be carcinogenic despite the presence of these low PAH levels.

# IS ANY RESEARCH BEING CONDUCTED TO FURTHER STUDY WHETHER EXPOSURE TO ASPHALT FUMES MIGHT CAUSE CANCER?

For nearly 20 years the U.S. asphalt roofing industry has sponsored or supported research on a variety of issues relating to asphalt fumes, including studies of potential health effects, chemical composition, sampling and analytical methods, fume exposure levels and the development and evaluation of effective methods to control exposures. On the subject of potential carcinogenicity, the Asphalt Roofing Manufacturers Association (ARMA) and the National Roofing Contractors Association (NRCA), together with other asphalt industry organizations, are sponsoring two ongoing studies in an effort to address the uncertainties in the existing scientific data:

- An animal study is underway to compare the potential carcinogenicity of fumes generated using the NIOSH laboratory protocol and fumes which are chemically similar to fumes encountered by workers in applying built up roofing with hot asphalt, and
- A study of European asphalt workers is being conducted by IARC, investigating whether lung cancer occurrence of these workers is associated with exposures to asphalt fumes or other possible causes such as coal tar, asbestos, or tobacco smoking.

The results of both studies are expected to be available by mid-2009.

# WHAT ABOUT OTHER CHRONIC HEALTH EFFECTS?

Chronic lower respiratory tract effects such as chronic bronchitis have been reported in a few studies of workers exposed to hot asphalt, but conflicting results have been found in animal studies. Most regulatory and authoritative scientific bodies say the available data are limited and at present do not support the conclusion that long-term exposures to asphalt fumes are associated with these effects.

# WHAT DO REGULATORY AGENCIES AND WIDELY-RESPECTED SCIENTIFIC ORGANIZATIONS SAY ABOUT THE HEALTH EFFECTS OF ASPHALT FUMES AND PROTECTIVE EXPOSURE LIMITS?

At this writing, the key determinations are the following:

- IARC currently states that asphalt is "not classifiable as to its carcinogenicity to humans." IARC has indicated that it will review asphalt fumes again during 2010.
- The American Conference of Governmental Industrial Hygienists (ACGIH) determined in 1999 that asphalt fumes are "not classifiable as a human carcinogen" and concluded that exposures should be controlled to prevent eye and upper respiratory tract irritation.
- In 2000 NIOSH interpreted essentially the same available scientific evidence in a manner consistent with ACGIH but concluded that "roofing asphalt fumes" are a "potential occupational carcinogen." The ongoing studies in workers and animals mentioned above are designed to resolve the existing uncertainties that are reflected in the much different ACGIH and NIOSH views.

# WHAT STANDARDS AND GUIDELINES EXIST FOR LIMITING EXPOSURES?

Because of the challenges faced by scientists studying asphalt fumes, no consensus has emerged on an exposure limit to protect workers against adverse health effects. There is no federal OSHA permissible exposure limit on worker exposure to asphalt fumes. In California, the workplace exposure limit is 5.0 mg/m3 (milligrams of fume per cubic meter of air) to prevent irritation effects. ACGIH recommends a "threshold limit value" (TLV) of 0.5 mg/m3 to prevent irritation effects in occupational settings.

No national standards or guidelines have been established for exposures outside the workplace, such as indoor air quality standards or broadly applicable criteria limiting short-term or long-term airborne concentrations of asphalt fumes.

Nevertheless, the roofing industry supports the use of appropriate engineering controls, work practices, and personal protective equipment to control worker exposures to fumes from hot asphalt.

#### WHAT PROTECTIVE MEASURES ARE RECOMMENDED FOR BUILDING OCCUPANTS?

Fume exposures to building occupants and others near a hot asphalt roofing job are expected to be many times lower than that of roofing workers under normal circumstances, even though an "asphalt" odor may be noticeable. Odor is detectable for asphalt at extremely low concentrations – part per billion levels. Although building occupant exposure is likely to be very low, the asphalt roofing industry supports several common-sense precautions to prevent discomfort as well as protect unusually sensitive individuals, including:

- Air intakes and windows that are downwind from hot asphalt should be closed if practicable;
- Building occupants should be informed about the hot asphalt roofing activities and the possibility that they may notice an asphalt odor, and provided with the latest available information on health effects; and
- People who experience the short-term health effects mentioned above should move to a non-affected area until the symptoms subside.

#### **ADDITIONAL INFORMATION**

Additional information about asphalt roofing products and potential exposures to asphalt fumes can be found in the joint asphalt roofing industry publication entitled "The Bitumen Roofing Industry – A Global Perspective: Production, Use, Properties, Specifications and Occupational Exposure," available online at www.asphaltroofing.org and www.nrca. net. If there are any further questions or concerns, please feel free to contact us:



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This fact sheet is intended to provide a general informational resource for building occupants and others in the vicinity of roofing jobs involving the use of hot asphalt. It is based on information that is published in the open literature or otherwise readily available to the general public and believed to be reliable. Although every reasonable effort has been made to be accurate as of the publication date, ARMA and NRCA cannot accept responsibility for any inaccuracies or omissions this brochure may contain. ARMA and NRCA are not engaged in the rendering of legal or medical advice or services. If expert assistance is required, the services of a competent professional should be sought. This brochure is not intended for roofers exposed to asphalt fumes on the job. A number of informational resources for workers developed by Government and Industry organizations may be obtained by contacting ARMA or NRCA.