A-79-55

II-D-48

AMMONIUM NITRATE
AP-42 Section 6.8
Reference Number
8

Monsanto

MONSANTO AGRICULTURAL PRODUCTS CO.
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Phone (314) 694-1000

December 27, 1978

Mr. Eric A. Noble
Industrial Studies Branch
Emission Standards and Engr. Div.
Research Triangle Park,
North Carolina 27711

Dear Eric,

Enclosed is the Luling Plant response to your AN emissions survey. Pursuant to your request, and following the practice used in El Dorado's survey response and the prior Luling plant trip report; I have carefully reviewed this response and blocked in those portions (very few) that Monsanto considers Trade Secret and Confidential information.

If you have any specific questions or problems give me a call at (314)694-4956. I believe this gets Monsanto up-to-date on this phase of your project. Best regards and have a happy new year.

Sincerely,

D. E. Cayard
Manager, Manufacturing
Environmental Control

/jn
Attachment

CC: R. Shear - St. Louis
E. Debus - Luling
L. Adams - El Dorado

INFORMATION BLOCKED IN THIS REPORT

IS CONSIDERED MONSANTO TRADE SECRET

AND CONFIDENTIAL DATA.

[illegible]

I. GENERAL

A. Process flow diagrams are found in the appendix

B. Production Description

1. 83 Percent Solution

Anyhydrous ammonia vapor at 140°F and 15 psig and 56 percent nitric acid preheated to 180°F are sparged into a recirculating line of each of two neutralizers. The resultant product is typically an 83 percent solution at 290°F. Product is either stored for later use or fed immediately to high and/or low density prill production.

Nitric acid and ammonia are fed to the two identical forced-circulation neutralizers at a weight ratio of approximately 3.7:1.0 HNO_3/NH_3. The neutralizers operate slightly above atmospheric pressure and a pH barely above the neutral point. A pH meter was installed on each neutralizer.

Part of the 3-5 psig reaction steam from one of the neutralizers is used to preheat the HNO_3 feed to both neutralizers in a shell and tube exchanger. The remainder of the overheads of both neutralizers are totally condensed except for a pressure vent. The condensate is used as cooling tower make-up or scrubber liquor.

2. LOW DENSITY PRILL

A thermal circulation vacuum evaporator, "low concentrator", is fed with the 88 percent solution which it concentrates to 95 percent through steam heating to 305°F.

The 95 percent ammonium nitrate solution exiting the concentrator enters a seal tank and is then pumped to a head tank at the top of the prill tower. The head tank is maintained at 305°F. It is open to atmospheric pressure and delivers solution to the spray nozzle via an overflow pipe designed to maintain a constant pressure head.

2. Low Density Prill (Cont'd)

The molten droplets released from the sprayer fall 170 feet through a counter current stream of air. The resultant prill at ground level is kept at a maximum of 170° by turning on or off one fan or more of the five fans located near the nozzle level on the tower.

The prills exit the tower bottom on a belt conveyor and are dumped through a "scalping" screen which removes large agglomerated lumps, and are deposited on another belt conveyor to the kilns.

Low density prills pass through three rotary kilns in series. These kilns are designated: predryer, dryer, and cooler.

Air flow in each kiln is countercurrent to product flow. Predryer and dryer kilns have individual air intakes and steam coils for air heating. The air for the low density cooler is ducted from a dehumidifier and then passed over chilled water coils.

2. Low Density Prill (Cont'd)

The air exhaust from each kiln is ducted to separate and identical Pease-Anthony Scrubbers.

Product exiting the cooler is dropped to open vibrating deck screens. Oversized and undersized product drops into an open trough irrigated with a dilute ammonium nitrate recycle solution. The recycle solution is returned to the process sump.

The low density prill is conveyed via an open line belt conveyor from the vibrating screens to a surge hopper. The prills drop from the surge hopper to a weigh conveyor and are transferred into a common chute. Clay coating is stored in a hopper and is metered into the common chute [redacted] Prills and coating exit the common chute and enter a rotary drum coater. Coated product leaving the rotary drum coater is conveyed by bucket elevator and belt conveyor to the bulk loading operation.

2. Low Density Prill (Cont'd)

The prill coating clay is received at the plant in bags. The bags are opened in a small booth. The dry material falls through a grate into a small hopper from which it is removed by a screw conveyor. The back wall has exhaust slits through which dust generated is removed.

The rotary drum coater, chute, bag opening booth, and various bucket and belt conveyor transfer points in the low density prill coating area are exhausted to three sly baghouses. Material is manually removed from the baghouse hoppers once daily and returned to the coating hopper.

The bulk loading facility consists of a roofed over railroad siding and truck dock. Both trucks and railcars are top-loaded via gravity through their hatches. The loading operation is controlled by valves at the outlet of a product surge hopper.

3. HIGH DENSITY PRILL

3. High Density Prill (Cont'd)

Recycled weaker solutions are stripped of organics in charcoal adsorption column and then concentrated to approximately 70 percent in the remelt concentrator. This recycle solution is combined with fresh neutralizer product and/or storage solution in the high density process tank.

The ammonium nitrate solution additive is received in bulk hopper cars and is pneumatically conveyed to the storage bin and the reaction tank. Dust is collected by bag filters and then discharged into the additive storage bin.

The high density solution is sent through similar "low concentrator" as the low density solution. However, the 95 percent head tank solution is pumped to a "high" concentrator located on top of the prill tower.

In this second thermal circulation vacuum evaporator the ammonium nitrate concentration is increased to 99 + percent with an additional temperature rise of approximately 40°F. Overheads from this concentrator enter a barometric condenser supplied with cooling tower water. Barometric condenser condensate flows to a hot well.

Vacuum is maintained by a two stage steam jet pulling across the barometric condenser. Exhaust from the first stage steam jet enters a direct contact condenser supplied with cooling tower water. The resulting condensate flows to the hot well. The second stage steam jet maintains vacuum across the direct contact condenser and exhausts to the atmosphere.

The 99+ percent ammonium nitrate solution stream exiting the second stage concentrator is delivered to a head tank at the top of the prill tower. The head tank is open to atmospheric pressure and delivers solution to its spray nozzle via an overflow pipe.

The process is similar in mechanics for the high density and the low density from the spray nozzle to entrance of the first rotary kiln. Solution temperature in the head tank however is about 350°F and the temperature of the prills exit the tower at 170-208°F.

High density prills need only be cooled. This is accomplished by sending product through a single kiln with air countercurrent to product flow. Intake of air is passed over chilled water coils.

3. High Density Prill (Cont'd)

Two additional kilns are used with ambiant air as cooling medium when necessary. Exhausted air is ducted to separate Pease-Anthony Scrubbers.

High density prills are screened for size on two vibrating screens with off spec material going to the process sump and final product conveyed to the bulk loading facilities.

The original production line was constructed in 1953 with total 83% solution serving as feed for low density ammonium nitrate prills. In 1959 both production lines were altered to provide capabilities of producing high density prills [redacted] The plant was built by Chemico.

Process flow rates are measured at the various locations with their estimated accuracy indicated along side.

	Process Flow	Measurement Device	Accuracy Measurement
(2)	56 percent nitric acid to neutralizers	Orifice plate	95%
(2)	NH_3 to neutralizers	Orifice plate	95%
	High Density Loading	Scales/watch	80%
	Low Density Loading	Scales/watch	80%

FINISHED PRODUCT SPECIFICATION

Characteristics	Typical Low Density	Typical High Density
Moisture	.11%	.30
Mg additive (oxide base)	---	.52
Kaolin	1.2%	---
Surfactant	.04%	---
Screen Size, USSS		
on 6 mesh	0.0	0.0
-6 + 14 mesh	85.0%	97.0%
-20 mesh	0.4%	0.2%
pH of 10% Solution	4.5	6.0
Total Nitrogen	34.4%	34.5%
Ammonium Nitrate	98.6%	98.6%

Based on a 365 day year average daily production for all three product lines is shown below. Design capacity has remained constant over the three year period and is also shown below. No data is readily available for accurate number of days of operation per product line. [redacted] Production for high density has peak demand periods. [redacted] All rates are based on 100% ammonium nitrate production. Days of operation are calculated using typical production for the entire three year period requested.

[redacted]

II. SOLUTION PRODUCTION

A. Neutralizers, process reference numbers 7 and 8.

The neutralizers are atmospheric forced circulation reactors. Nitric acid at about 56 percent concentration and 180°F is sparged into each recirculating leg at about 75 gpm. 7,500 lb/hr of anhydrous ammonia gas at about 140°F is sparged in the same recirculating leg. The reactants are introduced into the neutralizers at a pressure of 3 to 5 psig. Each neutralizer is fitted with a mist eliminator installed prior to vapor exit.

The ammonium nitrate solution produced is approximately 88 percent concentration with a maximum excess of ammonia at .006%. The maximum rate per neutralizer is about 47,000 lb/hr of 100% concentration. Average rate per neutralizer is approximately 34,000 lb/hr.

Each neutralizer exhausts at 16,405 lb/hr along with 262 lb/hr of NH_3 and about .7 lb/hr of NH_4NO_3. Approximately 70 percent of the chemical steam is condensed in overhead water condensers A and B while 20 percent is used in the acid preheater. The remainder is vented to atmosphere to control pressure in the neutralizers.

A. Neutralizers (Cont'd)

Emissions are controlled by a mist eliminator in each neutralizer C and G and by almost total condensation of overheads in condensers A and B.

Operating parameters used to control process are excess NH_3 and pH of product stream. As these two parameters increase above standard set points excess NH_3 is liberated to condensers and atmosphere. If pH drops considerably the neutralizer froths and ammonium nitrate is carried over operating parameters. Monitored are ammonia feed rates, temperatures, and pressures; acid feed rates; neutralizer temperature, pH, and excess NH_3. The pH and excess NH_3 are the only parameters not continously recorded.

The recirculating pump in each neutralizer is designed to pump 6000 gpm or approximately 4,000,000 lb/hr.

III CONCENTRATORS

A. Low Concentrators, reference numbers 12 and 28.

The two forced circulation vacuum concentrators were manufactured by Foster Wheeler. Each concentrator is identical and designed to operate independently or crossed at a rate of 52,000 lb/hr (100% Ammonium Nitrate) from 78 percent solution at 125°F to 95.5 percent solution at 310°F using psig. saturated steam.

A. Low Concentrators (Cont'd)

The two vacuum units will each condense 12,300 lb/hr of water vapor at 284°F and 400 mm.Hg. absolute pressure. Each ejector requires 225 lb/hr of 70 psig. steam. Each condenser requires 350/GPM of water at 90°F.

[redacted] Concentration is usually held at 96.5 percent ammonium nitrate and 3.5 percent water in the low density train and 94.4 percent ammonium nitrate, 3.6 percent water and 2.0 percent harding solution in the high density train.

Off-gas stream rates from the low concentrators for the low and high density trains are ~~3960~~ 3650 lb/hr and ~~16,650~~ 8838 lb/hr.

B. High Concentrator, reference number 33

The high concentrator is only used during high density prill production, [redacted]

Each of the concentrators was manufactured by Swenson Co. and is a single pass, vertical, shell and tube, falling film, vacuum evaporator. The exchanger feed is heated from ~~285~~ 305°F to ~~370~~ 356°F. It enters a flash drum maintained at 74 mm.Hg.

97.7 percent AN at a [redacted] The product is composed of 2.1 percent water and 0.2 percent $MgNO_3$.

The off-gas is pulled off under vacuum. A vapor head booster jet is provided but normally not used. Cooling tower water is used to condense the vapors in a condenser with a temperature rise of about 15°F. The flow rate is about 3920 lb/hr. The overheads are made up of 94.8 percent water and 5.2 percent Ammonia Nitrate.

The temperature and pressure of the off-gas are the same as in the concentrator. The low density train overheads are at a concentration of approximately 8 percent Ammonia Nitrate while the remainder is water. The high density overheads are at a concentration of 12 percent Ammonia Nitrate and 88 percent water.

Overheads from each concentrator pass through a baffled separator to trap out any entrained nitrate which is returned to the flash drum. The vapors pass into the barometric condenser where they are condensed by direct contact with cooling tower water and removed through the barometric seal leg into a hotwell.

B. High Concentration (Cont'd)

The hotwell overflows to the cooling tower return water. The inlet gases are pumped from there to the hop of a condenser by steam ejector and returned to the hotwell.

Concentrator temperature is monitored continuously and automatically controls steam flow to one exchanger. Other parometers checked occassionally are pH of feed streams and height of liquid leg to the hot wells.

There is no known uncontrolled emmission to atmosphere or to an emission control device.

A two stage steam jet maintains a vacuum across the direct contact condensor. Exhaust from the first stage steam jet enters a direct contact cooler supplied with cooling water. The resulting condensate flows to the hot well. The second stage steam jet exhausts to the atmosphere at a negligible rate of noncondensible gases only. The temperature of the overheads entering the condenser is about 280°F.

There is no emissions control device and the rate is unknown. There are no sample ports for the overheads being vented through the two stage steam jet.

B. High Concentration (Cont'd)

Product temperature exit the flash drum is monitored continuously and automatically controls steam flow to the heat exchanger. Pressure is monitored and controlled manually by increasing or decreasing steam to two stage air ejectors. Temperatures are also recorded for cooling water entering and exiting the barometric condenser and exiting the first stage contact condenser. An unusually high vacuum could cause slightly higher emmissions of non-condensible gases to the atmosphere from the steam ejectors.

C. Remelt Concentrator, reference number 25.

The remelt or sump concentrator is an auxillary concentration unit used on a "as needed" basis. It was manufactured by Whiting Corp. It is operated at and discharged to atmospheric. Operating temperature is about 250°F. The unit is desighned to receive 150 gpm of 25 to 30 percent ammonium nitrate solution and discharge 75 to 80 percent ammonium nitrate solution.

A typical rate of 8540 lb/hr of 19 percent ammonium nitrate solution is fed to the unit. Product leaving at a rate of 2300 lb/hr is about 71.5 percent ammonium nitrate, .7 percent Mg (NO_3) and 27.8 percent water.

Product temperature is monitored and automatically controlled by steam flow rate. The uncontrolled emmission rate from the remelt concentrator is unknown.

C. Remelt Concentrator (Cont'd)

There is a mist eliminator, emission control letter H, manufactured by fitted inside the stack for insured loss protection.

IV SOLIDS FORMATION

A. Prill Towers, process reference numbers 17 and 36

Each tower is 30' x 30' x 170'. When both process are being run under normal conditions total inlet and outlet air, to the system is 670,000 acfm. Five fans at an elevation of 170 feet emit 300,000 acfm at 108^{O}F. Four fans at the same elevation emit 240,000 acfm at 88^{O}F. Three fans at ground elevation direct 130,000 acfm at 115^{O}F through a H-E Brinks Mist Eliminator.

[redacted] The feed concentration is 96.5 percent. Temperature is maintained at 305^{O}F, and pressure at atmospheric.

The high density solution is fed at 356^{O}F [redacted] The ammonia nitrate feed is 97.7 percent ammonium nitrate, 2.1 percent $MgNO_3$ and 0.2 percent water. Pressure is maintained at atmospheric.

A. Prill Towers (Cont'd)

Head tanks are maintained at a constant head to produce uniform prills. This is accomplished by recycling overflow back to each process respective process tank.

The ammonium nitrate prills exit the tower bottom on a belt conveyor, are dumped through a "scalping" screen which removes large agglomerated lumps, and deposited on another belt conveyor which delivers the prills to the rotary kiln dryers and/or coolers.

Water flashes off the low density prill to give a prill with 2.5 percent moisture and a temperature of 170^{O}F exit the tower. Approximately 36,000 lb/hr of low density prills are prilled at 75 percent of full capacity.

High density prills have the same composition exit the tower as in the head tank, ie. 2.1 percent $MgNO_3$ and o.2 percent water.

A. Prill Towers (Cont'd)

Prills exit the tower [redacted] and have a temperature of about 185°F.

The pH is continuously monitored in each head tank. Gaseous ammonia is dissolved in the melt to maintain control of process. Each head tank monitored for temperature with automatic steam flow used to control. Prill temperature is monitored regularly in order to maintain control.

Uncontrolled emissions from the prill tower were measured about two years ago. At typical production rates now encountered a total of 450 lb/hr ammonia nitrate is a good estimate for uncontrolled emissions. NH_3 and NO_x emissions are small and unknown.

Each tower is equipped with a CFCA cone. Each cone annulus is at a 90 foot elevation and has a 20 foot diameter. The cones continue up to 14.3 foot diameter at the 170 foot elevation (spray nozzle height). The cones were installed in 1975. Both towers have an air flow of about 120,000 acfm through the cones. The high density tower has a total air flow of 365,000 acfm while the low density tower has a total air flow of 305,000 acfm.

A. Prill Towers (Cont'd)

Air bypasses the high density cone at a rate of 300,000 acfm and the low density cone at a rate of 240,000 acfm. The temperature of the two gas streams are 110^{O}F and 90^{O}F respectively although variations are experienced dependent upon embient conditions. Loading is around 37 lb/hr on the high density side and 27 lb/hr on the low density side. Particle size analyses taken in March and April of 1978 are shown below:

High Density		Low Density	
Particle Size Range (microns)	Number %	Particle Size Range (microns)	Number %
2.36-4.72	39.7	20-40	.8
4.72-9.44	23.7	40-80	30.0
9.44-18.88	13.6	80-160	36.6
18.88-37.76	22.6	160-320	21.4
37-76 75.52	.4	320	11.1
	100.0		100.0

Emmissions are controlled through a common H-C Brinks Mist Eliminator, control reference letter N.

V. PREDRYERS/DRYERS/COOLERS, process reference numbers 18, 19, 20, 38, 39, and 40.

There are six countercurrent rotary kilns, all of similiar construction, manufactured by General American Transportation Corporation - Louisville used for predrying, drying and cooling nitrate prills. Each was desighned for 42,000 lb/hr of low density prills under standard conditions. Residence time for solids is about 10 minutes.

Heating or cooling is accomplished by ducting inlet air across either steam coils or chill water coils. Listed below is a set of typical data for the kilns.

		AMMONIA NITRATE				AIR			
		Temp. (^oF)		Moisture (%)		Flow Rate (acfm)		Temp. (^oF)	
(High Density)									
		In	Out	In	Out	In	Out	In	Out
Predryers	#38	235	230	.20	.20	32,060	32,600	90	100
Dryer	#34	230	184	.20	.20	32,100	38,300	90	196
Cooler	#40	184	137	.20	.24	32,100	35,400	65	151
(Low Density)									
Predryer	#18	162	159	2.5	1.5	31,200	35,800	145	161
Dryer	#19	159	142	1.5	0.3	33,700	37,200	135	139
Cooler	#20	142	95	0.3	0.15	31,200	32,700	85	111

V: Predryers, Dryers, Coolers (Cont'd)

Operating parameters monitored are prill temperatures and moisture exit the high density cooler and each low density kiln $MgNO_3$ content and pH of high density prills exit the cooler are also monitored. Predryer and Dryer temperatures are continuously recorded on both ammonium nitrate trains. Steam flow and chill water flow to coils are used to control the process parameters listed above. High density pH is controlled by opening up ammonia gas to the head tank in the prill tower.

Extremely high prill temperatures in the drying stage will cause greater dust emissions. Thermal shock, caused by large temperature differences between prills and air, will cause prill breakage due to moisture escaping too fast.

The uncontrolled emission rates from each unit are unknown. The air exhaust from each rotary kiln is ducted to separate Pease Anthony scrubbers, control reference letters D, E, F, K, L and M.

VI. COATING, PROCESS reference number 25

A Kaolin clay containing a surfactant about 3 percent by weight, is received at the plant in 50 pound bags. The methods of application, storage and receiving are explained earlier in this report.

VI. Coating, Process (Cont'd)

Uncontrolled emission rates from coating storage, handling, and application are unknown.

The emission control technique used for dusting is to collect all dust emitted from the clay section in filter bags, control reference letter I and J.

VII. CONTROL EQUIPMENT

A. Wet scrubbers, control reference letters D, E, F, K, L, and M.

Each of six identical cylindrical scrubbers manufactured by Pease-Anthony corp. are used to independently clean the air ducted from the six rotary kilns, reference numbers 18, 19, 20, 38, 39 and 40. The model number of the Pease Anthony's is unknown . They were installed in 1953 before the plant began operations.

Flow rates and temperatures to the scrubbers are given earlier. Scrubber D can handle about 2000 lb/hr of ammonium nitrate dust sized 95 percent above 10 microns. Actual loadings are unknown. Scrubbers are at least 95 percent efficient with all loadings considerably less to the remainder of the scrubbers than to scrubber D. Pressure drop across each scrubber is 165 inches of water. Outlet temperature is around $100^{\circ}F$ from each scrubber.

Contaminated air enters tangentially at the top of the unit and cleaned air exits tangentially from the bottom. The stack exits are vertical. There is a Christmas tree arangement of 36 nozzles down the center of the unit which spray the walls of the cylinder. Spray liquor is collected in a trough around the circumference of the cylinder near its bottom and from the bottom of the unit itself and flows into one of two solution tanks. Each tank serves as makeup for three scrubbers. Scrubber liquor is initially a low concentration, about 20 percent ammonium nitrate solution from the cooling tower water. The liquor is used in the scrubber until the concentration reaches 45 percent. Each scrubber uses 75 gpm of solution giving a liquid-to-gas ratio of about 1 gallon per 900 cubic feet. Liquid pressure at the nozzles is 45 psig. The nozzles are Spraying Systems "Whirljet" nozzles, Model 138 Boss No. 8.

Scrubber concentration is monitored regularly and maintained between 30 and 50 percent ammonium nitrate. No data is available for concentration effects on efficiency.

New stacks were recently installed. Each stack height is 10' the dimensions of the outlet area is 4'0" x 3'8". Emissions have not been tested for these units.

B. Mist Eliminators

1. Neutralizers, control reference letters C and G.

   Each neutralizer is fitted with a Peerless single bank top outlet mist extractor. Each is designed to handle 10,200 lbs/hr of steam with a minimum liquid carry-over of .05 percent by weight of the vapor.

   Pertinent characteristics of the vapors are impossible to determine as eliminator was welded inside neutralizer during original construction. However testing shows that at typical rates about 6500 acfm at 288^{o}F leaves the mist eliminator. Entrained in the 14,000 lb/hr of steam is about 220 lb/hr ammonia and less than 2 lb/hr of ammonium nitrate.

   Information concerning eliminator construction and design is missing.

2. Brinks Mist Eliminator, Control reference letter N

   An Enviro-Chem H.E. Brinks unit was installed in 1974. This unit controls emissions associated with both prill towers, reference numbers 17 and 36.

B. Mist Eliminators (Cont'd)

Air temperatures exit the cones have been in the range of 190°F and 150°F for the high and low density towers respectively. Temperatures inside the cone are not measurable at this time.

Approximately 120,000 acfm of air is pulled through each CFCA cone. 54 percent of this air is sent to the Brinks. The remainder is cooled and then recycled to the bottom of the two cones. Of the fresh air being pulled in at the bottom of the towers 19 percent is pulled through the cone along with the cooled recycled air mentioned above. The temperature of the recycled air is about 80-90°F. CFCA cone dimensions are given earlier in this report.

Paritculate rates and particl size distribution to the Brinks have never been determined. The temperature of the 130,000 acfm of air to the Brinks is about 170°F. Total pressure drop across the Brinks is 7 inches of water. The Brinks emits to atmosphere less than 1 lb/hr of ammonium nitrate particles less than 3 microns.

B.Mist Elimination(Cont'd)

The prill tower exhaust air stream enters the bottom of the Brinks unit and passes upward through an S-C mist pad. This pad is continuously irrigated from the top and bottom by sprays of cooling tower water which has been pH adjusted using 56 percent HNO_3. These sprays are a closed loop that is blown-down when the ammonium nitrate solution reaches 15 to 20 percent. The S-C Pad is irrigated by 14 nozzles at 400 gpm and 35 psig. Seven nozzles above pad are Spraying Systems 3/4-in. H71WSQ with 11/64-in. orifices. Seven nozzles below pad are Spraying Systems 1½-in. H290WSQ with 5/16-in. orifices. The S-C mist pad is 27'11" x 29'10½" x 11¾". Total surface area is 1668 square feet.

After passing through the S-C pad, the air passes through a fogged chamber through the H-E Brinks elements to the atmosphere.

There are 160 fogging nozzles rated at 9.8 gph each at 120 psig. Fog nozzles are Spraying System ¼ M8.

B. Mist Elimination (Cont'd)

There are 120 H-E Brinks elements. Each element is 10 ft. long with a 24-in 0.0 and 18-in. I.D. There is no stack exit the H-E elements.

Attached to this report is a test report with discription included of test method for tower emissions.

3. York Mesh Separator reference letter O

A 304 SS steel mesh pad was installed in 1977 to reduce emissions from the remelt concentrator, reference number 25, installed at the same time. The manufacturer is Otto H. York Company, Inc. The pad is York style mesh 931 and is 6'5 5/8" in diameter and 6" thick.

No measurements have been made prior to or after the pad. Temperatures are probably 212^{O}F. Pressure drop is unknown. Design rate of equipment is 75,000 lb/hr of 20 percent ammonium nitrate feed. Unit is never more than 20 percent loaded based on design.

Stack height is 4 feet after a 90^{O} elbow. The diameter is 2 feet.

C. Bag Filter, control reference letters H, I, and J.

There are three separate baghouses for the clay coating. W. W. SlY is the manufacturer of three - Model No.s 26, 34 and 28. Dust is collected off the rotary drum mixer, reference number 25. Relevant design data is shown below. Actual testing of these units has never been performed. Bag material is cotton sateen. Bag replacement period is unknown.

SLY BAGHOUSES

No.	Model No.	Cloth area (Sq.ft.)	No. of bags	design air flow(acfm)	A/C ratio
1	26	1,232	100	2,587	2.10
2	34	1,496	120	3,140	2.10
3	28	1,848	150	3,890	2.11

Pressure drop across bags is 2 to 3 inches of water. Bag cleaning is by mechanical shaking and is manually actuated. The stack off Baghouse No. 2 is rectangular with dimensions of 15in. x 15in. It is approximately 6 ft. in length and is ducted horizontally out of the building. Baghouse No. 3 has a circular stack, 15 in. in diameter, and is approximately 6 ft. in length. This stack is ducted vertically out of the building.

C. Bag Filter (Cont'd)

Baghouse No. 1 has a 15 in. diameter duct, 10 foot in length with a horizontal exit from the building.

D. Neutralizer Vapor Condensers, control reference letters A and B.

Each neutralizer's overheads is almost totally condensed. Some venting is allowed to maintain pressure in neutralizers, reference numbers 7 and 8, below 5 psig. The vertical condensers are Graham 16 x 14 fixed tube sheet units. Each contains 180 - 3/4 in. O.D. #16 BWG 14'-0" long tubes. Each is designed to condense 10,200 lbs/hr of water vapor in at 266°F., 14.7 psig, out at 120°F with a maximum pressure drop of ½ psi.

Cooling water enters the tubes at 90°F and exits at 90°F. All controls on cooling water are manual.

Typical flow rates and temperatures are stated earlier in this report.

VIII. CONSTRUCTION PLANS

No plans or construction for new ammonium nitrate facilities or air pollution control systems are at this time being considered or implemented.

IX MODIFICATION/RECONSTRUCTION

No [redacted] plans exist by the company for modification or reconstruction of the existing ammonium nitrate facilities within the next 5 years, [redacted]

X. GENERAL OPERATION

A. Production Equipment

Choice of most processing equipment was made 26 years ago by Lion Oil Company. Only speculation can be made as to the exact weighting these choices were dependent upon factors such as market, costs, emissions, product specifications, etc. However, prilling instead of granulation was probably adopted due to the high humidity in the area and the increased hygroscopic tendencies of granulated over prilled nitrate. This is substantiated by the critical process involved in Luling to insure a marketable low density product.

No knowledge of types and/or amounts of pollutants emitted to the atmosphere by the different solution formation and concentration schemes used in the U.S. is held by Monsanto. Technology is not specific enough to predict whether a 99+ percent ammonia nitrate melt or a 95 percent ammonia nitrate melt would result in greater or lesser emissions during solution forming and concentration steps.

A. Production Equipment (Cont'd)

Emissions are probably effected to some unknown degree, by the number and type of solution forming and concentration steps used to produce a 99+ percent ammonia nitrate melt.

No quantitative figures are on hand to determine between various emissions potential. Speculation would stress low density small particulate coatings as greater potentially in their emissions. Significant differences in amount of coating is possible with diffferent types of coatings on the market and humidity differences in production areas; however, drastic differences are limited by consumer demands for guarranteed nitrogen in ammonium nitrate.

B. Emission Control Equipment

All materials removed by emission control equipment are either recycled back into the process equipment they emanated from, to other pieces of process equipment or emission control equipment, or to cooling tower makeup. Ultimately once collected all materials are concentrated in the remelt concentrator for high density prill production. An exception to this is the dust collected from the clay coating section is always returned to the clay hopper.

B. Emission Control Equipment (Cont'd)

Periodic measurement of all scrubber solutions are used to check operation of Pease-Anthony's and Brinks. Pressure drop across Brinks is also measured to insure proper efficiency.

All emissions control devices, except the Brinks, were chosen during initial plant design by Lion Oil Company and Chenical Construction Company. Available technical knowledge was probably used in determining each control device. The Brinks were chosen due to their ability to eliminate 100 percent of tower emissions greater than 3 microns.

Ammonia nitrate facilities at Luling do not now produce or use urea. The effect on emissions by ammonia nitrate equipment on urea production is unknown by plant personnel.

XI MAINTENANCE

A. Production Equipment

The scope of the question concerning periodic maintenance required to maintain proper operation of "each" piece of process equipment is beyond the reach of this report. The most troublesome piece of process equipment with respect to breakdowns, malfunctions, upsets, etc.

A. Production Equipment (Cont'd)

Periodic replacement of pieces of process equipment in total is seldom if ever done. No single piece is noteworthy of comment.

Breakdowns, malfunctions and upsets normally experienced at the facilities are in chains, sprockets, moisture problems, gear boxes, etc.

B. Emission Control Equipment

The five fans at the bottom of the prill towers require considerable maintanence. Operation personnel clean the fans every 4 hours to eliminate dust loading on fans. Dust loading and resultant vibrations have caused excessive maintenance costs in the past. The Brinks are checked periodically every 2 hours for plugging.

Periodic maintenance is not performed on the other emissions control equipment. Maintenance is performed on a as needed basis.

XII ENERGY CONSUMPTION

Total energy consumption is calculated from electricity, 175 pound steam and 600 pound steam usage for the first three-quarters of 1978. Average operating time is used to calculate a typical load to be about 146,000 hp. Total peak load for air pollution control devices is 1400 hp. The total energy consumption for the facility excluding pollution control equipment is therefore 143,600 hp. Included in the average load is approximately 1014 MMSCF of natural gas is used per year to produce the necessary steam. The energy consumption for each pollution control system is shown below.

Prill Tower-Brinks	1030 hp.
Pease Anthony Scrubbers	320 hp.
Neutralizer Vapor Condensers	40 hp.
Baghouses	10 hp.
Total	1400 hp.

INFORMATION

On the following page information requested for each air pollution control system is provided. Life expectancy for all equipment is listed as 10 years.

Control Cost Information