

# Asphalt Fumes - A Growing Concern

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There is a growing concern over possible harmful effects of asphalt fumes on workers, particularly in the hot mix roofing and roadwork industries. OSHA has designated asphalt fumes as its number one non-regulatory priority. According to Ed Geddie of the North Carolina Occupational Safety and Health Administration (NC OSHA), the fume issue is on the priority planning list of issues to be considered for federal rule planning, and he expects a rule on asphalt fumes to be out within the next few years.

The effect of asphalt fumes on workers has been the subject of studies for many years. In one such study done on hot asphalt mixes at two hot mix facilities involving four asphalts from three refineries, air contaminants were found to be within the threshold limit values (TLV). The study concluded there were no serious air pollution or employee health problems resulting from the use of petroleum-derived asphalt in hot mixes.

A later 1988 study showed the amount of volatile material measured from asphalt at temperatures above 316 degrees C had increased 9-16 times the earlier measured amounts, and 2-7 times more from coal tar. The authors of the study concluded that the asphalt and especially coal tar pitch are highly carcinogenic, particularly at elevated temperatures. Studies all show that the fumes from coal tar (a common ingredient in roof patching materials) are more carcinogenic than asphalt fumes.

Between 1976 and 1993, a total of 19 epidemiological studies examined the potential carcinogenic effects of bitumens on workers through inhalation and dermal exposure. Lung cancer excesses occurred in 11; lung cancer and bladder cancer excesses occurred in 8; and asphalt exposure was significantly associated with an excess of ureter and pelvic cancer, stomach cancer, and colon cancer in most groups.

OSHA currently has no permissive exposure limit (PEL) for asphalt. Since there is no regulation without a PEL, OSHA must enforce current hazardous conditions from asphalt fumes under the General Duty Clause, if it attempts to enforce them at all.

The General Duty Clause [OSHA Section 5(a)(1)] was enacted to cover serious hazards to which no specific standard applies. These three elements must be shown for a General Duty violation:

- 1) The employer failed to render its workplace free of a hazard;
- 2) The hazard is recognized by the employer or its industry; and
- 3) The hazard is causing or is likely to cause death or serious physical harm.

NIOSH (National Institute for Occupational Safety and Health) lists asphalt as a suspect carcinogen with a threshold limit value (TLV) of 5mg/m<sup>3</sup> (milligrams per cubic meter) measured over a 15-minute period. This is a very low standard. Mark Wiggins (South Carolina OSHA) indicated that a TLV of 5 mg/m<sup>3</sup> particulate matter is visible as a cloud or smoke.

OSHA can enforce this NIOSH standard under the general duty clause if it so chooses. Currently, OSHA must prove overexposure to support a General Duty violation, since there is no PEL regulation to enforce. This will change, of course, if and when an OSHA regulation is implemented dealing with asphalt fumes.

Asphalt fumes are a definite and growing concern in regulatory agencies; there will be regulations governing it within a very few years. The current projection of regulation includes rotation of workers, respiratory protection, monitoring of temperatures, and measuring of air quality. Studies show that several simple measures will keep exposure of workers to a minimum, especially proper ventilation and careful attention to constant temperatures of hot mix. You should help ensure that your client won't be a target of an OSHA investigation by taking such measures seriously and bringing them to the attention of those who can effect these precautions.

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The individual charts for each of the Life Cycle Cost Analyses in the article by William Kirn in the April 1998 issue of *Interface* had some incorrect figures due to typographical errors. For that reason, we are reprinting the charts here. The Life Cycle Cost Summary chart on page 5 of the April issue is correct.

**Life Cycle Cost Analysis #2  
Modest Maintenance Program**

Year	0	1	2	3	4	5	6	7	8	9	10
Dis. Factor (10%)	1.000	0.909	0.826	0.751	0.680	0.621	0.564	0.513	0.466	0.424	0.386
Capital Expense	\$300,000										\$0
PV	\$300,000										\$0
Mgt. Overhead		\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000
PV		\$909	\$826	\$751	\$680	\$621	\$564	\$513	\$466	\$424	\$386
Visual Survey		\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000
PV		\$909	\$826	\$751	\$680	\$621	\$564	\$513	\$466	\$424	\$386
Moisture Survey					\$0						\$0
PV		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Leaks		\$0	\$0	\$250	\$250	\$250	\$250	\$250	\$250	\$250	\$250
PV		\$0	\$0	\$188	\$170	\$155	\$141	\$128	\$117	\$106	\$97
Interior Damage					\$0	\$500	\$0				
PV		\$0	\$0	\$0	\$0	\$0	\$257	\$0	\$0	\$0	\$0
Wet Insul. Sq. Ft.		0	0	25	25	50	50	75	75	100	100
Wasted Energy		\$0	\$47	\$94	\$141	\$188	\$235	\$282	\$329	\$376	\$423
PV Energy		\$0	\$0	\$35	\$32	\$58	\$53	\$72	\$66	\$80	\$73
Energy Saved		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
PV		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

Year	11	12	13	14	15	16	17	18	19	20	Summary
Dis. Factor (10%)	0.350	0.319	0.290	0.263	0.239	0.217	0.197	0.179	0.163	0.148	
Capital Expense	\$0					\$325,000					
PV	\$0					\$70,525					\$370,525
Mgt. Overhead	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	
PV	\$350	\$319	\$290	\$263	\$239	\$217	\$197	\$179	\$163	\$148	\$8,505
Visual Survey	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	
PV	\$350	\$319	\$290	\$263	\$239	\$217	\$197	\$179	\$163	\$148	\$8,505
Moisture Survey					\$5,000						\$0
PV	\$0	\$0	\$0	\$0	\$1,195	\$0	\$0	\$0	\$0	\$0	\$1,195
Leaks	\$250	\$250	\$250	\$250	\$250	\$250	\$250	\$250	\$250	\$250	
PV	\$88	\$80	\$73	\$66	\$60	\$54	\$49	\$45	\$41	\$37	\$1,638
Interior Damage	\$0				\$0	\$500					
PV	\$0	\$0	\$0	\$0	\$0	\$109	\$0	\$0	\$0	\$0	\$0
Wet Insul. Sq. Ft.	125	125	150	150	175	0	0	25	25	50	
Wasted Energy	\$235	\$235	\$282	\$329	\$376	\$0	\$0	\$47	\$47	\$94	
PV Energy	\$82	\$75	\$82	\$74	\$79	\$0	\$0	\$8	\$8	\$14	\$891
Energy Saved	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
PV	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

**Life Cycle Cost Analysis #1  
No Maintenance Program**

Year	0	1	2	3	4	5	6	7	8	9	10
Dis. Factor (10%)	1.000	0.909	0.826	0.751	0.680	0.621	0.564	0.513	0.466	0.424	0.386
Capital Expense	\$300,000										\$0
PV	\$300,000										\$0
Mgt. Overhead		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
PV		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Visual Survey		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
PV		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Moisture Survey					\$0						\$0
PV		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Leaks		\$0	\$0	\$750	\$750	\$750	\$750	\$750	\$1,500	\$2,250	\$3,000
PV		\$0	\$0	\$563	\$510	\$466	\$423	\$385	\$699	\$954	\$1,158
Interior Damage					\$500						
PV		\$0	\$0	\$0	\$311	\$0	\$0	\$0	\$233	\$0	\$0
Wet Insul. Sq. Ft.		0	25	50	75	100	125	150	175	200	225
Wasted Energy		\$47	\$94	\$141	\$188	\$235	\$282	\$329	\$376	\$423	
PV Energy		\$0	\$39	\$71	\$96	\$117	\$133	\$145	\$153	\$159	\$163
Energy Saved		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
PV		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

Year	11	12	13	14	15	16	17	18	19	20	Summary
Dis. Factor (10%)	0.350	0.319	0.290	0.263	0.239	0.217	0.197	0.179	0.163	0.148	
Capital Expense	\$500,000										
PV	\$175,000										\$475,000
Mgt. Overhead	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
PV	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Visual Survey	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
PV	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Moisture Survey					\$0						\$0
PV	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Leaks	\$0	\$0	\$750	\$750	\$750	\$750	\$750	\$1,500	\$2,250	\$3,000	
PV	\$0	\$0	\$218	\$197	\$179	\$163	\$148	\$269	\$367	\$444	\$7,142
Interior Damage	\$500				\$500						
PV	\$175	\$0	\$0	\$0	\$120	\$0	\$0	\$90	\$0	\$0	\$928
Wet Insul. Sq. Ft.	0	25	50	75	100	125	150	175	200	225	
Wasted Energy	\$0	\$47	\$94	\$141	\$188	\$235	\$282	\$329	\$376	\$423	
PV Energy	\$0	\$15	\$27	\$37	\$45	\$51	\$56	\$59	\$61	\$63	\$1,489
Energy Saved	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
PV	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

**Life Cycle Cost Analysis #3  
Comprehensive Maintenance Program**

Year	0	1	2	3	4	5	6	7	8	9	10
Dis. Factor (10%)	1.000	0.909	0.826	0.751	0.680	0.621	0.564	0.513	0.466	0.424	0.386
Capital Expense	\$300,000										\$75,000
PV	\$300,000										\$28,950
Mgt. Overhead		\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000
PV		\$909	\$826	\$751	\$680	\$621	\$564	\$513	\$466	\$424	\$386
Visual Survey		\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
PV		\$1,818	\$1,652	\$1,502	\$1,360	\$1,242	\$1,128	\$1,026	\$932	\$848	\$772
Moisture Survey					\$5,000						\$5,000
PV		\$0	\$0	\$0	\$3,105	\$0	\$0	\$0	\$0	\$0	\$1,930
Leaks					\$250	\$250	\$250	\$250	\$250	\$250	\$250
PV		\$0	\$0	\$188	\$170	\$155	\$141	\$128	\$117	\$106	\$97
Interior Damage					\$0	\$500	\$0				
PV		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Wet Insul. Sq. Ft.											
Wasted Energy											
PV Energy		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Energy Saved											\$8,070
PV		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	(\$3,115)

Year	11	12	13	14	15	16	17	18	19	20	Summary
Dis. Factor (10%)	0.350	0.319	0.290	0.263	0.239	0.217	0.197	0.179	0.163	0.148	
Capital Expense	\$0										
PV	\$0										\$328,950
Mgt. Overhead	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	
PV	\$350	\$319	\$290	\$263	\$239	\$217	\$197	\$179	\$163	\$148	\$8,505
Visual Survey	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	
PV	\$700	\$638	\$580	\$526	\$478	\$434	\$394	\$358	\$326	\$296	\$17,010
Moisture Survey					\$5,000						\$5,000
PV	\$0	\$0	\$0	\$0	\$1,195	\$0	\$0	\$0	\$0	\$0	\$740
Leaks	\$250	\$250	\$250	\$250	\$250	\$250	\$250	\$250	\$250	\$250	
PV	\$88	\$80	\$73	\$66	\$60	\$54	\$49	\$45	\$41	\$37	\$1,693
Interior Damage	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
PV	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Wet Insul. Sq. Ft.											
Wasted Energy											
PV Energy		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Energy Saved	\$8,070	\$6,460	\$6,460	\$6,460	\$6,460	\$6,460	\$6,460	\$6,460	\$6,460	\$6,460	
PV	(\$2,261)	(\$2,261)	(\$1,873)	(\$1,699)	(\$1,544)	(\$1,402)	(\$1,273)	(\$1,156)	(\$1,053)	(\$956)	(\$18,393)