AP42 Section: 11.2

Background Chapter 4

Reference: 5

Title: Air Pollution Emission Test, Elk Roofing Company, Stephens, Arkansas,

EMB Report No. 76-ARM-11,

U. S. Environmental Protection Agency, Research Triangle Park, NC, May 1977.

Excerpts

Section 4 Reference 5
AP-42 Reference __

Emission Test Report Review Checklist--Short Form

Reviewer: BRIAN SHRAGER
Review Date: 1/5/93

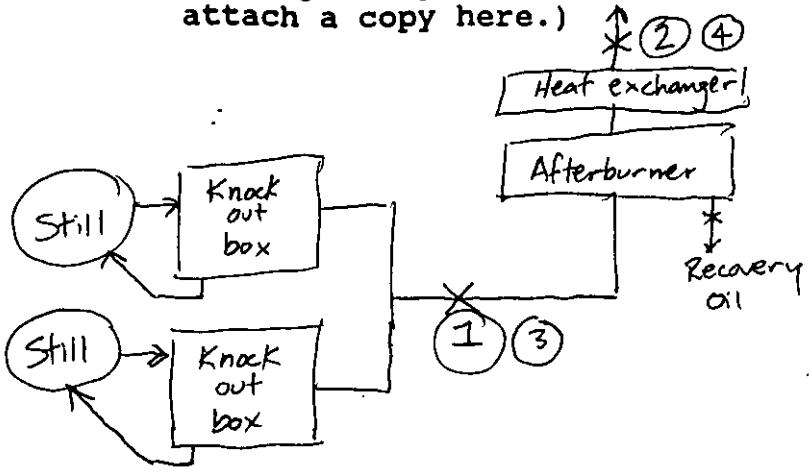
A. Background Information

1. Facility name: ELK ROOFING COMPANY
   Location: STEPHENS, ARKANSAS
2. Source category: ASPHALT ROOFING
3. Test date: AUGUST 20-26, 1975
4. Test sponsor: EPA
5. Testing contractor: BATTELLE COLUMBUS
6. Purpose of test: NSPS
7. Pollutants measured (include test method and indicate if valid): PM - Method 5a
   Total VOC's - FID (flame-ionization detector)
   CO_2 - ORSAT
   CO - NDIR (nondisporsive infrared)
   NOx & SO_2 - 1 run by an electrochemical method. → NOx data void. SO_2 data incomplete. DO NOT USE!
   Aldehydes - Los Angeles wet chemistry method.
   POM - Modified EPA Method 5 w/ POM collection column.
8. Process overview: Attach a process description and a block diagram. Identify processes tested with letters from the beginning of the alphabet (A, B, C, etc...) and APC systems with letters from the end of the alphabet (V, W, X, etc...). Also identify test locations with Arabic numerals (1,2,3, ...). Using the ID symbols from the diagram, complete the table below.

Test ID	Process	Process ID	Emissions tested		APCD (controlled emissions only)
			Uncontrolled	Controlled	
1	Saturant Blow	A	✓		ID: W Type: Afterburner Model #:
2	Saturant Blow	A		✓	ID: Z Type: Afterburner (HIRT) Model #: H1H13MX
3	Coating Blow	B	✓		ID: Type: Model #:
4	Coating Blow	B		✓	ID: Z Type: Afterburner (HIRT) Model #: H1H13MX

B. Process Information

1. Provide a brief narrative description of the process and attach process flow diagram. (Note: If the process description provided in the test report is adequate, attach a copy here.)



III. PROCESS DESCRIPTION AND OPERATION

This roofing plant has two asphalt blowing (oxidizing) stills. For controlling emissions from the stills, the plant uses an afterburner equipped with a waste heat boiler. The stills and the afterburner are about one year old. Details of the blowing process, design data on the afterburner and operational data monitored during the emissions tests are presented next.

Process Description

Asphalt is oxidized or air-blown to raise its softening point, reduce penetration, and achieve other desired rheological and physical properties. At this plant, asphalt is blown in batches in vertical stills. The flux asphalt is usually pumped into the still at 400°F to 460°F and the oxidization process is started by forcing air into the asphalt through a perforated pipe arrangement or sparger located near the bottom of the still. Initially, the purge valve is open (see Figure 2) and some of the air bypasses the sparge line and enters the still above the asphalt. This purge valve closes gradually, over a period of 4 to 6 minutes. When closed, all the air passes through the sparger. Emission tests were initiated when the compressor was started, although plant operators do not consider the blow to have started until the purge valve is completely closed.

The asphalt temperature increases as blowing progresses, due to the exothermic nature of the oxidization process. (No external heat is added.) This increase in temperature, in turn, increases the rate of oxidization of the asphalt. Water is sprayed into the surface of the hot asphalt as necessary to keep its temperature safely below the flash point. The blowing duration varies with the type of asphalt used, the blowing temperature and the required asphalt characteristics (penetration, softening point and consistency). At this plant, the same flux asphalt is used for saturating and

coating asphalt. Only the blowing duration is changed, from 1-1/2 hours for saturant to 4-1/2 hours for coating. Asphalt samples are checked periodically during the blow and when the desired characteristics are achieved, oxidization is terminated by shutting off the air supply.

Emission Control System

Figure 3 is a schematic of the layout of the blowing stills, the afterburner and the waste heat boiler at the Elk Roofing Plant. Even though emissions from both stills are ducted to the afterburner, blowing was only done in one still at a time during sampling. The capacity of the blowing stills, the physical dimensions and design information on the afterburner are summarized below.

Type of stills: vertical
No. of stills: two
Working capacity: 9,600 gal. each
Physical dimensions: Height: 30 ft (asphalt level does not exceed 20 ft)
Pressure drop of knock out boxes: 4" H_2O
Type of air blower: rotary lobe blower (100 hp)
Identification: Roots ID No. 847-205-110, Model 812 RAG-J
Manufacturer: Dresser Industries, Inc.
Roots Blower and Vacuum Pump Division
Connersville, Indiana

Control Device: HIRT incinerator equipped with waste heat boiler

Manufacturer: HIRT Combustion Engineers, Montebello, California
Model No.: H1H13MX
Design operating temp: 1700°F (actual $\simeq$ 1600°F)
Maximum temp.: 1800°F
Retention time: 0.5 sec at 1400°F
Exhaust fan: 24,000 acfm at 500°F (75 hp)
Natural gas burner: 16,500 scfh at 5 psig

Waste Heat Boiler

Model No.: WHB 400
Manufacturer: Scotch Marine Boiler, Abilene, Texas
Rating: 29,360 Btu/hr
Produces: 1,500 lb steam/hr
Design water pressure: 150 psig
No. of tubes: 371

Design Constraints

Flow: 1,600 to 3,200 scfm
Quench steam: 0 to 2,800 scfm
Fume temperature: 400°F
Hydrocarbon present in fumes: 0 to 12 X 10^6 Btu/hr
Oxygen: 0 to 21 percent
Primary dilution air: 1,500 to 6,000 scfm
Secondary dilution air: 0 to 1,500 scfm
Combustion air: rate unknown

Process Operation

Process parameters monitored during sampling were:

1. Blowing duration (from start-up to shut-down of air blower)
2. Air flow through still (cfm)
3. Temperature of asphalt entering/leaving stills
4. Temperature of asphalt in still as a function of time during blowing
5. Amount of asphalt in still at start/end of blow cycle
6. Cooling water used during blowing as a function of time
7. Specification on asphalt - before and after blowing
8. Quantity of oil recovered from incinerator
9. Afterburner operating temperature
10. Waste heat boiler outlet temperature
11. Pressure and quantity of steam generated by waste heat boiler as a function of time.
12. Temperature of fumes emitted from blowing still prior to dilution with air
13. Natural gas consumption by afterburner plus storage and preheater tanks as a function of time
14. Asphalt transfers into (and out of) still not being blown

The blowing duration was generally 1-1/2 hours for blowing saturant and 4-1/2 hours for blowing coating. The actual times during sampling varied somewhat and are recorded in Table 14

C. 1. List any APCD parameters (supplied in the test report) below.

APCD ID	Parameter	Units	Readings			
			~~Run 1~~	Run 2	Run 3	Run 4
Z	Design oper. Temp	°F	1700°			
Type of APCD: HIRT incinerator w/ waste heat boiler Model # H1H13MX	Max Temp	°F	1800°			
	Retention time	0.5 sec @	1400°F			
	Exhaust Fan	24,000 acfm	@ 500°F (75 hp)			
	Natural Gas burner	16,500 scfh	@ 5 psig			
Type of APCD:						
Type of APCD:						

SEE Previous 2 pages

2. Include any additional information (such as capture techniques for fugitive systems) and descriptions of the air pollution control systems (use a separate page if necessary).

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run ~~1~~ 2	Run ~~2~~ 6	Run ~~3~~ 7	~~Run 4~~ AVG
1	Stack temperature	°F	~~[illegible]~~ 393	~~[illegible]~~ 405	371	
uncont.	Moisture	%	44.7	41.0	27.2	
	Oxygen	—				
	Volumetric flow, actual	acfm	5004	5239	4322	
	Volumetric flow, standard	dscfm	1715	1884	2001	
	Percent isokinetic		85.3	90.5	73.5	
Circle: Production or feed rate Capacity:		tons/hr	26.7	26.7	26.7	*
	Pollutant concentrations:					
	Filterable PM	Gr/dscf	16.6	11.3	8.56	
	Total VOC's	Gr/dscf	2.70	2.40	1.69	
	CO_2	%	~~[illegible]~~ 1.2	~~[illegible]~~ 0.5	~~[illegible]~~ 0.5	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	227	175	128	
	Total VOC's lb/hr	~~[illegible]~~	39.4	38.1	28.5	
	CO_2	lb/hr	141.	64.7	68.7	
	Emission factors:					AVERAGE
	Filterable PM	lb/ton	8.5	6.6	4.8	6.6
	Total VOC's	lb/ton	1.5	1.4	1.1	1.3
	CO_2	lb/ton	5.3	2.4	2.6	3.4

* DATA RATED C BECAUSE OF ISOKINETICS & AVG. PRODUCTION RATE.

CO_2 $\rho = 0.1149$ lb/ft³ at 68° & 29.92 in. Hg
$\rho = 0.1144$ lb/ft³ at 70° & 29.92 in. Hg ← USE THIS (STANDARD COND. FROM TEST REPORT)

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run ~~1~~ 2	Run ~~5~~ 6	Run ~~7~~ 7	Run 4
2	Stack temperature	°F	399	393	378	
contr.	Moisture	%	18.8	20.8	11.6	
	Oxygen	—				
	Volumetric flow, actual	acfm	17357	17290	17000	
	Volumetric flow, standard	dscfm	8673	8476	9485	
	Percent isokinetic		112.1	98.3	91.3	
Circle: (Production) or feed rate Capacity:		tons/hr	26.7	26.7	26.7	
	Pollutant concentrations:					
	Filterable PM	gr/dscf	0.286	0.087	0.104	
	Total VOC's	gr/dscf	0.023	0.002	0.001	
	CO_2	%		3.6	3.3	
	CO		*			
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	22.6	6.3	8.1	
	Total VOC's	lb/hr	1.72	0.15	0.08	
	CO_2	lb/hr	VOID RUN 2	2094	2148	
	*CO		28.74	—	—	
	Emission factors:					AVERAGE
	Filterable PM	lb/ton	—	0.24	0.30	0.27
	Total VOC's	lb/ton	—	0.0056	0.0030	0.0043
	CO_2	lb/ton	—	78.4	80.4	~~79~~
	CO	lb/ton	1.1	—	—	—

* Pg D-1 of test report

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 3	Run 4	Run 5	Run 4
3	Stack temperature	°F	419	430	411	
	Moisture	%	33.6	33.9	34.9	
	Oxygen	—				
	Volumetric flow, actual	acfm	4603	4960	4765	
	Volumetric flow, standard	dscfm	1838	1943	1881	
	Percent isokinetic		77.5	78.4	82.4	*
Circle: (Production) or feed rate Capacity:		tons/hr	8.9	8.9	8.9	
	Pollutant concentrations:					
	Filterable PM	gr/dscf	15.1	15.4	14.4	
	Total VOC's	gr/dscf	1.89	2.08	1.80	
	CO_2	%	0.4	0.5	0.5	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	211	229	212	
	Total VOC's	lb/hr	28.8	33.7	28.8	
	CO_2	lb/hr	50.5	66.7	64.6	
	Emission factors:					AVERAGE
	Filterable PM	lb/ton	23.7	25.7	23.8	24
	Total VOC's	lb/ton	3.24	3.79	3.24	3.4
	CO_2	lb/ton	5.67	7.49	7.26	6.8

* DATA RATED C BECAUSE OF ISOKINETICS

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run ~~1~~ 3	Run ~~2~~ 4	Run ~~3~~ 5	Run 4
4	Stack temperature	°F	391	382	382	
	Moisture	%	15.6	15.0	16.5	
	Oxygen	—				
	Volumetric flow, actual	acfm	17213	17895	16250	
	Volumetric flow, standard	dscfm	9045	9549	8524	
	Percent isokinetic		87.6	98.7	95.3	
Circle: Production or feed rate Capacity:		ton/hr	8.9	8.9	8.9	
	Pollutant concentrations:					
	Filt. PM	gr/dscf	0.123	0.066	0.099	
	Total VOC's	gr/dscf	0.020	0.030	0.006	
	CO_2	%	3.0	0.2	3.7	
	Pollutant mass flux rates:					
	Filt. PM	lb/hr	9.0	5.4	7.1	
	Total VOC's	lb/hr	1.57	2.49	0.46	
	CO_2	lb/hr	1860	131	2160	
	* CO	lb/hr	71.27			
	Emission factors:					AVERAGE
	Filt. PM	lb/ton	1.01	0.607	0.798	0.81
	Total VOC's	lb/ton	0.176	0.280	0.0517	0.17
	CO_2	lb/ton	209	14.7	243	160
	CO	lb/ton	8.0			

* Pg D-3 of test report

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
	Stack temperature					
	Moisture					
	Oxygen					
	Volumetric flow, actual					
	Volumetric flow, standard					
	Percent isokinetic					
Circle: Production or feed rate Capacity:						
	Pollutant concentrations:					
	Pollutant mass flux rates:					
	Emission factors:					