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AP42 Section:	11.3
Background Chapter	4
Reference:	26
Title:	<i>Source Sampling Report, General Shale Products Corporation, Kingsport, TN, Particulate Emissions from Beehive Kilns 17 and 15, 9/30/76 and 10/1/76, State of Tennessee Department of Public Health, Division of Air Pollution Control, 1976.</i>

STATE OF TENNESSEE  
DEPARTMENT OF PUBLIC HEALTH  
DIVISION OF AIR POLLUTION Control

SOURCE SAMPLING REPORT

GENERAL SHALE PRODUCTS CORPORATION  
HILL STREET  
KINGSPORT, TENNESSEE 37660

REFERENCE NUMBER 82:00036

PARTICULATE EMISSIONS  
FROM

Beehive Kilns 17 and 15  
9/30/76 and 10/1/76

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## I. Plant Description and Location

General Shale Productions Corporation operates a brick manufacturing plant in Kingsport, Tennessee. Bricks of varying size and composition are produced. Raw materials - clay, ash, and shale are properly mixed and blended prior to extrusion and formation into bricks. These bricks are then dried and properly cured in either a continuous tunnel kiln or in batch-type beehive kilns. The tunnel kiln burns pulverized coal in the fire zone and #2 oil in the preheat and dryer zones. The beehive kilns are fired by two underfeed stokers each and have both natural draft and forced draft exhaust stacks.

## II. Process Observation

The Stack Test Team of the State Division of Air Pollution Control performed a particulate emission stack test on October 1, 1976 on the forced draft beehive kiln #15. This beehive kiln was fired by two coal underfeed stokers. The operation of the beehive kilns is batch-type in nature.

The kiln is loaded with brick by fork trucks. Each kiln will hold approximately 45,920 bricks each weighing approximately 4.25 pounds each. The fire in the underfeed stokers is started by placing a bed of hot coals in the firebox. The coal feed rate is slowly increased so as to bring up the temperature of the brick slowly. There is a louvered damper on the side of the forced draft stack. This louvered damper remains closed during the first half or so of the firing cycle. After the first 50 to 60 hours of the firing cycle, the temperature reaches a maximum of approximately 1960°F. The brick are allowed to soak at this temperature for about 6 to 8 hours. After this high temperature soak, the brick are cooled for approximately 45 to 60 hours before being unloaded from the kiln. The total cycle of loading, firing, cooling, and unloading takes approximately one week.

During the testing, the stoker coal feed rates were as follows:

Run #1: stoker #1 - 220 #/hr, stoker #2 - 220 #/hr.  
Run #2: stoker #1 - 220 #/hr, stoker #2 - 300 #/hr, alternate load on stokers  
Run #3: stoker #1 - 300 #/hr, stoker #2 - 220 #/hr, alternate load on stokers

The bricks being fired in the kiln were "patinas" - composition: 55% blue shale, 45% Cardova clay. Coal analysis indicates 0.7% sulfur, 5% ash, and a heat content of 14,000 Btu/pound. The kiln had been in operation about 45 hours when tested. The first test run occurred prior to the high temperature soak. Test runs #2 and #3 occurred during the high temperature soak.

Representatives of the Division of Air Pollution Control were as follows: Dave Carson, Jeryl Stewart, Fred O. Singleton, Barry Stephens.

Representatives for General Shale were as follows: Buddy Archer, Plant Manager and Dave McNees.

## III. Conclusion

The kiln was operating at representative performance during the particulate emission compliance stack test. The process weight rate was determined to be 1.5 tons per hour allowing an emission rate of 5.38 #/hr. From the observation point of the process observer, the heaviest emissions from a beehive kiln are during startup - primarily during the first 2 or 3 hours of operation. This observation was made by observing several other similar kilns to the one stack tested.

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## I. Plant Description and Location

General Shale Productions Corporation operates a brick manufacturing plant in Kingsport, Tenn. Bricks of varying size and composition are produced. Raw materials - clay, ash, and shale - are properly mixed and blended prior to extrusion and formation in to bricks. These bricks are then dried and properly cured in either a continuous tunnel kiln or in batch-type beehive kilns. The tunnel kiln burns pulverized coal in the fire zone and #2 oil in the preheat and dryer zones. The beehive kilns are fired by two underfeed stokers each. These kilns are exhausted by natural draft and forced draft stacks.

## II. Process Observation

The Stack Test Team of the State Division of Air Pollution Control performed a particulate emission stack test on September 30, 1976 on the natural draft beehive kiln #17. This beehive kiln was fired by two coal underfeed stokers. The operation of the beehive kilns is batch-type in nature.

The kiln is loaded with brick by fork trucks. Each kiln will hold approximately 45,920 bricks each weighing approximately 4.25 pounds each. The fire in the underfeed stokers is started by placing a bed of hot coals in the firebox. The coal feed rate is slowly increased so as to bring up the temperature of the brick slowly. There is a louvered damper on the side of the natural draft stack. This louvered damper remains closed during the first half or so of the firing cycle. After the first 50 to 60 hours of the firing cycle, the temperature reaches a maximum of approximately 1960°F. The brick are allowed to soak at this temperature for about 6 to 8 hours. After this high temperature soak, the brick are cooled for approximately 45 to 60 hours before being unloaded from the kiln. The total cycle of loading, firing, cooling, and unloading takes approximately one week.

During the testing, the stoker coal fired rates were as follows:

Test Run #1: Stoker #1 - 220#/hr, stoker #2 - 300#/hr.

Test Run #2: Stoker #1 - 220#/hr., stoker #2 - 300#/hr., at the end of this run during test points #9, #10, and #11, the ash was raked from the stokers on the kiln.

Test Run #3: Stoker #1 - 300#/hr., stoker #2 - 220#/hr.

The brick being fired in the kiln were "standard size everglades" - composition: 55% blue shale, and 45% cordova clay. Coal analysis indicates 0.7% sulfur, 5% ash, and a heat content of 14,000 Btu/pound. The kiln had been in operation about 50 hours when tested.

Representatives of the Division of Air Pollution Control were as follows: Dave Carson, Jeryl Stewart, Fred O. Singleton, Barry Stephens.

Representatives for General Shale were as follows:

Buddy Archer, Plant Manager  
Dave McNees

## SUMMARY OF RESULTS

The particulate emissions from the process emission sources at General Shale Products Corporation in Kingsport, Tennessee are regulated by Chapter 1200-3-7, Section .04, and Section .02, Subsection (4) of the Rules and Regulations of the Division of Air Pollution Control. Three samples of the emissions from kilns 15 and 17 were obtained and analyzed for particulates. The results of the emissions from kiln 17 are based on the average of the three sample runs. The emissions from kiln 15 are based on samples 2 and 3. Sample one was contaminated when the probe hit the wall of the stack while sampling.

The emissions from kilns 15 and 17 have been determined with and without including the material collected in the impingers of the sampling train. The results are summarized below.

<u>Kiln</u>	<u>*Front Half Part. Catch</u>		<u>Front Half and Impingers</u>	
	<u>lb/hr</u>	<u>grains/SCF</u>	<u>lb/hr</u>	<u>grains/SCF</u>
15	0.92	0.006	1.30	0.008
17	0.63	0.015	0.71	0.016

\*Includes particulate collected by probe, cyclone, connecting glassware up to the filter, and the particulate collected by the filter.

Both kilns 15 and 17 are in compliance with the Rules and Regulations of the Tennessee Division of Air Pollution Control which relate to particulate emissions from the sources.

The emissions from kiln 15 are based on runs 2 and 3. This is because run 1 was contaminated, biasing the results high. Even if the contaminated sample were included, the source would still be well in compliance.