72-MM-16

(REPORT NUMBER)

AIR POLLUTION EMISSION TEST

DELTA AND PINE LAND COMPANY

(PLANT NAME)

(COTTON GIN)

SCOTT, MISSISSIPPI

(PLANT ADDRESS)

U. S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Water Programs
Office of Air Quality Planning and Standards
Emission Standards and Engineering Division
Emission Measurement Branch
Research Triangle Park, N. C. 27711

PARTICULATE EMISSION MEASUREMENTS

FROM COTTON GINS

Plant Tested

Delta and Pine Land Company
Scott, Mississippi

November 1974

EMB Project Report No. 72-MM-16

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INTRODUCTION

The test is part of the Cotton Ginning Industry Study, a project of the Industrial Survey Section, Industrial Studies Branch, Emission Standards and Engineering Division, Office of Air Quality Planning and Standards, Environmental Protection Agency. The field test work was directed by Joseph Bazes and John Snyder of the Field Testing Section, Emission Measurement Branch. The sampling was performed by Monsanto Research Corporation (MRC). The Cotton Ginning Industry Study is being conducted by William O. Herring, Industrial Survey Section.

Under the Clean Air Act of 1970, the Environmental Protection Agency is given the responsibility of establishing performance standards for new installations or modifications to existing installations in stationary source categories. As a contractor, Monsanto Research Corporation, under the Environmental Protection Agency's "Field Sampling of Atmospheric Emissions" Program, was asked to provide emission data from the Delta and Pine Land Company, Scott, Mississippi. The cotton gin selected and studied was equipped with the best types of pollution control equipment currently available.

This report tabulates the data collected at the Delta and Pine Land Company during the periods from October 25 to October 27, 1972, and from November 6 to November 17, 1972. In this cotton gin, vacuum is used to remove the field picked cotton from the cotton wagons and then the material inside the gin is moved from one operation to the next by a moving air system. Air moves the material to the ginning machines for removal of dirt, plant material, the cotton seeds, and fine lint, and finally to the battery condenser and the press or baling machine. The air from the unloader, feeder, dryer, and lint cleaners is exhausted from the building into a group of twenty-six cyclones, while the air from the lint cleaner condenser and battery condenser is exhausted through rotary screen in-line filters. The trash, including plant debris and dirt, is directed to two cyclones mounted on a tepee burner. A schematic diagram of the control devices with respect to the building and indicating which of the devices were sampled is shown in Figure 1. The description of the device and the designation of the sample point numbers and source of emissions are given in Table 1.

The major emphasis of the study was to obtain accurate data on the particulate emissions. Outlets to the atmosphere were measured for particulate concentrations using Method 5, "Determination of Particulate Emissions from Stationary Sources." Other procedures that were required during the study included Method 1, "Sample and Velocity Traverses for Stationary Sources;" Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube);" Method 3, "Gas Analysis for Carbon Dioxide, Excess Air and Dry Molecular Weight;" and Method 4, "Determination of Moisture in Stack Gases."

Samples of unprocessed seed cotton and trash were obtained from three different locations within the cotton processing system. The samples were analyzed at the EPA Pesticides Monitoring Laboratory in Bay St. Louis, Mississippi, for pesticide content. High concentrations of both p,p'-DDT (up to 59 ppm) and Toxaphene (up to 135 ppm) were found.

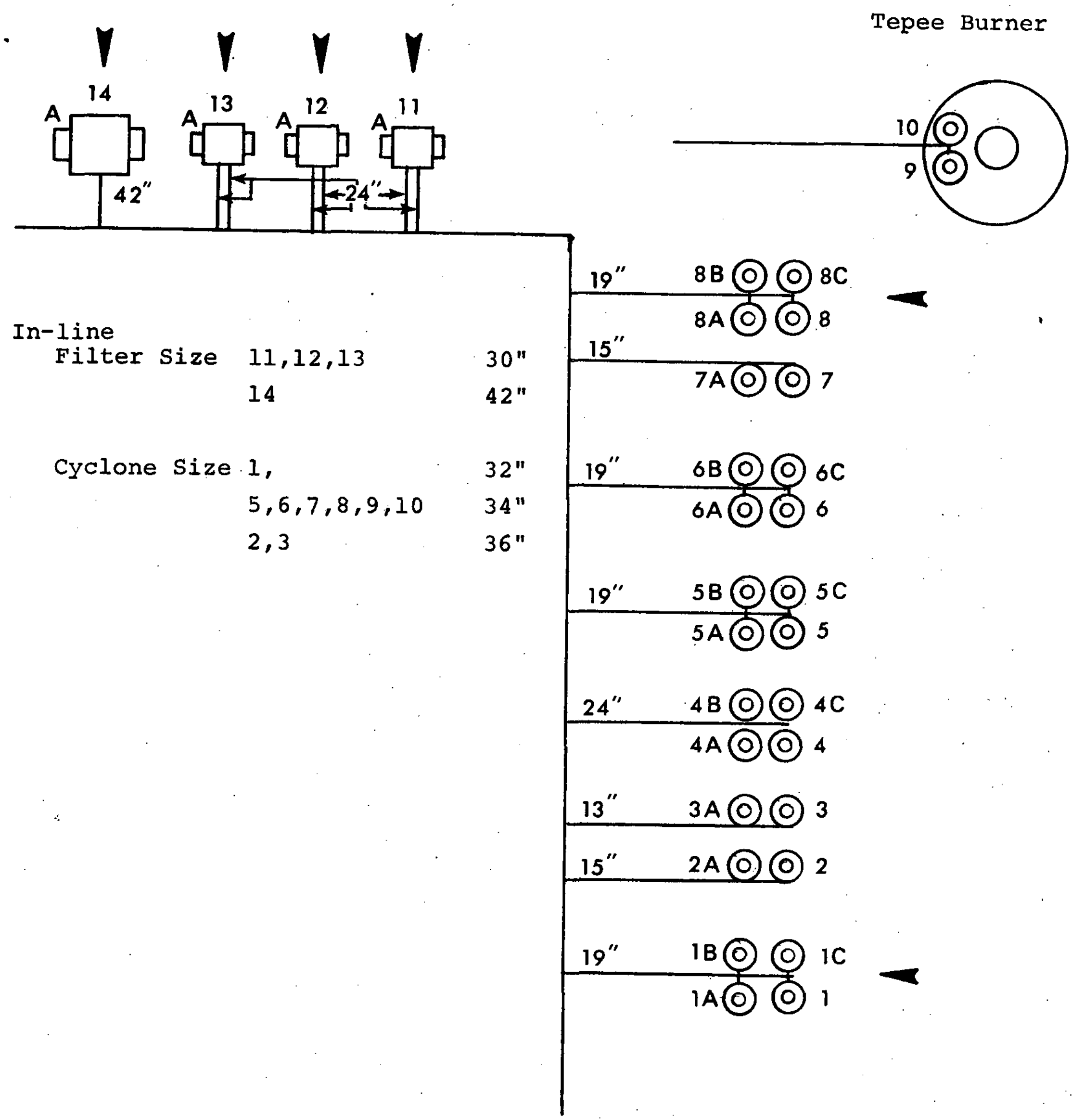

Figure 1. SCHEMATIC DIAGRAM OF COTTON GIN CONTROL DEVICES
ARROW HEADS INDICATE SAMPLED DEVICES

Table 1. SUMMARY OF SAMPLE POINT NUMBERS, CONTROL DEVICES, AND EMISSION SOURCE

Sample Point No.	Control Device	Size of Device (in.)	Source of Emissions
1	Cyclone (4)	32	Heater No. 1, Tower Dryer, Inclined Cleaner
2	Cyclone (2)	36	Overflow Separator
3	Cyclone (2)	36	Extractor Feeder
4	Cyclone (4)	32	Inclined Cleaner
5	Cyclone (4)	34	Condenser, Unit-Saw, Lint Cleaner
6	Cyclone (4)	34	Condenser, Unit-Saw, Lint Cleaner
7	Cyclones (2)	34	Trash Line from Filters
8	Cyclones (4)	34	Unloading Separator
9, 10	Cyclone (1 ea)	34	Trash Lines from All Cyclones, Dryer Cleaner
11	Filter (1)	30	Gin Stand No. 3, Lint Cleaner, Lint Cleaner Condenser
12	Filter (1)	30	Gin Stand No. 2, Lint Cleaner, Lint Cleaner Condenser
13	Filter (1)	30	Gin Stand No. 1, Lint Cleaner, Lint Cleaner Condenser
14	Filter (1)	30	Battery Condenser

Extensive modifications were required on the control devices at the cotton gin prior to sampling. All twenty-six cyclones were prepared for sampling by replacing the rain cap with a duct of the same diameter as the cyclone outlets. The duct, resembling a candy cane, consisted of a large radius 180° bend, a straightening vane, and a long length of straight pipe. With this device, the flow was directed downward toward the ground. The straightening vane reduced or eliminated the cyclonic flow pattern, and the long length of duct provided relatively stable flow at the sampling points. The in-line filters controlling emissions from the three gin stands and the battery condenser were modified by replacing the rain shields with a 90° bend and a sufficient length of pipe to meet required sampling criteria. As the air flow from the filters is directed out of both sides of the unit, both outlets were provided with ducting. Details of the modifications are given in Section IV.

The following sections of this report include the summaries of data, conclusions, and process description. The appendicies provide complete data summaries, field and analytical data sheets, production data, and sampling logs.

SECTION II

SUMMARY AND DISCUSSION OF RESULTS

The emission control devices at the "Green Gin" of the Delta and Pine Land Company consist of twenty-eight small diameter cyclones and four in-line filters. Twenty-six of the cyclones are arranged in two rows and are grouped in two to four units for each of the eight ducts from the plant. Two cyclones are located on the trash incinerator (a tepee burner) to separate the bulk trash from fine particulate. Each in-line filter has two inlet ducts. The filter, consisting of a rotating screen, removes large particulate from the air stream which is then emitted from both sides of the unit into the atmosphere.

A summary of the emission sources and the control devices by site designation is given in Table 1. A diagram showing the physical layout of the devices in relation to the gin building was shown in Figure 1.

The sampling program at this gin was planned to include all of the listed control devices. The large number of emission points, wet weather, the fact that the subcontractor hired to install ducts did not finish on time, and the necessity of sampling at another gin during this year's ginning season required that a number of points be deleted from the plan. The wet weather contributed delays in several ways. When the fields were very wet, cotton could not be picked by the mechanical pickers. During this time, only the dry areas were picked. In general, if cotton was available for ginning during the rain periods, the emissions were sampled.

Referring to Figure 1 and Table 1, emission data were collected at points 1, 8, 11, 12, 13, and 14. These points represent all of the low pressure system and the first two stages of the high pressure system of the plant. These systems and the operational scheme of the plant will be explained in more detail in Section III of this report.

The "Green Gin" is representative of modern cotton ginning plants and is quite well controlled by the present concepts. The plant was constructed in 1966 and employs established ginning and control equipment. At the normal production rate of 20 bales per hour, there is considerable evidence of emission from all outlets. In addition, during ginning, the tepee burner operates to burn trash, including material from the bottom of all cyclones and plant debris. The smoke from the tepee burner has a yellowish white color and has a quite acrid, very characteristic odor.

Considerable additional duct work was required at the gin before sampling could begin. Delta Sheet Metal of Greenville, Mississippi, was hired as a subcontractor to provide the needed modifications.

The in-line filters have two outlets venting directly from the sides of the filter into the outside air. Each outlet is covered with a rain cap. These rain shields were removed and replaced with a 90° bend and a long straight run of duct work. Identical units were installed on each side of the filter. The ducts were of 30 inch I.D. on the small filters at sites 11, 12, and 13 and 42 inch I.D. on the battery condenser filter, site 14. In general, a minimum duct length of three diameters upstream and one diameter downstream from the sampling points were available on all of these units. In each case, one side of the unit was sampled for particulate loading, and the other side was traversed for velocity and temperature data.

The exhaust from the other systems (unloading separator, inclined cleaner, extractor feeders, gin stands, and trash lines) were directed to cyclones, which were grouped in banks of 2 or 4 from each inlet line. The cyclones were capped with a rain shield, adjusted by the gin builder to yield a back pressure that would provide good separation efficiency. Such a system, however, is not suitable for testing from two points of view. First, no suitable location is available in the exhaust from the cyclone, due to the short length of outlet pipe, and second, the flow from these devices is cyclonic and thus, would require a device to eliminate the spiral flow pattern. The sampling modifications for these devices were required to provide a sampling location consistent with good sampling practice and also include straightening vanes.

The approach considered and finally adopted was to remove the rain cap and replace it with a large radius 180° bend, a straightening vane, and a long straight length of pipe. The duct additions resembled a large "candy cane." Each cyclone in a bank was provided with the same type of device so that changes in back pressure would not change the proportion of air to each cyclone in the bank.

Some preliminary tests were conducted at the gin to determine the effect of the duct modification on cyclone operation. A sample port for static pressure measurements was cut in the inlet of cyclone site number 8. The test data given below indicates that while there is a different pressure with the bend and straightening vane than in normal operation, the pressure difference is less than the normal variation in static pressure.

Condition	Date	Inlet Pressure In. H_2O
Normal	9/27/72	1.55
Duct Work in Place	9/27/72	1.45
Simulated Vane	9/27/72	1.20
Normal	9/28/72	1.55
Duct/Straightening Vane	9/28/72	0.0, .75, 1.40, 1.20

The readings taken with the duct in place on September 28, 1972, over a 1.5 hour period, showed considerable variation. These variations typically exceeded 0.2 inches of water and, at the extreme, ranged from 0.0 to 1.6 inches of water.

As the tests were not conclusive, calculations were made of the expected pressure drop due to the added duct work. Considering a 17 inch duct, the 180° bend would be equal to 43 feet of straight duct. (Industrial Ventilation Manual, Section 6, Figures 6-10, 1955) Based on data from the Air Conditioning Handbook, 100 feet of 17 inch duct causes a pressure equal to about 0.25 inches of water. Thus, the elbow and length of duct is equivalent to 43 feet (180° elbow) plus 12 feet (straight duct). The total length of 55 feet should show a back pressure of 0.14 inches of water. The value is very close to the 0.15 inches of water difference in pressure obtained at another cotton gin with and without the complete "candy cane" (Test Report 72-MM-23). As a result of these tests, we believe that while there is a difference in pressure caused by the additional duct work, it is not sufficient to cause a serious deviation in the test results.

A summary of the emission data on all sampled outlets is given in Table 2. Three isokinetic (90-110%) sampling runs were conducted at each site. Each run was verified in the field for isokinetic conditions before acceptance. Samples were collected from sites 1, 8, 11, 12, 13, and 14A, for a total of eighteen runs.

At each site, any unsampled outlets were traversed for velocity and temperature data during the sampling of the outlets given in Table 2. The summary of the data on unsampled ducts is given in Table 3. During sampling run 1 on site 1, outlets 1A, 1B, and 1C were traversed. Thus, the data in Table 3 labeled 1A-1, 1B-1, 1C-1 were collected during sampling of duct 1-1, 1A-2, 1B-2, 1C-2 during 1-2, etc. After completion of the analytical results, the emission rate in grains per DSCF was calculated for each sampled run. This value was then assumed to be the emission rate in all ducts of the same bank. The lb/hour data was then calculated from the grains/DSCF and the calculated air flow rate at each individual outlet. The pounds of emission per ton of cotton produced was calculated from the pounds/hour figure.

Table 4 summarizes the data for each group of outlet control devices with a single outlet. This data, based on front-half loading (from the probe tip to filter, and not the contents of the impinger section), provides the combined total emission rate in lbs/hr (Kg/M ton) and the emission factors in lb/ton (Kg/M ton) for all outlets in a bank.

In general, the emission rate and emission factors for the cyclones are about half of the corresponding figures for the in-line filters. However, point 11, the filter controlling emissions from the third gin stand and associated

Table 2. SUMMARY OF EMISSION MEASUREMENTS MADE AT DELTA AND PINE LAND COMPANY, SCOTT, MISSISSIPPI

Date	Test		Average Velocity		Average Stack Temperature		Emission Rate (Front)		Emission Rate (Total)		Emission Factor (Front)		Emission Factor (Total)		
1972	No.	Test Site	Ft/Sec	(m/Sec)	°F	°C	Lbs/Hr	(Kg/Hr)	Lbs/Hr	(Kg/Hr)	Lb/Ton	(Kg/M Ton)	Lb/Ton	(Kg/M Ton)	% H_2O
10/25	1C1	Cyclone - Heater No. 1, Inclined Cleaner	1560	(475)	130	(54.4)	0.682	(0.309)	2.32	(1.05)	0.145	(0.0725)	0.494	(0.246)	1.76
10/25	1C2	Cyclone - Heater No. 1, Inclined Cleaner	1680	(512)	134	(56.7)	0.340	(0.154)	0.616	(0.279)	0.0685	(0.0342)	0.124	(0.0620)	1.80
11/6	1C4	Cyclone - Heater No. 1, Inclined Cleaner	1550	(472)	119	(48.3)	0.666	(0.302)	0.920	(0.417)	0.127	(0.0547)	0.176	(0.0755)	5.37
11/6 11/7	8-1	Cyclone - Unloading Separator	1670	(509)	77	(25.0)	0.459	(0.208)	1.55	(0.703)	0.109	(0.0546)	0.369	(0.185)	2.58
11/8	14A2	Filter - Battery Condenser	1520	(463)	83	(28.3)	2.30	(1.04)	3.49	(1.58)	0.701	(0.349)	1.06	(0.530)	1.25
11/8	8-4	Cyclone - Unloading Separator	1800	(549)	76	(24.4)	0.481	(0.218)	0.556	(0.252)	0.186	(0.0932)	0.216	(0.108)	1.32
11/10	14A4	Filter - Battery Condenser	1470	(448)	76	(24.4)	2.05	(0.930)	2.53	(1.15)	0.487	(0.243)	0.601	(0.301)	1.20
11/10	8-5	Cyclone - Unloading Separator	1800	(549)	66	(18.9)	0.694	(0.315)	0.852	(0.386)	0.158	(0.0793)	0.195	(0.0972)	1.30
11/10	14A5	Filter - Battery Condenser	1450	(442)	79	(26.1)	2.67	(1.21)	3.01	(1.37)	0.562	(0.281)	0.634	(0.318)	1.23
11/10	13-1	Filter - Gin Stand 1, Lint Cleaner	1580	(482)	74	(23.3)	3.24	(1.47)	4.10	(1.86)	0.684	(0.342)	0.865	(0.433)	3.21
11/10	12-1	Filter - Gin Stand 2, Lint Cleaner	1470	(448)	68	(20.0)	2.77	(1.26)	3.15	(1.43)	0.546	(0.274)	0.621	(0.311)	0.02
11/10	13-2	Filter - Gin Stand 1, Lint Cleaner	1560	(475)	70	(21.1)	5.56	(2.52)	6.22	(2.82)	1.05	(0.522)	1.17	(0.584)	3.31
11/10	12-2	Filter - Gin Stand 2, Lint Cleaner	1370	(418)	59	(15.0)	4.37	(1.98)	5.09	(2.31)	0.812	(0.406)	0.946	(0.473)	0.00
11/17	11-1	Filter - Gin Stand 3, Lint Cleaner	1570	(479)	69	(20.6)	1.30	(0.590)	1.56	(0.708)	0.304	(0.152)	0.364	(0.182)	0.55
11/17	12-3	Filter - Gin Stand 2, Lint Cleaner	1410	(430)	63	(17.2)	1.59	(0.721)	2.21	(1.00)	0.371	(0.186)	0.516	(0.258)	1.11
11/17	13-3	Filter - Gin Stand 1, Lint Cleaner	1220	(372)	64	(17.8)	2.03	(0.921)	2.50	(1.13)	0.474	(0.325)	0.584	(0.399)	1.03
11/17	11-2	Filter - Gin Stand 3, Lint Cleaner	1570	(479)	67	(19.4)	1.74	(0.789)	2.05	(0.930)	0.363	(0.181)	0.427	(0.214)	1.42
11/17	11-3	Filter - Gin Stand 3, Lint Cleaner	1550	(472)	64	(17.8)	1.58	(0.717)	2.20	(0.998)	0.363	(0.181)	0.506	(0.253)	0.00

Table 3. SUMMARY OF VELOCITY AND ESTIMATED EMISSIONS OF UNSAMPLED STACKS AT DELTA AND PINE LAND COMPANY, SCOTT, MISSISSIPPI

Site Test No.	Sampled Site No.	Test Site	Average Stack Temperature °F	(° C)	Average Stack Gas Velocity Ft/Min	(m/Min)	Stack Flow Rate DSCFM	(Nm^3/Sec)	Particulate Emission (Sampled Site) GR/DSCF	(Mg/Nm^3)	Estimated Emission Rate Lb/Hr	(Kg/Hr)	Emission Factor Lb/Ton	(Kg/ M Ton)
1-1	1C-1	Cyclone - Heater No. 1, Inclined Cleaner	129	(53.9)	1470	(448)	1850	(0.873)	0.0406	(92.9)	0.644	(0.292)	0.137	(0.0685)
1A-1	1C-1	Cyclone - Heater No. 1, Inclined Cleaner	123	(50.6)	1370	(418)	1740	(0.821)	0.0406	(92.9)	0.605	(0.274)	0.129	(0.0643)
1B-1	1C-1	Cyclone - Heater No. 1, Inclined Cleaner	127	(52.8)	1350	(411)	1700	(0.802)	0.0406	(92.9)	0.592	(0.269)	0.126	(0.0631)
1-2	1C-2	Cyclone - Heater No. 1, Inclined Cleaner	129	(53.9)	1570	(479)	1970	(0.930)	0.0190	(43.5)	0.321	(0.146)	0.0647	(0.0324)
1A-2	1C-2	Cyclone - Heater No. 1, Inclined Cleaner	126	(52.2)	1380	(421)	1740	(0.821)	0.0190	(43.5)	0.283	(0.128)	0.0571	(0.0284)
1B-2	1C-2	Cyclone - Heater No. 1, Inclined Cleaner	126	(52.2)	1380	(421)	1740	(0.821)	0.0190	(43.5)	0.283	(0.128)	0.0571	(0.0284)
1-4	1C-4	Cyclone - Heater No. 1, Inclined Cleaner	142	(61.1)	1420	(433)	1670	(0.788)	0.0409	(93.6)	0.585	(0.265)	0.112	(0.0480)
1A-4	1C-4	Cyclone - Heater No. 1, Inclined Cleaner	139	(59.4)	1280	(390)	1520	(0.717)	0.0409	(93.6)	0.533	(0.242)	0.102	(0.0438)
1B-4	1C-4	Cyclone - Heater No. 1, Inclined Cleaner	141	(60.6)	1230	(375)	1450	(0.684)	0.0409	(93.6)	0.508	(0.230)	0.0969	(0.0417)
8A-1	8-1	Cyclone - Unloading Separator	82.0	(27.8)	1230	(375)	1870	(0.883)	0.0209	(47.8)	0.335	(0.152)	0.0798	(0.0399)
8B-1	8-1	Cyclone - Unloading Separator	81.0	(27.2)	1540	(469)	2340	(1.10)	0.0209	(47.8)	0.419	(0.190)	0.0998	(0.0499)
8C-1	8-1	Cyclone - Unloading Separator	78.0	(25.6)	1400	(427)	2140	(1.01)	0.0209	(47.8)	0.383	(0.174)	0.0912	(0.0457)
8A-4	8-4	Cyclone - Unloading Separator	83.0	(28.3)	1380	(421)	2140	(1.01)	0.0199	(45.5)	0.365	(0.166)	0.141	(0.0709)
8B-4	8-4	Cyclone - Unloading Separator	83.0	(28.3)	966	(294)	1500	(0.708)	0.0199	(45.5)	0.256	(0.116)	0.0992	(0.0496)
8C-4	8-4	Cyclone - Unloading Separator	81.0	(27.2)	1750	(533)	2720	(1.28)	0.0199	(45.5)	0.464	(0.210)	0.180	(0.0897)
8A-5	8-5	Cyclone - Unloading Separator	85.0	(29.4)	1220	(372)	1860	(0.878)	0.0287	(65.7)	0.457	(0.207)	0.104	(0.0521)
8B-5	8-5	Cyclone - Unloading Separator	81.0	(27.2)	1260	(384)	1940	(0.916)	0.0287	(65.7)	0.477	(0.216)	0.109	(0.0544)
8C-5	8-5	Cyclone - Unloading Separator	73.0	(22.8)	1470	(448)	2300	(1.09)	0.0287	(65.7)	0.566	(0.257)	0.129	(0.0647)

Table 3. (Continued)

Site Test No.	Sampled Site No.	Test Site	Average Stack Temperature ° F	(° C)	Average Stack Gas Velocity Ft/Min	(m/Min)	Stack Flow Rate DSCFM	(Nm^3/Sec)	Particulate Emission (Sampled Site) GR/DSCF	(Mg/Nm^3)	Estimated Emission Rate Lb/Hr	(Kg/Hr)	Emission Factor Lb/Ton	(Kg/ M Ton)
11A-1	11-1	Filter - Gin Stand 3, Lint Cleaner	68.0	(20.0)	1430	(436)	7130	(3.37)	0.0195	(44.6)	1.19	(0.540)	0.278	(0.139)
11A-2	11-2	Filter - Gin Stnad 3, Lint Cleaner	65.0	(18.3)	1530	(466)	7590	(3.58)	0.0262	(60.0)	1.70	(0.771)	0.354	(0.177)
11A-3	11-3	Filter - Gin Stand 3, Lint Cleaner	65.0	(18.3)	1490	(454)	7510	(3.54)	0.0235	(53.8)	1.51	(0.685)	0.347	(0.173)
12A-1	12-1	Filter - Gin Stand 2, Lint Cleaner	77.0	(25.0)	1310	(399)	6430	(3.03)	0.0441	(101)	2.43	(1.10)	0.479	(0.239)
12A-2	12-2	Filter - Gin Stand 2, Lint Cleaner	75.0	(23.9)	1100	(335)	5430	(2.56)	0.0731	(167)	3.40	(1.54)	0.632	(0.316)
12A-3	12-3	Filter - Gin Stand 2, Lint Cleaner	65.0	(18.3)	1310	(399)	6540	(3.09)	0.0263	(60.2)	1.47	(0.667)	0.343	(0.172)
13A-1	13-1	Filter - Gin Stand 1, Lint Cleaner	74.0	(23.3)	1290	(393)	6150	(2.90)	0.0502	(115)	2.65	(1.20)	0.559	(0.279)
13A-2	13-2	Filter - Gin Stand 1, Lint Cleaner	70.0	(21.1)	1210	(369)	5810	(2.74)	0.0865	(198)	4.31	(1.95)	0.810	(0.404)
13A-3	13-3	Filter - Gin Stand 1, Lint Cleaner	65.0	(18.3)	1100	(335)	5490	(2.59)	0.0389	(89.0)	1.83	(0.830)	0.428	(0.214)
14-2	14A-2	Filter - Battery Condenser	79.0	(26.1)	1430	(436)	13600	(6.42)	0.0186	(42.6)	2.17	(0.984)	0.662	(0.330)
14-4	14A-4	Filter - Battery Condenser	78.0	(25.6)	1440	(439)	13600	(6.42)	0.0171	(39.1)	1.99	(0.903)	0.607	(0.303)
14-5	14A-5	Filter - Battery Condenser	80.0	(26.7)	1390	(424)	13100	(6.18)	0.0227	(51.9)	2.55	(1.16)	0.777	(0.389)

Note: The particulate emissions, particulate emissions rate, and emission factors are based on "front-half" loading only.

Table 4. TOTAL CALCULATED EMISSIONS FOR SAMPLED OPERATIONAL SYSTEMS
(Based on "Front-half" Particulate Loading)

System	Site No.	Run No.	Total Particulate Emissions GR/DSCF	(Mg/Nm³)	Emission Rate Lb/Hr	(Kg/Hr)	Emission Factors Lb/Ton	(Kg/M Ton)
Heater No. 1, Tower Dryer, Inclined Cleaner	1	1	0.0406	(92.9)	2.52	(1.14)	0.537	(0.269)
	1	2	0.0190	(43.5)	1.23	(0.558)	0.247	(0.124)
	1	4	0.0409	(93.6)	2.29	(1.04)	0.438	(0.219)
Unloading Separator	8	1	0.0209	(47.8)	1.60	(0.726)	0.380	(0.190)
	8	4	0.0199	(45.5)	1.57	(0.712)	0.606	(0.303)
	8	5	0.0287	(65.7)	2.19	(0.993)	0.500	(0.250)
Gin Stand No. 3, Lint Cleaner, Lint Cleaner Condenser	11	1	0.0195	(44.6)	2.49	(1.13)	0.582	(0.291)
	11	2	0.0262	(60.0)	3.44	(1.56)	0.717	(0.359)
	11	3	0.0235	(53.8)	3.09	(1.40)	0.710	(0.355)
Gin Stand No. 2, Lint Cleaner, Lint Cleaner Condenser	12	1	0.0441	(101)	5.20	(2.36)	1.03	(0.515)
	12	2	0.0731	(167)	7.77	(3.52)	1.44	(0.720)
	12	3	0.0263	(60.2)	3.06	(1.39)	0.714	(0.357)
Gin Stand No. 1, Lint Cleaner, Lint Cleaner Condenser	13	1	0.0502	(115)	5.89	(2.67)	1.24	(0.620)
	13	2	0.0865	(198)	9.87	(4.48)	1.86	(0.930)
	13	3	0.0389	(89.0)	3.86	(1.75)	0.902	(0.451)
Battery Condenser	14	2	0.0186	(42.6)	4.47	(2.03)	1.36	(0.680)
	14	4	0.0171	(39.1)	4.04	(1.83)	1.09	(0.545)
	14	5	0.0227	(51.9)	5.22	(2.37)	1.34	(0.670)

lint cleaner and lint cleaning condenser has lower emissions than the other filters on similar systems. It is possible that this gin stand was not in use as much as the other two gin stands, but we cannot be certain of this with the available information.

Based on average results of the six systems that were tested at this plant, the emissions are estimated to be about 5.2 pounds of particulate per ton of cotton produced. If all possible emission points except the smoke from the tepee burner were considered, the value could be easily double this figure or about 10 pounds of particulate per ton of cotton produced.

Samples of seed cotton and trash from the cotton gin were submitted for analysis to Dr. Han Tai at the EPA Pesticides Monitoring Laboratory in Bay St. Louis, Mississippi. The results of these analyses are shown in Table 5.

Complete data for the tests conducted at each site is given in Tables 6 through 11.

Table 5. ANALYSIS OF SEED COTTON AND TRASH

Test No. 72-MM-16

Source	Seed Cotton (Unprocessed)			Trash		
	Raw Material	Raw Material	Raw Material	Greenleaf and Stock Extractor	Gin Stand Mote Chamber	Gravity Cleaner
Sample No.*	653	654	655	656	657	658
p,p'-DDT(ppm)	3.97	2.40	7.82	10.1	17.2	53.0
o,p-DDT(ppm)	0.47	0.37	0.70	1.0	2.0	5.94
p,p'-TDE(ppm)	0.27	N.D.**	N.D.	0.21	0.78	2.60
p,p'-DDE(ppm)	0.56	0.28	0.16	0.45	1.0	3.91
Toxaphene(ppm)	9.10	6.8	4.12	25.9	27.9	136.0
DEF(ppm)	0.05	N.D.	0.17	0.17	0.17	0.07
Methyl Parathion(ppm)	N.D.	N.D.	N.D.	0.17	0.06	0.10

*All sample numbers contained the prefix 72-004. The complete numbers were 72-004-653 to 72-004-658.

**N.D. - not detected. Minimum detection limit: p,p'-DDT; o,p-DDT; p,p'-TDE; and p,p'-DDE is 0.01 ppm., Toxaphene 0.1 ppm, DEF and Methyl Parathion 0.05 ppm.

Table 6. SUMMARY OF RESULTS

OUTLET OF THE HEATER NO. 1 TOWER DRYER, INCLINED CLEANER - POINT NO. 1C

Run Number:	1C1	1C2	1C4	Average
Date:	10/25/72	10/25/72	11/6/72	
Method Type:	EPA-5	EPA-5	EPA-5	
Volume of gas sampled-DSCF[1]-(Nm^3)[4]	28.4 (0.804)	30.0 (0.850)	28.2 (0.799)	28.9 (0.818)
Percent Moisture by Volume	1.76	1.80	5.37	2.98
Average Stack Temperature-°F-(°C)	130 (54.4)	134 (56.7)	119 (48.3)	128 (53.1)
Stack Volumetric Flow Rate-DSCFM[2]-(Nm^3/sec)	1960 (0.925)	2090 (0.986)	1900 (0.897)	1980 (0.936)
Stack Volumetric Flow Rate-ACFM[3]-(m^3/sec)	2180 (1.03)	2340 (1.10)	2160 (1.02)	2230 (1.05)
Percent Isokinetic	104	102	107	104
Product Rate-ton lint cotton/hr-(M ton/hr)[5]	4.70 (4.26)	4.96 (4.50)	5.24 (5.52)	4.97 (4.76)
Duration of run - minutes	60.0	60.0	60.0	60.0
<u>Particulates</u> - probe, cyclone and filter catch				
mg	74.8	37.1	74.9	62.3
grains/DSCF[6]-(mg/Nm^3)	0.0406 (92.9)	0.0190 (43.5)	0.0409 (93.6)	0.0335 (76.7)
lb/hr-(Kg/hr)	0.682 (0.309)	0.340 (0.154)	0.666 (0.302)	0.563 (0.255)
lb/ton of lint cotton produced (kg/M ton of lint cotton produced)	0.145 (0.0725)	0.0685 (0.0342)	0.127 (0.0547)	0.114 (0.0538)
<u>Particulates</u> - total catch				
mg	225	67.0	104	132
grains/DSCF[6]-(mg/Nm^3)	0.138 (316)	0.0344 (78.7)	0.0565 (129)	0.0763 (175)
lb/hr-(Kg/hr)	2.32 (1.05)	0.616 (0.279)	0.920 (0.417)	1.29 (0.582)
lb/ton of lint cotton produced (Kg/M ton of lint cotton produced)	0.494 (0.246)	0.124 (0.0620)	0.176 (0.0755)	0.265 (0.128)
percent impinger catch	66.8	44.6	28.0	46.5

[1]Dry Standard Cubic Feet @ 70°F, 29.92 in Hg
[2]Dry Standard Cubic Feet per Minute @ 70°F, 29.92 in Hg
[3]Actual Cubic Feed per Minute - Stack Conditions
[4]Normal Cubic Meters at 21.1°C, 760 mm Hg
[5]Metric Tons per Hour (1 metric ton = 1000 Kg)
[6]Grains per Dry Standard Cubic Feet

Table 7. SUMMARY OF RESULTS

OUTLET OF THE UNLOADING SEPARATOR - POINT NO. 8

Run Number:	801	804	805	Average
Date:	11/6-7/72	11/8/72	11/10/72	
Method Type:	EPA-5	EPA-5	EPA-5	
Volume of gas sampled-DSCF[1]-(Nm³)[4]	32.1 (0.909)	36.4 (1.03)	37.5 (1.06)	35.3 (1.00)
Percent Moisture by Volume	2.58	1.32	1.30	1.73
Average Stack Temperature-°F-(°C)	77.0 (25.0)	76.0 (24.4)	66.0 (18.9)	73.0 (22.8)
Stack Volumetric Flow Rate-DSCFM[2]-(Nm³/sec)	2560 (1.21)	2820 (1.33)	2850 (1.35)	2740 (1.30)
Stack Volumetric Flow Rate-ACFM[3]-(m³/sec)	2630 (1.24)	2830 (1.34)	2840 (1.34)	2770 (1.31)
Percent Isokinetic	101	104	106	104
Product Rate-ton lint cotton/hr-(M ton/hr)[5]	4.20 (3.81)	2.58 (2.34)	4.38 (3.97)	3.72 (3.37)
Duration of run - minutes	60.0	60.0	60.0	60.0
<u>Particulates</u> - probe, cyclone and filter catch				
mg	43.6	47.1	69.2	53.3
grains/DSCF[6]-(mg/Nm³)	0.0209 (47.8)	0.0199 (45.5)	0.0284 (65.0)	0.0231 (52.8)
lb/hr-(Kg/hr)	0.459 (0.208)	0.481 (0.218)	0.694 (0.315)	0.545 (0.247)
lb/ton of lint cotton produced (kg/M ton of lint cotton produced)	0.109 (0.0546)	0.186 (0.0932)	0.158 (0.0793)	0.151 (0.0757)
<u>Particulates</u> - total catch				
mg	147	54.3	85.1	95.5
grains/DSCF[6]-(mg/Nm³)	0.0707 (162)	0.0230 (52.6)	0.0349 (79.9)	0.0429 (98.2)
lb/hr-(Kg/hr)	1.55 (0.703)	0.556 (0.252)	0.852 (0.386)	0.986 (0.447)
lb/ton of lint cotton produced (Kg/M ton of lint cotton produced)	0.369 (0.185)	0.216 (0.108)	0.195 (0.0972)	0.260 (0.130)
percent impinger catch	70.3	13.3	18.7	34.1

[1] Dry Standard Cubic Feet @ 70°F, 29.92 in Hg
[2] Dry Standard Cubic Feet per Minute @ 70°F, 29.92 in Hg
[3] Actual Cubic Feed per Minute - Stack Conditions
[4] Normal Cubic Meters at 21.1°C, 760 mm Hg
[5] Metric Tons per Hour (1 metric ton = 1000 Kg)
[6] Grains per Dry Standard Cubic Feet

Table 8. SUMMARY OF RESULTS

OUTLET OF THE LINT CLEANER, LINT CLEANER CONDENSER, GIN STAND NO. 3 - POINT NO. 11

	1101	1102	1103	Average
Run Number:	1101	1102	1103	Average
Date:	11/17/72	11/17/72	11/17/72	
Method Type:	EPA-5	EPA-5	EPA-5	
Volume of gas sampled-DSCF[1]-(Nm^3)[4]	29.8 (0.844)	29.7 (0.841)	32.9 (0.932)	30.8 (0.872)
Percent Moisture by Volume	0.55	1.42	0.00	0.657
Average Stack Temperature-°F-(°C)	69.0 (20.6)	67.0 (19.4)	64.0 (17.8)	66.7 (19.3)
Stack Volumetric Flow Rate-DSCFM[2]-(Nm^3/sec)	7800 (3.68)	7760 (3.66)	7840 (3.70)	7800 (3.68)
Stack Volumetric Flow Rate-ACFM[3]-(m^3/sec)	7700 (3.63)	7700 (3.63)	7610 (3.59)	7670 (3.62)
Percent Isokinetic	95.4	96.4	106	99.3
Product Rate-ton lint cotton/hr-(M ton/hr)[5]	4.28 (3.88)	4.80 (4.35)	4.35 (3.95)	4.48 (4.06)
Duration of run - minutes	60.0	60.0	60.0	60.0
Particulates - probe, cyclone and filter catch				
mg	37.7	50.5	50.1	46.1
grains/DSCF[6]-(mg/Nm^3)	0.0195 (44.6)	0.0262 (60.0)	0.0235 (53.8)	0.0231 (52.8)
lb/hr-(Kg/hr)	1.30 (0.590)	1.74 (0.789)	1.58 (0.717)	1.54 (0.699)
lb/ton of lint cotton produced (kg/M ton of lint cotton produced)	0.304 (0.152)	0.363 (0.181)	0.363 (0.181)	0.343 (0.171)
Particulates - total catch				
mg	45.3	59.6	69.8	58.2
grains/DSCF[6]-(mg/Nm^3)	0.0234 (53.5)	0.0309 (70.7)	0.0327 (74.8)	0.0290 (66.3)
lb/hr-(Kg/hr)	1.56 (0.708)	2.05 (0.930)	2.20 (0.998)	1.94 (0.879)
lb/ton of lint cotton produced (Kg/M ton of lint cotton produced)	0.364 (0.182)	0.427 (0.214)	0.506 (0.253)	0.432 (0.216)
percent impinger catch	16.8	15.3	28.2	20.1

[1]Dry Standard Cubic Feet @ 70°F, 29.92 in Hg
[2]Dry Standard Cubic Feet per Minute @ 70°F, 29.92 in Hg
[3]Actual Cubic Feed per Minute - Stack Conditions
[4]Normal Cubic Meters at 21.1°C, 760 mm Hg
[5]Metric Tons per Hour (1 metric ton = 1000 Kg)
[6]Grains per Dry Standard Cubic Feet

Table 9. SUMMARY OF RESULTS

OUTLET OF THE LINT CLEANER, LINT CLEANER CONDENSER, GIN STAND NO. 2 - POINT NO. 12

Run Number:	1201	1202	1203	Average
Date:	11/10/72	11/10/72	11/17/72	
Method Type:	EPA-5	EPA-5	EPA-5	
Volume of gas sampled-DSCF[1]-(Nm^3)[4]	30.6 (0.867)	27.7 (0.784)	29.7 (0.841)	29.3 (0.831)
Percent Moisture by Volume	0.02	0.00	1.11	0.377
Average Stack Temperature-°F-(°C)	68.0 (20.0)	59.0 (15.0)	63.0 (17.2)	63.3 (17.4)
Stack Volumetric Flow Rate-DSCFM[2]-(Nm^3/sec)	7340 (3.46)	6970 (3.29)	7060 (3.33)	7120 (3.36)
Stack Volumetric Flow Rate-ACFM[3]-(m^3/sec)	7220 (3.41)	6720 (3.17)	6920 (3.27)	6950 (3.28)
Percent Isokinetic	105	100	106	104
Product Rate-ton lint cotton/hr-(M ton/hr)[5]	5.07 (4.60)	5.38 (4.88)	4.28 (3.88)	4.91 (4.45)
Duration of run - minutes	60.0	60.0	60.0	60.0
<u>Particulates</u> - probe, cyclone and filter catch				
mg	87.6	131	50.8	89.8
grains/DSCF[6]-(mg/Nm^3)	0.0441 (101	0.0731 (167)	0.0263 (60.2)	0.0478 (109)
lb/hr-(Kg/hr)	2.77 (1.26)	4.37 (1.98)	1.59 (0.721)	2.91 (1.32)
lb/ton of lint cotton produced (kg/M ton of lint cotton produced)	0.546 (0.274)	0.812 (0.406)	0.371 (0.186)	0.576 (0.289)
<u>Particulates</u> - total catch				
mg	99.5	153	70.3	108
grains/DSCF[6]-(mg/Nm^3)	0.0501 (115)	0.0852 (195)	0.0365 (83.5)	0.0573 (131)
lb/hr-(Kg/hr)	3.15 (1.43)	5.09 (2.31)	2.21 (1.00)	3.48 (1.58)
lb/ton of lint cotton produced (Kg/M ton of lint cotton produced)	0.621 (0.311)	0.946 (0.473)	0.516 (0.258)	0.694 (0.347)
percent impinger catch	12.0	14.4	27.7	18.0

[1]Dry Standard Cubic Feet @ 70°F, 29.92 in Hg
[2]Dry Standard Cubic Feet per Minute @ 70°F, 29.92 in Hg
[3]Actual Cubic Feed per Minute - Stack Conditions
[4]Normal Cubic Meters at 21.1°C, 760 mm Hg
[5]Metric Tons per Hour (1 metric ton = 1000 Kg)
[6]Grains per Dry Standard Cubic Feet

Table 10. SUMMARY OF RESULTS

OUTLET OF THE LINT CLEANER, LINT CLEANER CONDENSER, GIN STAND NO. 1 - POINT NO. 13

Run Number:	1301	1302	1303	Average
Date:	11/10/72	11/10/72	11/17/72	
Method Type:	EPA-5	EPA-5	EPA-5	
Volume of gas sampled-DSCF[1]-(Nm^3)[4]	30.8 (0.872)	29.8 (0.844)	27.0 (0.765)	29.2 (0.827)
Percent Moisture by Volume	3.21	3.31	1.03	2.52
Average Stack Temperature-°F-(°C)	74.0 (23.3)	70.0 (21.1)	64.0 (17.8)	69.3 (20.7)
Stack Volumetric Flow Rate-DSCFM[2]-(Nm^3/sec)	7540 (3.56)	7500 (3.54)	6100 (2.88)	7050 (3.33)
Stack Volumetric Flow Rate-ACFM[3]-(m^3/sec)	7750 (3.66)	7660 (3.62)	5990 (2.83)	7130 (3.37)
Percent Isokinetic	102	100	111	104
Product Rate-ton lint cotton/hr-(M ton/hr)[5]	4.74 (4.30)	5.32 (4.83)	4.28 (3.88)	4.78 (4.34)
Duration of run - minutes	60.0	60.0	60.0	60.0
Particulates - probe, cyclone and filter catch				
mg	100	167	68.2	112
grains/DSCF[6]-(mg/Nm^3)	0.0502 (115)	0.0865 (198)	0.0389 (89.0)	0.0585 (134)
lb/hr-(Kg/hr)	3.24 (1.47)	5.56 (2.52)	2.03 (0.921)	3.61 (1.64)
lb/ton of lint cotton produced (kg/M ton of lint cotton produced)	0.684 (0.342)	1.05 (0.522)	0.474 (0.325)	0.736 (0.396)
Particulates - total catch				
mg	127	187	83.9	133
grains/DSCF[6]-(mg/Nm^3)	0.0634 (145)	0.0968 (222)	0.0479 (110)	0.0694 (159)
lb/hr-(Kg/hr)	4.10 (1.86)	6.22 (2.82)	2.50 (1.13)	4.27 (1.94)
lb/ton of lint cotton produced (Kg/M ton of lint cotton produced)	0.865 (0.433)	1.17 (0.584)	0.584 (0.399)	0.873 (0.472)
percent impinger catch	21.3	10.7	18.7	16.9

[1]Dry Standard Cubic Feet @ 70°F, 29.92 in Hg
[2]Dry Standard Cubic Feet per Minute @ 70°F, 29.92 in Hg
[3]Actual Cubic Feed per Minute - Stack Conditions
[4]Normal Cubic Meters at 21.1°C, 760 mm Hg
[5]Metric Tons per Hour (1 metric ton = 1000 Kg)
[6]Grains per Dry Standard Cubic Feet

Table 11. SUMMARY OF RESULTS
OUTLET OF THE BATTERY CONDENSER - POINT NO. 14A

Run Number:	14A2	14A4	14A5	Average
Date:	11/8/72	11/10/72	11/10/72	
Method Type:	EPA-5	EPA-5	EPA-5	
Volume of gas sampled-DSCF[1]-(Nm^3)[4]	31.1 (0.881)	30.5 (0.864)	30.0 (0.850)	30.5 (0.865)
Percent Moisture by Volume	1.25	1.20	1.23	1.23
Average Stack Temperature-°F-(°C)	83.0 (28.3)	76.0 (24.4)	79.0 (26.1)	79.3 (26.3)
Stack Volumetric Flow Rate-DSCFM[2]-(Nm^3/sec)	14400 (6.80)	14000 (6.61)	13700 (6.47)	14000 (6.63)
Stack Volumetric Flow Rate-ACFM[3]-(m^3/sec)	14600 (6.89)	14200 (6.70)	14000 (6.61)	14300 (6.73)
Percent Isokinetic	107	108	108	108
Product Rate-ton lint cotton/hr-(M ton/hr)[5]	3.28 (2.98)	4.21 (3.82)	4.75 (4.31)	4.08 (3.70)
Duration of run - minutes	60.0	60.0	60.0	60.0
<u>Particulates</u> - probe, cyclone and filter catch				
mg	37.5	33.9	44.3	38.6
grains/DSCF[6]-(mg/Nm^3)	0.0186 (42.6)	0.0171 (39.1)	0.0227 (51.9)	0.0195 (44.5)
lb/hr-(Kg/hr)	2.30 (1.04)	2.05 (0.930)	2.67 (1.21)	2.34 (1.06)
lb/ton of lint cotton produced (kg/M ton of lint cotton produced)	0.701 (0.349)	0.487 (0.243)	0.562 (0.281)	0.583 (0.291)
<u>Particulates</u> - total catch				
mg	57.2	41.8	49.8	49.6
grains/DSCF[6]-(mg/Nm^3)	0.0283 (64.8)	0.0211 (48.3)	0.0256 (58.6)	0.0250 (57.2)
lb/hr-(Kg/hr)	3.49 (1.58)	2.53 (1.15)	3.01 (1.37)	3.01 (1.37)
lb/ton of lint cotton produced (Kg/M ton of lint cotton produced)	1.06 (0.530)	0.601 (0.301)	0.634 (0.318)	0.765 (0.383)
percent impinger catch	34.4	18.9	11.0	21.4

[1]Dry Standard Cubic Feet @ 70°F, 29.92 in Hg
[2]Dry Standard Cubic Feet per Minute @ 70°F, 29.92 in Hg
[3]Actual Cubic Feed per Minute - Stack Conditions
[4]Normal Cubic Meters at 21.1°C, 760 mm Hg
[5]Metric Tons per Hour (1 metric ton = 1000 Kg)
[6]Grains per Dry Standard Cubic Feet

SECTION III

PROCESS DESCRIPTION AND OPERATION

INTRODUCTION

This process description shows the process equipment and materials from which all emissions are derived and identifies each of those sources with the specific device being used to control emissions therefrom.

Reference is made to the attached drawings showing the plant flow diagram (Figure 2) and location of each emission control device (Figure 3). Details on the individual items of process equipment, mentioned in this process description, may be found in the Handbook for Cotton Ginners, Agriculture Handbook No. 260 (USDA), 1964.

SEED COTTON UNLOADING

Seed cotton is unloaded from trailers by means of telescoping suction tubes. The resulting air stream, containing seed cotton, passes through ductwork to a rock trap, where heavy impurities such as rocks and green bolls are removed, then to the unloading separator, where air and seed cotton are separated. The air from the unloading separator (containing impurities such as dust derived from the seed

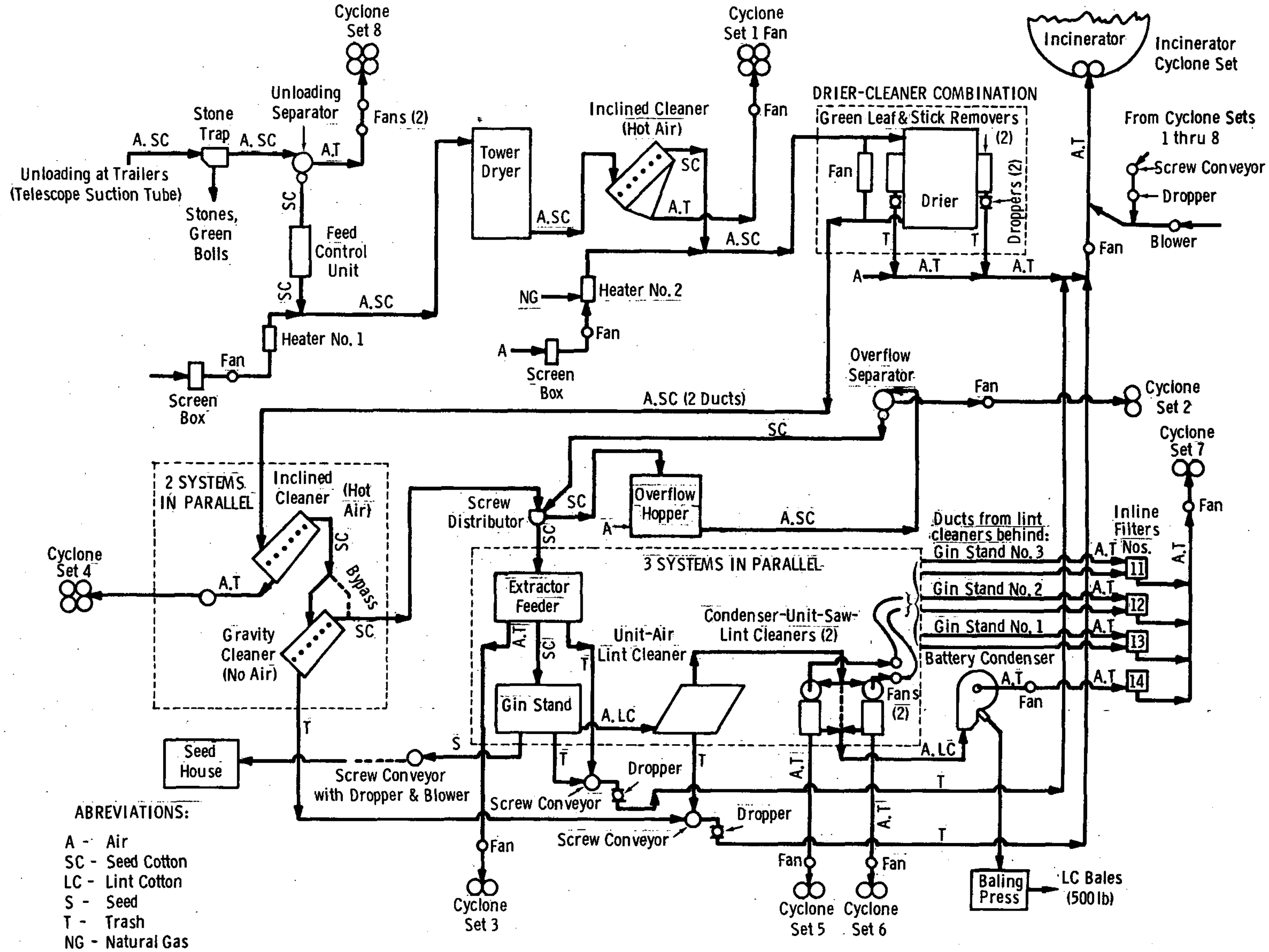

Figure 2. PLANT FLOW DIAGRAM - COTTON GINNING PLANT, TEST No. 72-MM-16

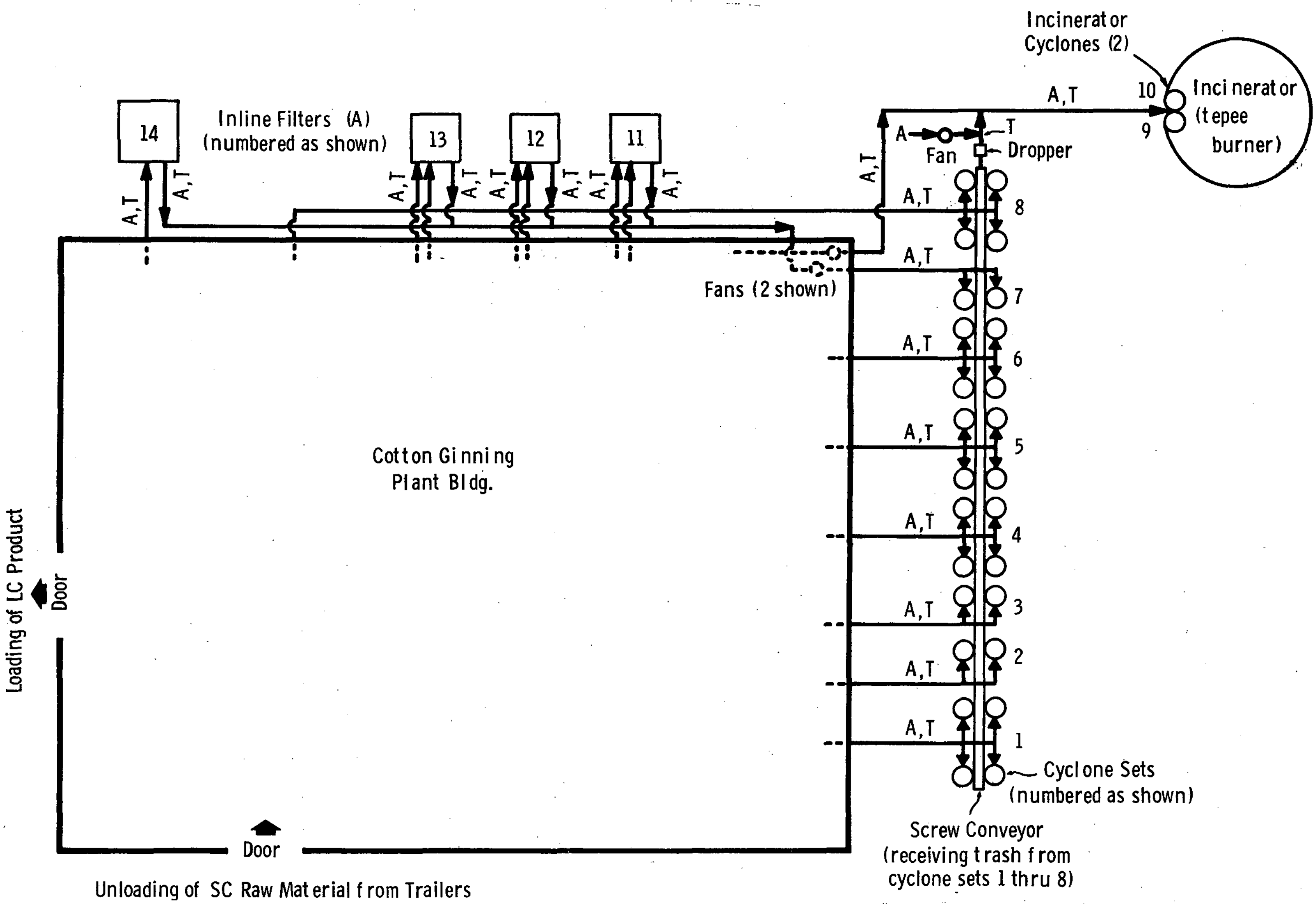

Figure 3. LOCATION OF EMISSION CONTROL DEVICES - COTTON GINNING PLANT, TEST No. 72-MM-16

cotton) is drawn through the unloading fan to cyclone bank 8 while the seed cotton flows into the feed control unit.

SEED COTTON DRYING AND CLEANING

A stream of hot gases is formed as a fan draws ambient air from inside the plant and forces it through heater No. 1 where natural gas is burned and the resulting combustion products mix with the air stream. The hot gas mixture thus formed flows through a duct to the seed cotton outlet of the feed control unit, where the seed cotton is entrained and carried through a tower dryer to an inclined cleaner. Gases, containing trash, are separated from the seed cotton in the inclined cleaner and are drawn through a fan to cyclone bank 1.

A stream of hot gases formed in heater No. 2, similar to that formed in heater No. 1, flows through a duct to the seed cotton outlet of the inclined cleaner where the seed cotton is entrained and carried through the cleaner-dryer combination (a dryer with two green-leaf-and-stick removers attached). Trash from the two green-leaf-and-stick removers, of the dryer-cleaner combination, flows through vacuum droppers to a duct having a vacuum, induced by a fan, wherein it is carried in an air stream to the incinerator cyclones. The same vacuum line receives trash from other sources which are shown in Figure 3, and which will be noted in the following paragraphs.

The seed cotton from the dryer-cleaner combination is drawn through ducts to two inclined cleaners, in parallel. Air and trash from the two parallel inclined cleaners is drawn through a fan to cyclone bank 4. The seed cotton from those two cleaners flows (by gravity) into one gravity cleaner each. Trash from these two gravity cleaners flows into a screw conveyor (which also receives trash from the unit-air lint cleaner, discussed in a following paragraph), thence through a dropper into the vacuum line leading to the incinerator cyclones. The seed cotton from the gravity cleaners flows (again by gravity) into the screw distributor, which carries it into the ginning system.

GINNING AND LINT CLEANING

The screw distributor distributes seed cotton to three extractor feeders which, in turn, feed it to one gin stand each, at rates controlled to the gin stand capacity. When the flow of seed cotton from the screw distributor exceeds the total of the intake rates of the extractor feeders, the excess seed cotton flows into the overflow hopper, from which it is again picked up, at a suitable time, by suction applied within the hopper and routed through the overflow separator back to the screw distributor. Air from the overflow separator (containing trash) is exhausted through a fan to cyclone bank 2.

Trash from the three extractor feeders and gin stands is carried by a screw conveyor, then a dropper, into the vacuum line leading to the incinerator cyclones.

Within the gin stands, lint cotton is separated from seed. The seed is removed to an elevated seed house by means of a screw conveyor with dropper and blower. The lint cotton is carried in air streams through the unit-air cleaners (one for each gin stand), then through the condenser-unit-saw lint cleaners (two in parallel for each gin stand), then to the battery condenser.

Trash from the three unit-air lint cleaners is carried by screw conveyor (with trash from the gravity cleaners) through a dropper into the vacuum line to the incinerator cyclones. Air from the upper (condenser) sections of the six condenser-unit-saw lint cleaners (containing trash) flows through one fan each, to in-line filters 11, 12, and 13. (The air-and-trash streams from the condensers of lint cleaners behind gin stands 1, 2, and 3 flow to in-line filters 13, 12, and 11 respectively.)

Air streams (containing trash and motes) from the saw units of the three condenser-and-unit-saw lint cleaners nearer to the gin stands flow through fans to cyclone bank 5. The corresponding air streams from the saw units of the three condenser-and-unit-saw lint cleaners further from the gin stands flow through fans to cyclone bank 6.

Air from the battery condenser flows into the baling press where the products, bales of lint cotton, are formed.

The air-and-trash streams exhausted from in-line filters Nos. 11 through 14 flow through a fan to cyclone bank 7.

Trash from cyclone banks 1 through 8 flows into a screw conveyor under those cyclones. It is then moved through a dropper and duct, under positive pressure from a blower, into the air-and-trash line to the incinerator cyclone set.

Thus, the total trash from the emission control system is carried into the tepee burner incinerator where it is burned, the smoke from that incinerator forming an additional emission point.

Typical process operation at the "Green Gin" can be summarized as follows:

Normal plant operating schedule:

20 hrs/day (2 shifts)

6 days/week

6 weeks/year, plus spasmodic periods to process remnants.

From October to January (ginning season).

Average plant operating capacity:

525,000 lbs of seed cotton/day (processed)

175,000 lbs of lint cotton/day (produced)

280,000 lbs of seed/day (produced)

Peak plant operating capacity:

600,000 lbs of seed cotton/day (processed)

200,000 lbs of lint cotton/day (produced)

320,000 lbs of seed/day (produced)

SECTION IV

SAMPLING AND ANALYTICAL PROCEDURES

LOCATION OF SAMPLING POINTS

There are two types of emission control devices at the Delta and Pine Land Company cotton gin; in-line filters controlling emissions from the battery condenser and the lint cleaner condensers and cyclones controlling emissions from the overflow separators, lint cleaners, unloading separator, dryer cleaners, extractor feeders, and trash hopper.

The in-line filters from the gin stands, lint cleaners, and lint cleaner condensers had 30 inch outlets; the battery condenser, 42 inch outlets. The rain shields were removed and replaced with a short adaptor, a 90° elbow and a straight length of pipe, each the same diameter as the outlet. To simplify sampling, the ducts were directed downward. As a result the ducts were sampled with two horizontal traverses rather than one horizontal and one vertical traverse.

The sample ports on the lint cleaner condensers were located 125 inches (4.2 Dia.) from the 90° elbows, and 25 inches (0.83 Dia.) from the outside air. The bottom of the ducts was approximately 42 inches above the ground. A diagram of the duct design and sample port location is shown in Figure 4. Only one section of scaffolding was required to reach the sample ports on these three units.

The battery condenser sampling ports were 156 inches (3.7 Dia.) below the elbow and 36 inches (0.86 Dia.) above the outside air. The bottom of the duct was about 48 inches above the ground. The battery condenser ducts and sample ports are shown in Figure 5. The ports were reached with scaffolding two sections high.

Each of the cyclones at the gin was equipped with a sampling duct in place of the rain cap. The duct was fitted to the short exhaust duct on the top of the cyclone and consisted of a large radius 180° bend, a straightening vane, and a long length of straight pipe. The "candy cane" sampling ducts were built in three inside diameters; 16, 17, and 18 inches as required; to fit the cyclone exhaust duct. A schematic diagram of the sampling ducts in place on a cyclone set is shown in Figure 6. Table 12 lists the cyclone sites and the important dimensions at each location. Figure 7 shows the construction of the straightening vanes.

Each cyclone duct was provided with an inspection port in the 180° bend directly above the straightening vane. This port, which was closed with a sheet metal band during sampling, provided access to the straightening vane. The vane was cleaned prior to each test so that the flow would not be restricted, and thus, divert the air stream to another outlet.

Continuous rows of scaffolding were set up on both sides of the sampling ducts to provide access. All samples were collected on ducts farthest from the building. All sampling

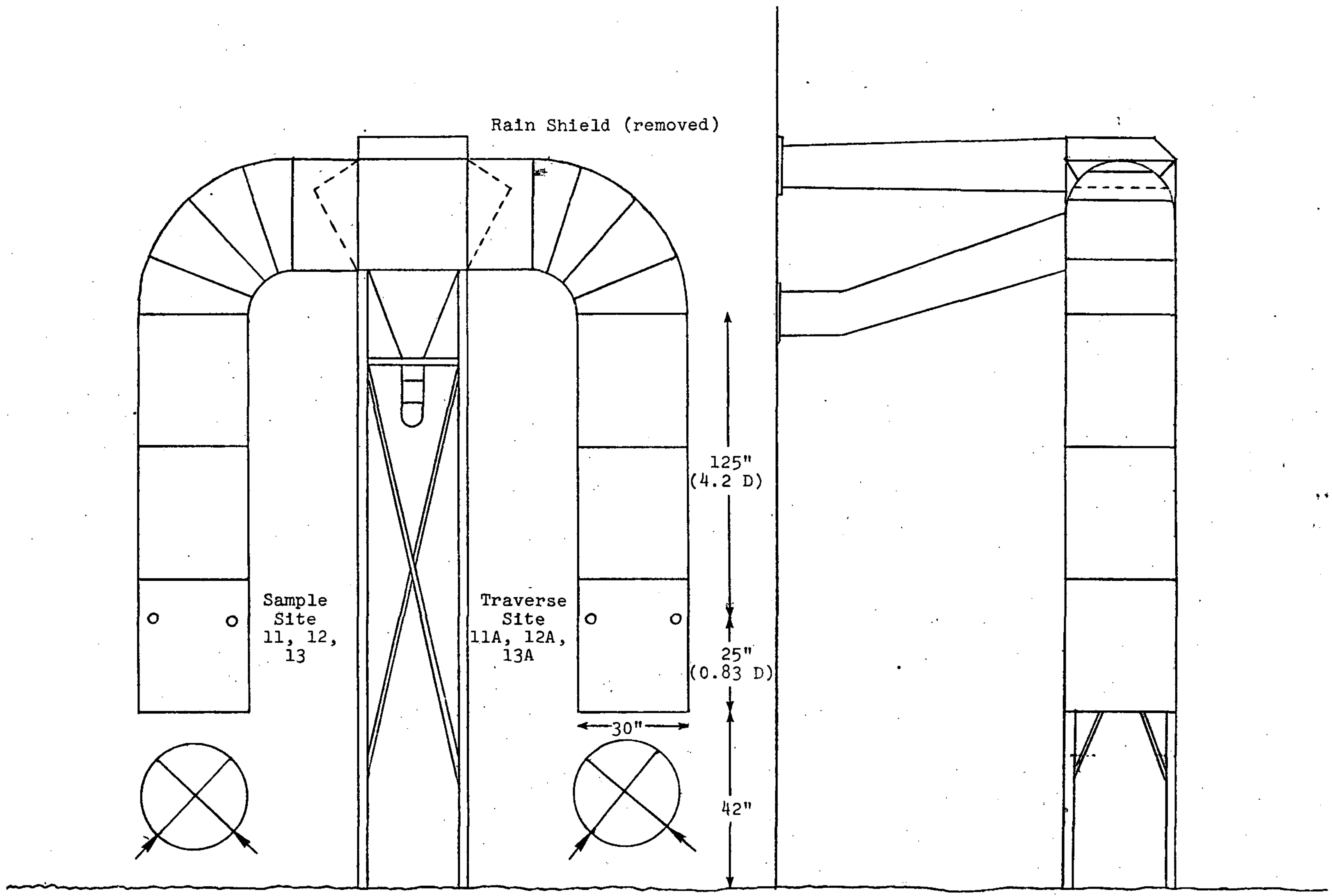

Figure 4. SCHEMATIC DIAGRAM OF THE IN-LINE FILTERS AND SAMPLING DUCTS FOR SITES 11, 12, AND 13

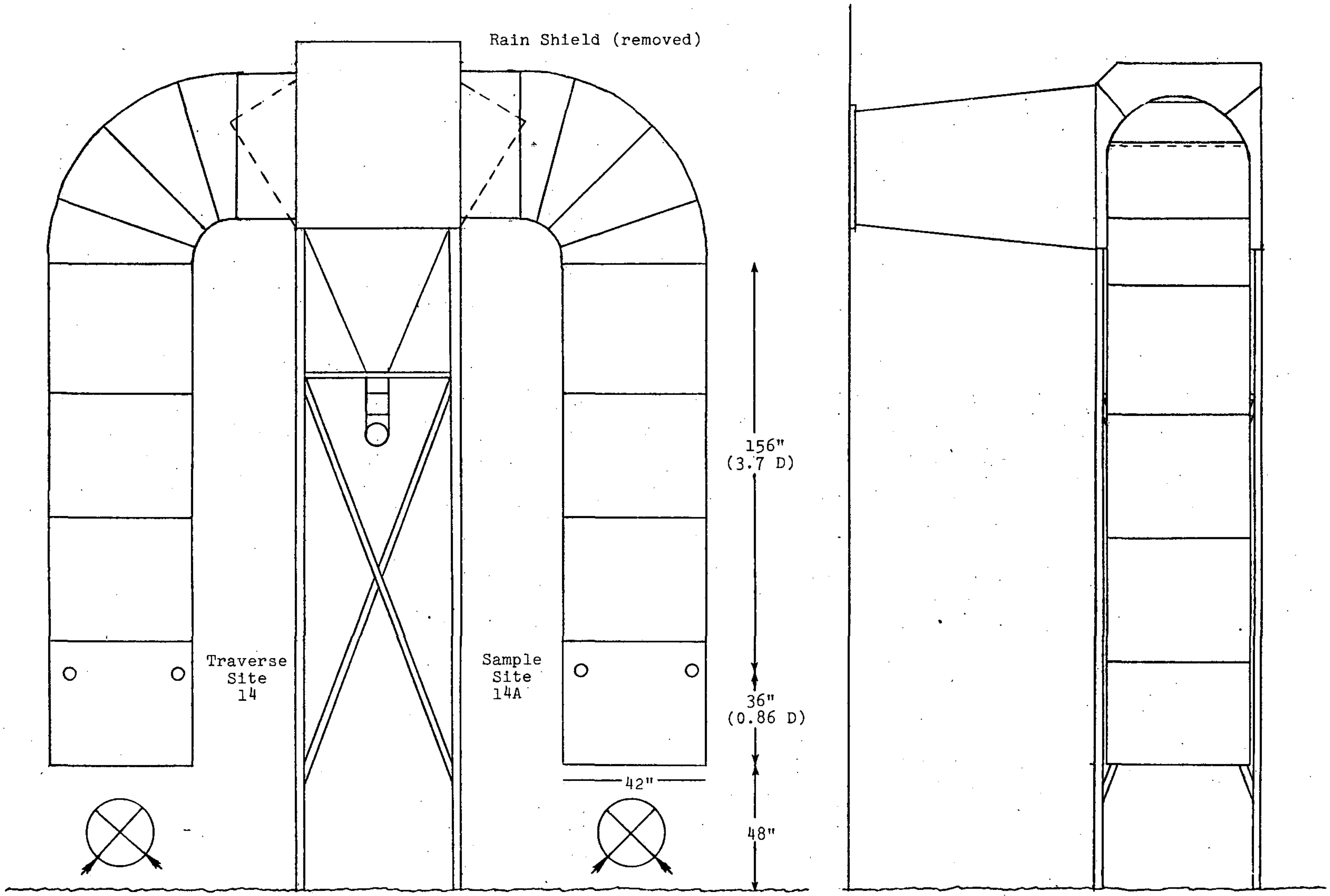

Figure 5. SCHEMATIC DIAGRAM OF THE BATTERY CONDENSER IN-LINE FILTER AND SAMPLING DUCTS - SITE 14

Table 12. DIMENSIONS AT CYCLONE SITES

Site No.	Cyclone Diameter Inches	Cyclone Outlet Inches	Duct I. D. Inches	Total Duct Length In. (Dia.)	Sampling Port Location: Upstream Distance In. (Dia.)	Sampling Port Location: Downstream Distance In. (Dia.)	No. of Traverse Points	Radius of 180° Bend (inches)
1	32	16	16	192 (12.0)	120 (7.5)	72 (4.5)	12	40
2	36	18	18	192 (10.7)	119 (6.6)	73 (4.1)	16	45
3	36	18	18	192 (10.7)	119 (6.5)	73 (4.1)	16	45
4	32	16	16	192 (12.0)	120 (7.5)	72 (4.5)	12	40
5	34	17	17	192 (11.3)	120 (7.0)	72 (4.2)	12	42.5
6	34	17	17	192 (11.3)	120 (7.0)	72 (4.2)	12	42.5
7	34	17	17	192 (11.3)	120 (7.0)	72 (4.2)	12	42.5
8	34	17	17	192 (11.3)	120 (7.0)	72 (4.2)	12	42.5

Note: Port locations apply to both sampled and unsampled sites.

All straightening vanes were honeycombed with 2.5 inch squares, 7.5 inches long, and with a diameter of 16, 17, or 18 inches.

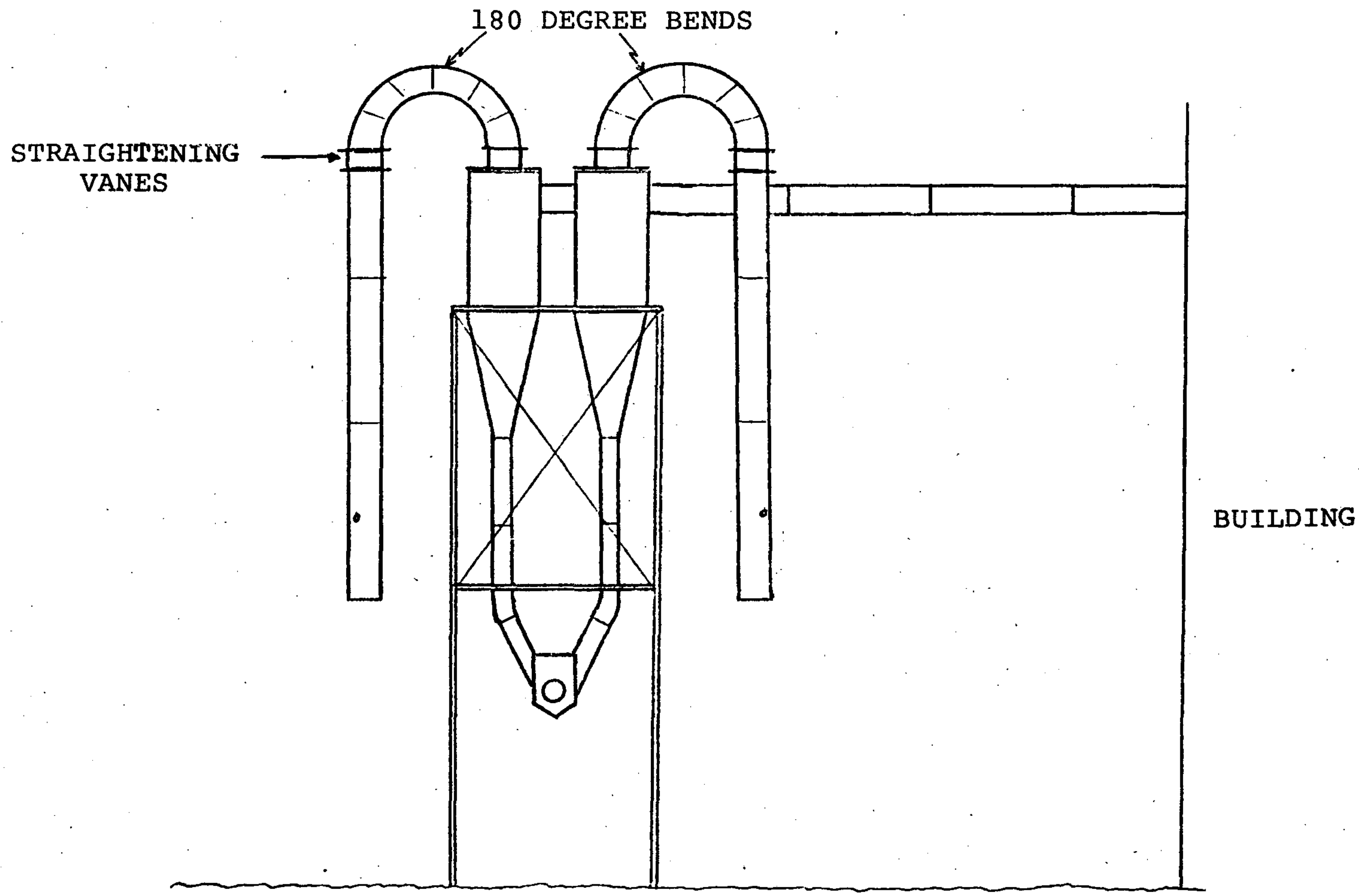

Figure 6. SCHEMATIC DIAGRAM OF THE CYCLONE UNITS AND SAMPLING DUCTS
(Table 12 lists the dimensions for the ducts and sample port locations)

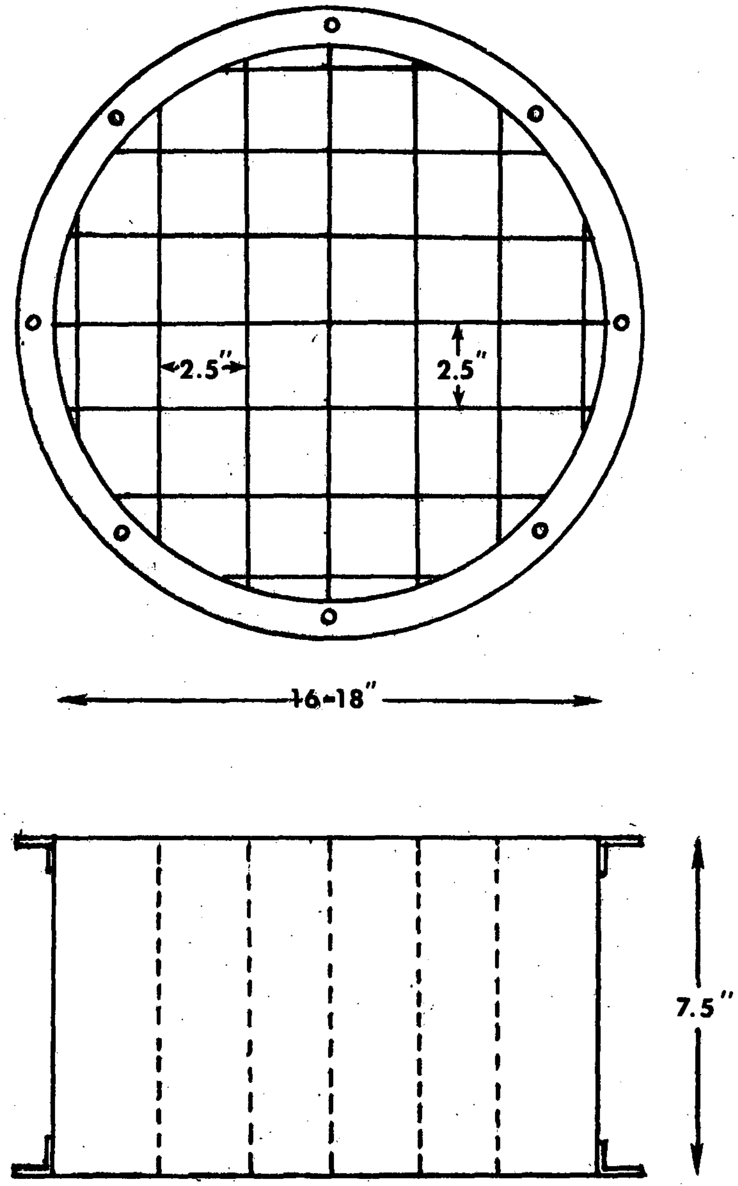

Figure 7. DIAGRAM OF STRAIGHTENING VANE CONSTRUCTION

ports were readily accessible, and equipment could be easily moved from one location to another.

No other modifications were required at this gin. Ample electrical capacity was available for all testing in the fan room adjacent to the cyclone banks.

SAMPLING PROCEDURES

The outlets from all of the control devices at the cotton gin were sampled generally in accordance with the methods given in the August 17, 1971, Federal Register. One exception was the use of the wet bulb-dry bulb technique to obtain initial moisture levels, rather than Method 4, "Determination of Moisture in Stack Gases." The low moisture levels (0-5.4%) and low stack temperatures (below 212°F) permitted the use of this deviation.

Method 5 of the Federal Register Methods was used to obtain the emission rate of all sampled outlets. During these sample runs, any unsampled outlets in the same cyclone bank or connected to the same control device were traversed to obtain the velocity profile and stack temperature following Method 2. If it is assumed that the loading in grains/standard cubic foot is the same at all outlets of the control devices in one unit, the emission rate in lb/hr would be a function of the differences in velocity at the outlets. The loading in grains/cubic foot were obtained from the Method 5 data, and from the velocity traverse of the unsampled ducts, the emission rate in lb/hr can be calculated for each individual outlet.

No conditions were encountered during this sampling program that were beyond the normal operating parameters of the

Method 5 sampling apparatus. The sampling runs were stopped, however, when portions of the gin ceased operation or if unusual conditions occurred in the gin. The runs were restarted when normal operation resumed.

While sampling was in process, production data was recorded by Mr. William Herring of EPA. The information obtained included the number and weight of finished cotton bales produced during the entire length of each run. The data was used to calculate the emission rate in terms of cotton produced.

ANALYTICAL PROCEDURES

Samples from the Method 5 sampling trains were recovered as outlined in the August 17, 1971, Federal Register. After removal of the filter, all sample exposed surfaces were washed with reagent grade acetone or distilled water as specified. All sample bottles for liquid samples were obtained from Wheaton Scientific, Catalogue No. 219630. Each of these bottles and the petri dishes for sample filters were acid soaked with a 1:1 HNO_3 for one day, rinsed with distilled water and soaked with distilled water for one day.

Sample recovered from the High Volume sampler included removal of the filter and placing it in a large mouth bottle, removal of the cyclone bottle and sealing it, and washing of all exposed surfaces of the train with acetone. Acetone washings were placed in acid washed Wheaton bottles.

Analytical procedures for the Method 5 samples follow the Federal Register guidelines, with one exception. Container No. 3 as indicated in the method contains water from the impingers and washing of the glassware of the train. The solution was extracted with chloroform and ether, and then the extracted portion was dried to constant weight, as specified. In addition, the remaining water after extraction was evaporated to dryness at 212°F to constant weight. Both weights were included in the total mass of particulate.

Sample weight from the Method 5 samplers were reported as "front half" (probe washings and filter collection weights) and "total" (front half plus water, chloroform-ether extract, and impinger acetone washing weights).

All particulate mass analyses with the exception of that of the impinger acetone washings were preformed at Monsanto Research Corporation, Dayton Laboratory. The sample for each run was analyzed at the EPA laboratories, and the data was supplied to MRC for inclusion in this report.