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December 15, 1978

AMMONIUM NITRATE  
AP-42 Section 6.8  
Reference Number  
136

Mr. Don R. Goodwin  
Director - Emission Standards  
and Engineering Division  
USEPA - Office of Air Quality  
Planning and Standards  
Research Triangle Park,  
North Carolina 27711

Dear Mr. Goodwin:

Re: Ammonium Nitrate Request for Information

Pursuant to your request, we have enclosed our responses to EPA's ammonium nitrate request for information. The reports are from our plants in Donaldsonville, Louisiana; Fremont, Nebraska; Terre Haute, Indiana; Tunis, North Carolina and Harrison, Tennessee.

I would like to call your attention to two of the reports. Due to slow mail deliveries the Donaldsonville and the Chattanooga reports were telecopied to our offices and we are transmitting photocopies to you. As soon as the originals arrive we will forward them to your office.

On some questions and in all of the reports there are references to a meeting held on November 13, 1978 with the EPA. For your information CF representatives met with Ken Durkee and Eric Noble and other EPA staff to discuss some of the problems we had with answering the questions. On questions where procedures for answering were changed this note will appear.

Also, all confidential information is at the end of the report in a section marked "Confidential Information."

This should clarify any questions you may have regarding the reports.

Sincerely,

  
John A. Lawrence  
Vice President - Manufacturing  
Northern Region

JAL/nd  
Enclosures



REQUEST FOR INFORMATION  
AMMONIUM NITRATE PRODUCTION

I. GENERAL

1. Figure I, attached, is a flow diagram for the ammonium nitrate plant at the Fremont Nitrogen Complex.
2. Ammonium nitrate is produced by reaction of 56% nitric acid with ammonia vapor from urea plant off-gas or vaporized virgin ammonia. Our AN neutralizer (1) is also fed an acidic (nitric acid/AN) solution from the nitric acid plant NO<sub>x</sub> abatement system.

AN produced is used to make 32% UAN or AAN solutions; no solid (prilled or granulated) product is produced. The bulk of our 83% AN is combined with the product solution from our urea plant to make 32% UAN in a (pipe) mixer. Some nitric acid is added to control pH of the UAN solution. AAN solution is made by blending various concentrations of AN with virgin ammonia in a blend tank (4) under pressure. Neither UAN or AAN produce any emissions during their manufacture under normal mixing conditions. The AN used to blend AAN is concentrated from 83% AN neutralizer product either by evaporating water from the solution by means of (A) steam coil in the 95% storage tank (3) holding the solution or (B) using an air swept evaporator (concentrator) (2) which can continuously produce a 93% AN solution. While the latter method is faster, it is not used often (for purposes of energy conservation); the solution is usually concentrated in the 95% AN storage tank without air sweep.

Typical product specifications are:

<u>Product</u>	<u>32% UAN</u>	<u>28% UAN</u>	<u>41-W</u>	<u>410-S</u>
% NH <sub>3</sub>	trace	trace	26.3 +	22.2
% AN	45.0 - 48.44	39 - 42.39	55.5 +	65.0
% Urea	34.9 - 32.25	31 - 28.32	0.0	0.0
% Water	20.06- 19.31	30 - 29.39	18.2 +	12.8
ppm Inhibitor	1000	1000	1000-1500	?
% Total N	32.0	28.0	41.0	41.0
Vap. Press. psig	0	0	17	11

<u>Product</u>	<u>47.1%</u>	<u>37A%</u>	<u>37M%</u>
% NH <sub>3</sub>	30.1 ±	15.8 ±	19.4 ±
% AN	64.0 ±	58.5 ±	60.0 ±
% Urea	0.0	7.7 ±	0.0
% Water	5.9 ±	18.0 ±	20.6 ±
ppm Inhibitor	1000-1500	1000-1500	1000-1500
% Total N	47.1	37.0	37.0
Vap. Press. psig	27	4	3

3. Average Daily Production T/D, based on annual production figures.

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(See Page 9)

4. Design Capacity - Design capacity has not changed with time.

AN - 112.5 T/D  
 32% UAN - 170.0 T/D  
 41-C )  
 47.1% )  
 37A ) - approximately 125 T/D  
 37B )

5. Operating days for AN plant (based on recorded hours downtime):

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(See Page 9)

Operating days for 32% UAN:

CONFIDENTIAL INFORMATION

(See Page 9)

Operating days for AAN solutions, blending 41-C%, 47.1%,  
37A%, 37B%:

1975 )  
1976 ) Data not available - process is batch operation.  
1977 )

6. Date AN plant first operated - January 1966.
7. Process flow rates for the AN and 32% UAN production are based on 83% AN and 32% UAN storage tank level changes. UAN level change gives urea production plus nitrate used to make UAN. This coupled with the 83% AN storage level change yields AN produced. Solution blends are recorded as batch weights (AN used for solution blends is considered in calculating AN production).

## II. SOLUTION PRODUCTION

A. Neutralizer - Process reference number for neutralizer  
① , flow diagram attached.

1. We have a C & I atmospheric pressure neutralizer with no internal recycle. The neutralizer is fed 56% nitric acid at about 18 gpm, urea off-gas (unreacted ammonia content, roughly 60%), 1 gpm solution from nitric acid NO<sub>x</sub> abatement system, and vaporized ammonia. The nitric acid feed rate is controlled by the 83% AN solution product pH as determined by an electronic (continuously controlling) meter. The neutralizer operates at 265° - 275°F. Solution pH is 4.0 - 4.5.
2. Nitrate solution is produced at 83% AN concentration at 270°F., atmospheric pressure. Average production rate is about 8,000 #/hr. as 83% AN solution. Maximum hourly production is 9,000 #/hr. NH<sub>3</sub> concentration of neutralizer product is 0.0015% free ammonia.
3. Neutralizer stack exhaust flow rates have not been measured; information on emissions is not available.
4. The neutralizer has a demister mesh screen (A) at the vessel outlet to the vent stack.
5. We record the neutralizer solution pH. pH is also used to control the process.

- B. Stengel Reactor - does not apply. We have none.
- III. CONCENTRATOR -- Does not apply. We have none which supplies solution to a prill tower.
- III A. CONCENTRATOR, process Reference Numbers ② and ③ -- used infrequently to make AAN solutions.
1. Description: Kettle type, Missouri Boiler and Tank Company; operating pressure, atmospheric; operating temperature, 270°F.; design capacity, approximately 1,000 #/hr. evaporated water.
  2. Approximate Composition: Inlet AN concentration 83%, Water 17%; Ammonia concentration under 0.5%.  
Production Rate - 7,000 # 100% AN/hr.
  3. Off Gas Steam Rate: Not measured. No information available.
  4. No additives used.
  5. No emission rates available.
  6. None.
  7. Process vents to atmosphere; no sample ports available. Not easily accessible.
  8. Check concentration of product AN to have it up to strength. We monitor level in concentrator and solution temperature exit concentrator.
- IV. SOLIDS FORMATION - does not apply, we have none.
- V. PREDRYERS/DRYERS/COOLERS - does not apply, we have none.
- VI. COATING - does not apply, we have none.
- VII. CONTROL EQUIPMENT
- A. Wet Scrubber - does not apply, we have none.
- B. Mist Eliminator ①

1. Mist Eliminator is stainless steel York Demister mesh installed inside the top of the neutralizer. It was installed with the neutralizer originally at plant start-up, January 1966.
2. Neutralizer ①
3. Does not apply.
4. Information not available.
5. Demister is 1'7" diameter and 6" thick, held in place by support bars -- packing density is unknown. Mesh is not irrigated with spray nozzles.
6. Does not apply.
7. Information not available.
8. Top of stack is 50' above grade; the stack is 14" diameter.

C. Bag Filter - does not apply.

VIII. Section not defined or included.

IX. Section not defined or included.

X. ENERGY CONSUMPTION

1. Omit, per 11-13-78 meeting with EPA.
2. Energy Consumption for Demister Mesh, while unmeasured, is considered negligible.

XI. COST INFORMATION - Does not apply. We have none of the previously described control devices.

XII. CONSTRUCTION PLANS - No immediate plans for construction of any ammonium nitrate or air pollution control systems.

XIII. MODIFICATION/RECONSTRUCTION - We have no plan to do the above within five years.

XIV. GENERAL OPERATION - We offer this requested information to EPA and their contractor, realizing that they do not have expertise in this area. In a spirit of cooperation, comments follow:

A. Production Equipment

1. Neutralizer pH meter requires periodic maintenance. The nitric acid sparger in the neutralizer is changed out periodically as needed.
2. The neutralizer pH meter controller is sometimes subject to malfunction.
3. None.
4. The neutralizer pH meter malfunctions on occasion. Periodic replacement of the nitric acid sparger in the neutralizer is required.
5. I speculate the (1965 built) plant considered market, costs, emissions, and product specifications. The relative importance of each factor, I do not know.
6. Unknown.
7. Probably, yes.
8. No comment. We do not have this type equipment.
9. No comment. We do not have this type equipment.
10. No comment. We do not have this type equipment.
11. No comment. We do not have this type equipment.

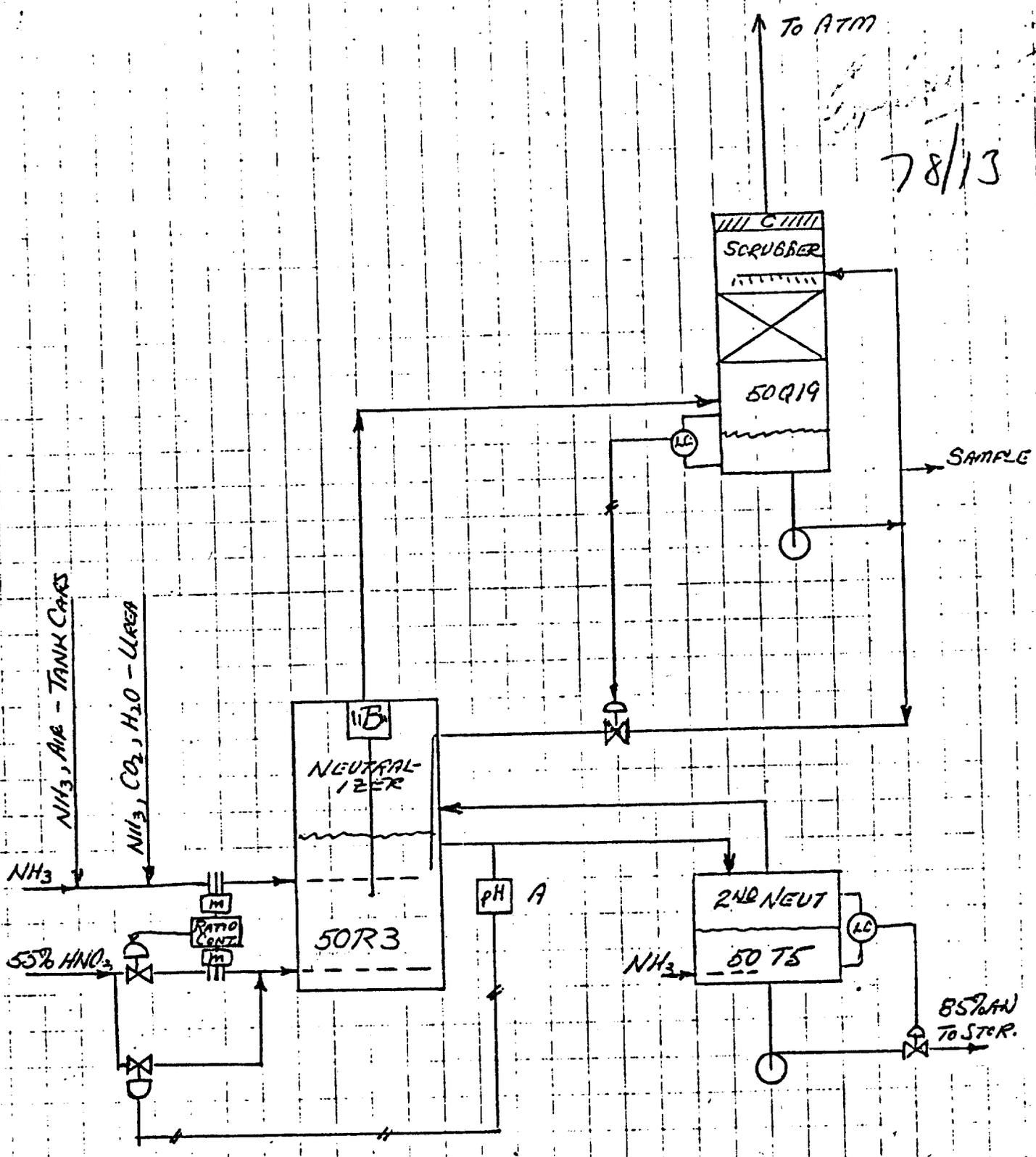
B. Emission Control Equipment - Does not apply.



Richard W. Johansen  
Assistant Manager, Operations

RWJ:drs  
11-29-78  
Attach.

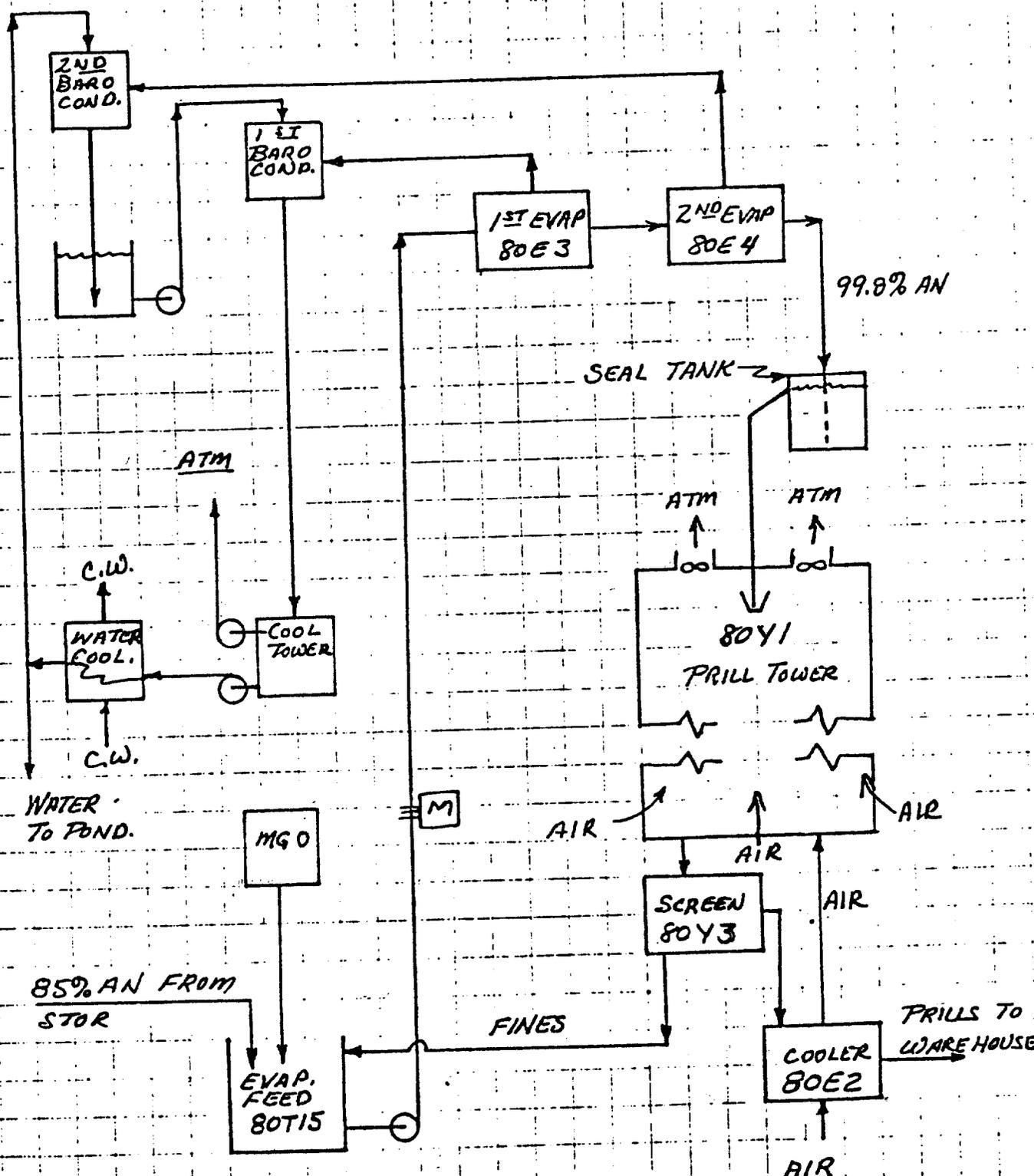




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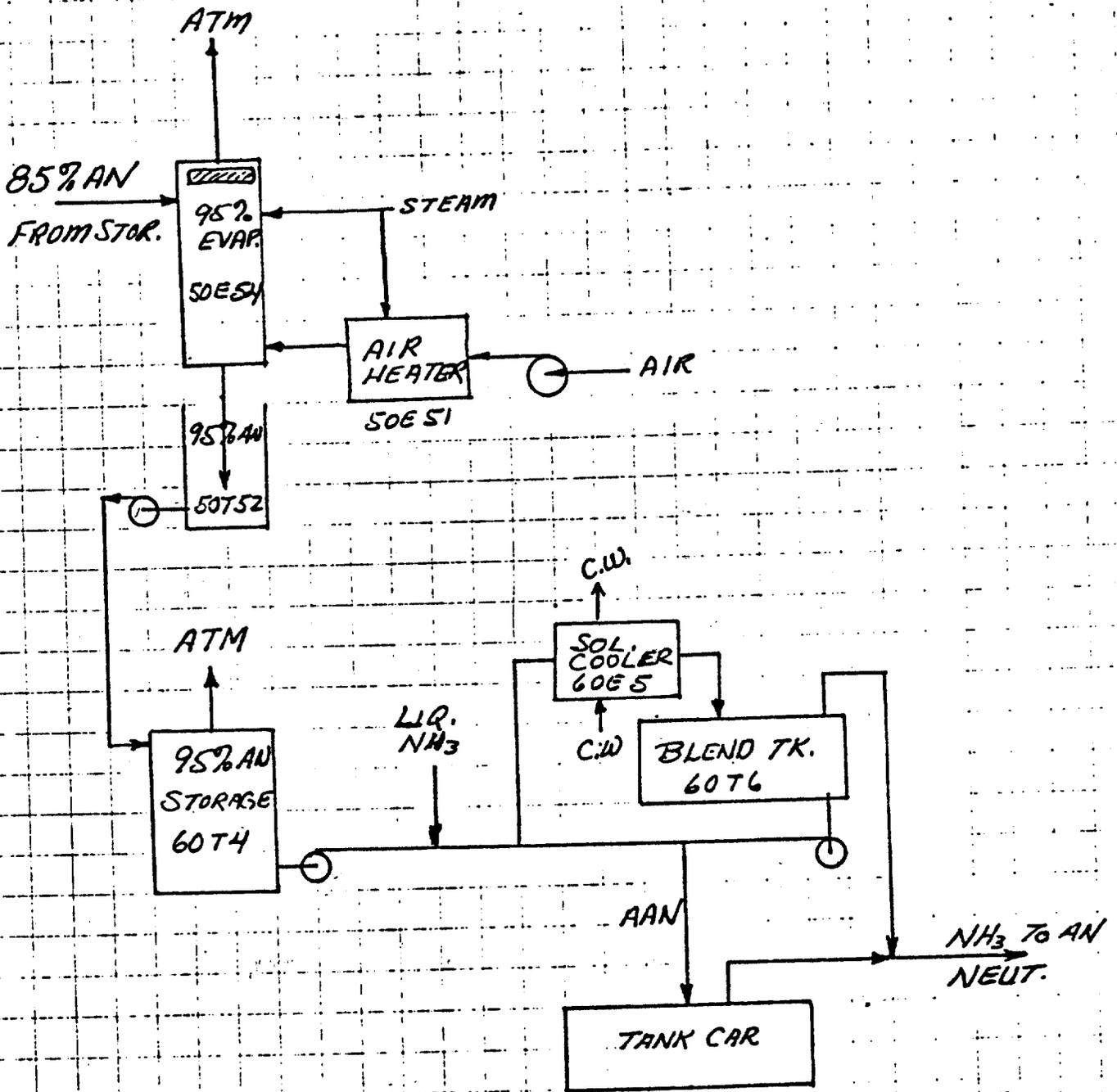
C F INDUSTRIES  
 N.C. NITROGEN COMPLEX  
 $\text{NH}_4\text{NO}_3$  NEUTRALIZER

R.H.S. 11-30-78



C.F. INDUSTRIES INC.  
 N.C. NITROGEN COMPLEX  
 NH<sub>4</sub> NO<sub>3</sub> PRILL PLANT.

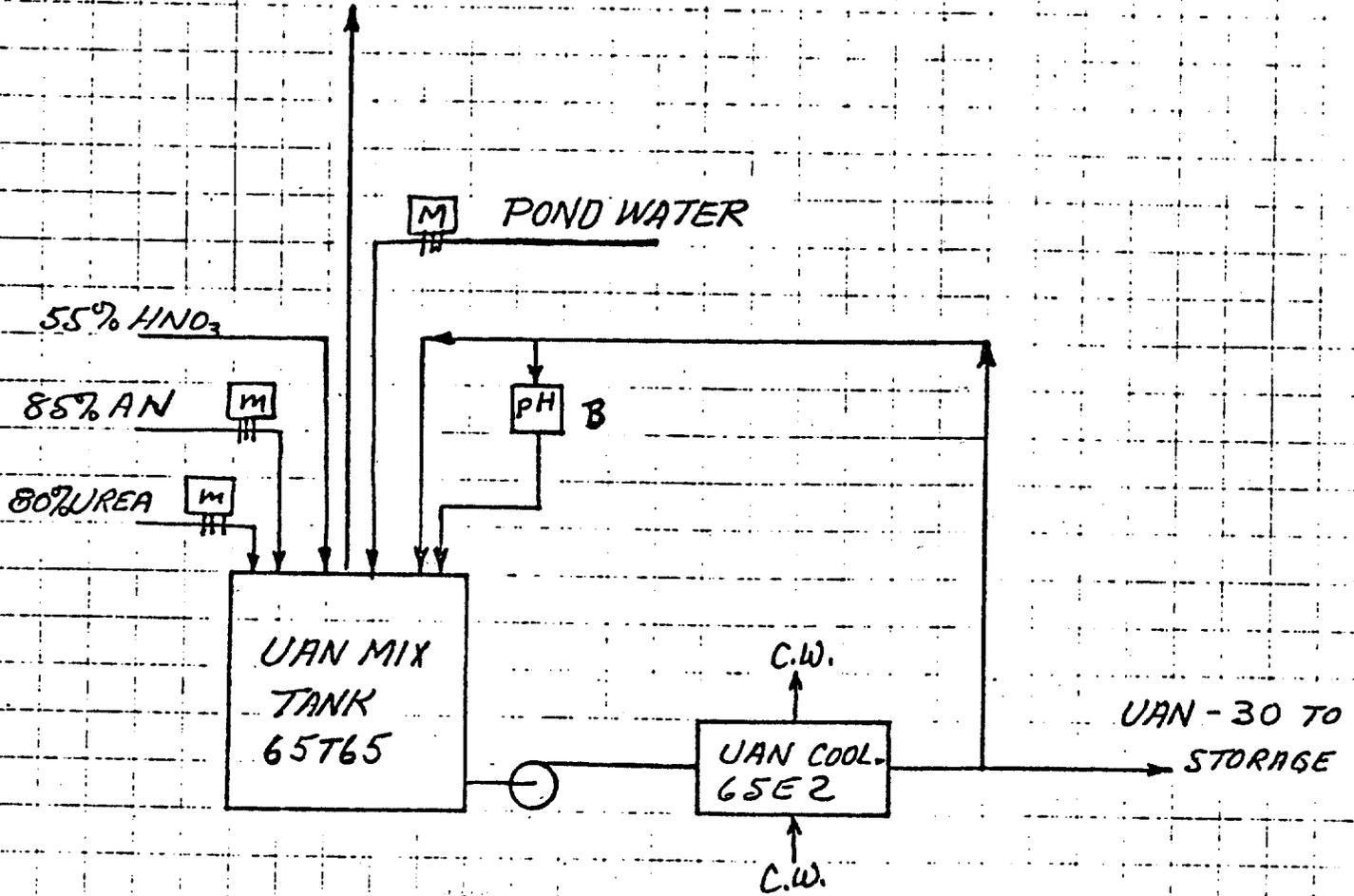
RAK, 10-30-78



C.F. INDUSTRIES INC.  
 N.C. NITROGEN COMPLEX  
 AAN BLEND PLANT

R.H.S. 11-15-78

VENT TO  
PRILL PLANT COOL. TOWER



C.F. INDUSTRIES INC.  
No. 6 NITROGEN COMPLEX  
UAN-30 MIX. PLANT.

R.H.S. 11-14-75

12-13, 14 & 15-77

AN NEUTRALIZER TEST

SUMMARY

AN PRODUCT Tpd.	TO SCRUBBER			FROM THE SCRUBBER			EMISSIONS # AN/ Tpd		
	P.H.	#NH <sub>3</sub> HR	#HNO <sub>3</sub> HR	#AN HR	P.H.	#NH <sub>3</sub> HR		#HNO <sub>3</sub> HR	# AN/ HR
547	2.5	0	3.5	8.4	2.8	0	2.5	8.2	0.36
723	1.8	0	42.1	11.5	2.9	0	2.8	6.3	0.21
1292	1.8	0	82.5	45.7	2.9	0	6.0	4.2	0.26

NOTE: THE DRAIN FROM NEUT. INTERNAL SEPARATOR APPEARS TO BE BROKEN OFF.

RPAH.

EPA REQUESTED INFORMATION  
AMMONIUM NITRATE PRODUCTION.

I. GENERAL

1. Process flow diagrams are attached for the AN Neutralizer, AN Prill Plant, UAN 30 Plant, and AAN Solutions Plant.

2. Process Description:

- a. Ammonium Nitrate Neutralizer - Ammonia from the vaporizer or from Urea Plant gas effluent is bubbled through 50-56% nitric acid to make ammonium nitrate. This solution strength varies from 78 to 89% AN. The ammonium nitrate solution is used to make prills, UAN 30 or several different AAN solutions. (85% AN at 6.0 to 5.5 pH)
- b. UAN 30 - The ammonium nitrate neutralizer effluent liquor is blended with urea-water solution and pond water to make UAN 30, containing 30% nitrogen. Nitric acid is blended in to adjust the free ammonia content. The solution cooled by water in heat exchangers and pumped to storage for loading into tank cars or trucks. (42.2% AN, 32.7% Urea, .1% NH<sub>3</sub>, 25% Water)
- c. AN Prills - The 85% AN solution is pumped through two steam heated vacuum evaporators. Exit strength is 99.3% AN and .5% MgO. Melt is butted to pH of 6.8 to 7.2 with NH<sub>3</sub> gas. This melt flows by gravity through a rotating prill bucket into a prill tower. Here the prills are formed and cooled by a counter current stream of air. The prills are screened, cooled by refrigerated air, and loaded into hopper cars or stored in a bulk warehouse. From the warehouse, prills are loaded into bulk cars or shipped out in 50 lb. bags.

Typical Analysis	MgO AN H <sub>2</sub> O	.5% 99.0% .5%	by U.S. Steel Method
------------------	-------------------------------	---------------------	----------------------

- d. AAN Solution - The 85% AN solution is concentrated to 95% AN in a falling film evaporator and pumped to a holding tank. The solution is pumped to a blend tank through a water cooled heat exchanger. Liquid ammonia is blended ahead of the cooler. The solution is brought to the desired composition by weight, cooled to 104°F and sampled. When proper analysis is obtained, the solution is loaded into tank cars. The tank cars are vented through the neutralizer while loading.  
Typical Analysis - AN - 69%, NH<sub>3</sub> - 25%, H<sub>2</sub>O - 6%.

3. Average daily production while running was as follows:

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(See Page 14)

4. Design capacity for each product did not change.
- |             |               |
|-------------|---------------|
| AN Solution | 1400 tons/day |
| Hard Prills | 1000 tons/day |
| UAN-30      | 2000 tons/day |
| AAN         | 300 tons/day  |
5. Number of days each production line in:

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(See Page 14)

6. Date Plants first operated:
- |             |      |
|-------------|------|
| AN Solution | 1969 |
| Hard Prills | 1973 |
| UAN-30      | 1974 |
| AAN         | 1969 |
7. Where process flows are measured: We have no way of knowing how accurate these meters are, because that knowledge has not been of importance to this plant.
- a. AN Neutralizer  
Ammonia flows are measured ahead of the first and second stage neutralizers ( $\pm 2.5\%$  accuracy estimated).  
Acid flow is measured ahead of the first stage neutralizer ( $\pm 2.5\%$  accuracy estimated).
  - b. Hard Prills  
AN solution flow is measured inlet the first stage evaporator.  
The accuracy is unknown.
  - c. UAN-30  
The AN solution is metered ahead of the blend tank.  
(Accuracy Unknown)  
The urea solution is metered ahead of the blend tank.  
(Accuracy Unknown)
  - d. AAN  
There are no flow meters in this system. All additions are made by weigh scales.

II A - NEUTRALIZERS - No. 50R3

1. Neutralizer Description:

The Neutralizer is the tank type with 5 acid spargers and 5  $\text{NH}_3$  spargers in the bottom. The vessel was manufactured by Metal Arts Co. in Houston, Texas and modified by plant people to 1400 TPD capacity. The neutralizer is rated at 15 PSIG. In the top of the neutralizer there is an Anderson type veined mist eliminator.

The second stage neutralizer (50T5) is a tank with an ammonia sparger extended below four feet of liquor to the tank bottom. This vessel vents to the first stage neutralizer.

Design Feed Rates Are:

Gas: 470 TPD (64%  $\text{NH}_3$ ) @ 140°F on 300 TPD (100%  $\text{NH}_3$ ) @ 180°F

Liquid:

Acid 2010 TPD (55%  $\text{HNO}_3$ ) @ 120°F to ambient

Water 6 TPD to 24 TPD @ 60°F

The neutralizer runs under 2 to 5 PSIG

The Neutralizer pH - 1st stage 2.5 to 3.5

The Neutralizer pH - 2nd stage 5.5 to 6.0

2. Ammonium Nitrate Product

Flow (100% AN) \*83 TPH max. 25 TPH avg.

Temperature 260° to 290°

Pressure 2 to 7 PSIG

Concentration 78 to 89% AN

$\text{NH}_3$  pH 6.0 or 0.0085% free  $\text{NH}_3$

\* This occurs for short periods of time (15 to 30 min.) during upset conditions.

3. Steam exhaust rate is 700 TPD. This carries with it 0.6 TPD of AN and one TPD of  $\text{HNO}_3$  at 1400 TPD AN rate to the scrubber.

- a. To the atmosphere is 706 to 724 TPD of steam carrying with it 400 to 800 #/day of AN and 144 #/day of  $\text{HNO}_3$  or 300 to 800 #/day of  $\text{NH}_3$ .

4. Control technique:

- a. The primary neutralizer liquor is kept between 2.5 and 3.5 pH  
(A) The unit that controls this is "A" on 50R3.
- b. The liquor from the second stage neutralizer is kept at 6.0 to 5.5 pH. From one to four GPM of clean water is added to the scrubber to keep the AN strength around 25%. See section VII (50Q19).

5. Operating Parameters:

The primary neutralizer pH is recorded continuously on a 50-50 solution of AN in water. The second neutralizer sample is taken every two hours. This pH is kept between 6.0 and 5.5 on a solution of 9 parts water and 1 part 85% AN solution.

### III CONCENTRATOR

A. Solutions Evaporator 50E54

1. This falling film evaporator was made by General American Transportation Corp. for Monsanto. It was bought from a scrap yard and design capacity is unknown. Plant capacity tests indicated 280 TPD of 100% AN from 85% to 95% AN.
2. The AN feed at 85% AN and 6.0 pH is feed at 13.725 TPD. The effluent was 95% AN at 2.5 pH.
3. Off Gas steam is 1.444 tons per hour of steam. Actual measurements of  $\text{NH}_3$  and AN in the off gas steam have never been made. The plume does become invisible in 50 to 100 feet from the stack.
4. No additives are used here.
5. Uncontrolled emission rates are not available as there is no data and the stack is not accessible.
6. There is no emission control. The unit is operated intermittently. There are no plans to operate it in the future.
7. There is one atmospheric vent which is not accessible and has no sample points.
8. There are no controllable parameters except pH of feed. (5.5)

B. Prill Tower Evaporators: 80E 3 & 4

1. This is a dual effect vacuum evaporator made by Norsk Hydro of Norway. Design capacity was 1000 TPD of 100% AN with 83% AN feed concentrated to 0.2% moisture. The melt operating temperature is 365°F at 1 PSIA.
2. In plant operation the feed rate was 781 TPD of 100%  $\text{NH}_4\text{NO}_3$  as 85% AN, 14.5% water and 0.5%  $\text{MgO}$ , .1%  $\text{NH}_3$ .
3. The off gas stream flow rates are unmeasurable. A calculated stream flow in total is 128.6 TPD of water. As the barometric condenser recover all of the ammonia and AN carry-over, there are no atmospheric emissions from the two evaporators.
4. The only additive used is 0.5%  $\text{MgO}$  to the melt. It is added according to U. S. Steel patented system.
5. There are no emissions from this concentrator system. The  $\text{NH}_4\text{NO}_3$ ,  $\text{NH}_3$ ,  $\text{HNO}_3$  and  $\text{NO}_x$  are all dissolved in pond water that ends up in the UAN-30 product.
6. Total capture of all waste products is the emission control technique.
7. The only atmospheric vents are inaccessible for analysis. However, the vented streams are 200 to 300#/hr. of steam for ejectors containing the air used to control vacuum.

8. The pH of the AN melt feeding the evaporators is kept between 5.5 and 6.0 to minimize the loss of nitrogen to the barometric condenser water.

#### IV SOILD FORMATION

##### A. Prill Tower 80Y1

1. The prill tower is made of reinforced concrete, 64 ft. inside diameter and 146 ft. 6 in. tall. Six fans are located at the very top of the prill tower. They discharge 320,000 CFM of air at 120°F. Ambient inlet air flow at the bottom is unknown but is estimated at 270,000 CFM.
2. AN solution feed rate is 790 TPD of .2% moisture AN melt at 365°F and atmospheric pressure.
3. The droplets are formed by a Norsk Hydro made rotating prill bucket with 1000 TPD capacity. The speed of rotation governs the prill size. This prilling mechanism is confidential and gives CF Industries a competitive advantage in the market place because of uniform prill size. Production rate is controlled by feed rate to the AN evaporators.
4. Magnesium oxide is used during prilling as a prill stabilizer.
5. The prills are removed from the base of the tower by a rake that loads a conveyor belt below the tower bottom. The prills are 95% plus 14 mesh and minus 6 mesh. The prill temperature ranges from 240°F to 150°F at the base of the tower. Moisture content is 0.3 to 0.2% by weight.
6. The pH of the prills is held at 6.8 to 7.2 and melt temperature to the prill bucket is kept around 365°F. If prill pH goes much above 7.2 the prills will fracture and particles of AN would go out the fans to fall on the ground inside the plant site. Higher melt temperature would increase AN vapors leaving in the air through the prill tower fans. Melt temperature to the bucket is recorded hourly and prill pH is recorded hourly.
7. There are no places to take adequate samples of the air from the fans; therefore, there is no data concerning  $\text{NH}_4\text{NO}_3$ ,  $\text{NH}_3$  or  $\text{NO}_x$  at the fan discharges.
8. Not applicable
9. The emission control technique is to keep prill pH below 7.2 and melt temperature below 365°F.

##### V COOLER 80E2

1. The cooler was made by Carrier to cool 40 tons per hour of prills from 170°F to 125°F. This unit is a fluidized bed vibrating conveyor where prills are cooled with dehumidified air.

2. Retention Time is 2 minutes.
3. The air to the cooler is chilled with an ammonia refrigeration system. (closed loop)
4. The prill temperature inlet the cooler is 194°F and 3% H<sub>2</sub>O. The prill temperature exit the cooler is 124°F and 3% H<sub>2</sub>O.
5. Prills cooler air flow is 25,000 C.F.M. at 45°F. The air temperature exit cooler is 70°F.
6. There are no operating parameters here that control emissions. All of the air leaving this cooler goes into the base of the prill tower. The particulate matter that drops out here is removed by the rotex screen and returns to the evaporator feed tank as remelt. Prill pH and moisture are monitored at the base of the prill tower.
7. Emissions from the cooler have not been measured, to my knowledge. As the solids are recovered in the prill tower we have not measured particulates in the air stream.
8. There is no emission control technique except product quality. Prill pH is kept below 7.2, moisture below .35% and MgO .5%.

VI COATING : With MgO stablized prills no coating is utilized.

#### VII CONTROL EQUIPMENT

##### A. Wet scrubber, control reference number 50Q19

1. The scrubber has counter current flow through 12 feet of 3 in. porcelain intalox saddles. The circulating liquid enters below a 12 in. York demister pad (50Q19C). The scrubber was built by Bristol Metal Products in 1968 as a co-current scrubber and modified in 1971 to be counter-current.
2. The scrubber controls the atmospheric emissions from the neutralizer (5OR3).
3. The gas stream generally consists of steam, CO<sub>2</sub>, NH<sub>4</sub>NO<sub>3</sub>, NH<sub>3</sub> and/or HNO<sub>3</sub>. The maximum expected gas flow rate is 39,000 ACFM at 1400 TPD, AN Produced. There is not a large amount of data available on this vessel. What is available shows the following range of emissions.
 

NH <sub>3</sub>	1 to 3#/ton of AN
NH <sub>4</sub> NO <sub>3</sub>	.03 to 1.0#/ton of AN

 The particles are molecular in size.  
 The scrubber pressure drop is about 3 PSI.
4. The scrubbing medium, by design, was 60% NH<sub>4</sub>NO<sub>3</sub> in water. In practice the solution is between 10 and 50% NH<sub>4</sub>NO<sub>3</sub>

(25% AN most of the time). The liquid to gas ration, at 1400 TPD AN rate is 18/1 on a weight basis. All of the liquor is recycled except for 1 to 2 GPM pumped to the neutralizer to maintain the scrubber liquor level of 5' 8½" + 7" above the pump suction. The liquor temperature varies from 205 to 215°F.

5. Scrubber liquor pH, temperature and level are monitored hourly by the operator.
  6. Sufficient data is not available to correlate the parameters and collection efficiency.
  7. Attached is a copy of the neutralizer scrubber test report. The test procedure is as follows;
    - a. Pull gas samle from a fixed connection in the stack through two 500 ml. wash bottles of H<sub>2</sub>SO<sub>4</sub> or two of NaOH, a drying tube, a manual flow control valve, a vacuum pump and a wet test meter.
    - b. The two bottles and drying tube are checked for weight gain. The ammonia carry over is determined by acid titration and/or the phenate colorimetric method using an auto analyzer. The ammonium nitrate or HNO<sub>3</sub> is determined by measuring the NO<sub>3</sub> using ferrous sulfate colorimetric method with an auto-analyzer. The non condensibles are calculated from the wet test meter as CO<sub>2</sub>. The stack gas mass is determined by a calculated material balance around the neutralizer and wet scrubber.
- B. Mist Eliminator (50R3-B)
1. It is a vein type mist eliminator with a drain leg. It is of unknown origin and looks like an Anderson unit.
  2. This unit is an intergral part of the neutralizer 50R3 and does not have any identifying number.
  3. Not applicable.
  4. The gas is of unknown compositions but contains NH<sub>4</sub>NO<sub>3</sub>, steam, NH<sub>3</sub> and/or HNO<sub>3</sub>. Flow rate is unmeasurable, temperature is about 230-220°F, and pressure drop is unknown.
  5. Not applicable
  6. Not applicable
  7. Not applicable
  8. This unit vents through the wet scrubber described in (VII-A)

## X ENERGY CONSUMPTION

1. As per an agreement between EPS and CF Industries, Inc. people on Nov. 13, 1978 this question is not answered.
2. The energy consumption in the neutralizer pollution control system is the two electrically driven circulating pumps. Only one pump at a time runs (5HP).

The only test data available was run in Dec. 1977 when the neutralizer internal demister was damaged and malfunctioning.

Prod. Rate	to scrubber		from scrubber	
	HNO <sub>3</sub>	AN	HNO <sub>3</sub>	AN
	#/T	#/Hr.	#/ton	#/Hr.
547 TPD	.184#/T	.37 8.4	.11	.36 8.2
723 TPD	.140	.38 11.5	.09	.21 6.3
1292 TPD	.153	.85 45.7	.11	.26 14.2

## XI COST INFORMATION

### A -1. Air Pollution Controls - Capital Cost

- a. Neutralizer - Wet Scrubber - Cost of Control equipment and installation was not itemized so the cost of control equipment is not known.
- b. Prill tower Barometric Condenser keep the air clear of potential evaporator effluent but its cost is unknown and the % that would be charged to control of air pollution is not available at this time.

### 2. Installation costs

- a. Neutralizer wet scrubber and demister were part of original equipment installation and cost is unknown. Material of construction is 304L and could last 20 years.
- b. Barometric condenser system was installed of 316L and carbon steel. Actual cost is unknown. The carbon steel has been replaced with a 300 series SS. This unit may last twenty years.

### 3. Annual Operating Costs: Neutralizer Scrubber.

- a. The neutralizer scrubber runs about 330 days per year.
- b. Operating labor is estimated at \$13,000/year.
- c. Maintenance labor & Materials run \$6,000/year.
- d. Electric power costs ----- \$1,200/year.
- e. Fuel is none -----

- f. Water Costs ----- \$ 300/year
- g. Steam is none -----
- h. Other operating supplies cost about \$1,000.
- i. All AN is recycled. While the weak solution must be concentrated from 25% to 85% the quantity recycled is unknown; hence the cost would be a wild guess. The cost is unknown.
4. As the cost of operating the unit is over \$21,500/year , but is actually unknown and as the quantity of ammonium nitrate recovered is unknown , no figures are available to answer this question.
5. Administrative charges ar not available.
- B. This section is not applicable to this plant.
- C. As agreed in the 11-13-78 meeting between CF people and EPA people this question is ignored.

XII THERE ARE NO CONSTRUCTION PLANS FOR THIS FACILITY AT THE PRESENT TIME.

XIII SAME AS ABOVE (XII)

XIV GENERAL OPERATIONS

A. Production Equipment

1. The maintenance necessary to the neutralizer and related equipment to control air emissions is as follows;

The neutralizer, as a vessel, has to have external leaks repaired. These are observed visually and repaired. They occur at no regular intervals. Holes in the ammonia spargers enlarge and spargers have to be replaced every two or three years. The spargers ( $\text{NH}_3$  and  $\text{HNO}_3$ ) have to be replaced as they break off every year or two. The only repairs made to the Anderson type vein demister in six years was to reweld the seal leg to the demister. Once a year the welds in the pipe from the neutralizer to the scrubber have to be repaired.

Controls - The ratio controller that regulates the flow of nitric acid in approximate proportions to the flow of ammonia gas to the neutralizer requires maintenance at irregular intervals several times a year. The pH cell that monitors the neutralizer effluent and controls the secondary flow of acid requires maintenance up to twelve times a year. The nature and extent of repairs varies. The sparger in the secondary neutralizer has to be replaced when worn. This is needed every five to ten years.

The secondary neutralizer ammonia spargers has to be replaced every two to 10 years. The vessel requires normal inspection and repairs of leaks caused by corrosion.

AN pumps must be replaced when they wear out. This does not occur with any predictable regularity. The bearing, seals and pump casings have to be repaired or replaced several times a year each. Electric motors fail and have to be replaced. This maintenance also has no predictable regularity.

2. The pH cell on the neutralizer effluent and the AN pumps are the most troublesome items. The pH cell electrodes break from thermal shock during neutralizer upsets.
3. This question is difficult to answer because pH cells may be replaced in total due to the urgency management places on control to minimize product loss and subsequent air emissions. The cell that has been removed may be repaired and kept for the next malfunction of the pH cell. The same is true for other equipment such as the pumps used in this area.
4. Kinds of breakdowns and upsets - Breakdowns and malfunctions in general center around pump seals and bearing failures or electric motor bearing and winding shorts. The second type is instrument mechanical and electrical failures or they simply drift out of calibration. Third is the breaking of ammonia and acid spargers or mechanical failure of the scrubber packing. Occasionally the level controls on AN melt vessels will salt out. Conveyor belts break and vessels develop holes or seam leaks from wear, corrosion or vibration.

Upsets normally involve excessive gas flows due to unexpected shutdowns elsewhere in the manufacturing complex. An unexpected change in strength of a liquid or gas stream. A pipe line or chute may plug and stop flow or valve may close unexpectedly and stop flow of one component. An undesirable component can be present in a gas or liquid stream. Also simple mechanical failure of a piece of equipment can cause upsets.

5. The factors effecting the choice of major processing equipments are:
  - a. Will it the unit produce the desired quantity of product at the quality required at minimum cost and minimum product losses to air or water.
  - b. Then cost and availability are carefully weighed.
6. If a plant is a marginally profitable operating unit certainly any regulation that required an outlay of money could render

the production facility unprofitable. Then the facility would be shut down and unemployment result. No one wants air pollution or water pollution, because they represent a loss of saleable product.

In other words, individual unit costs of intermediate products vary from plant to plant. If promulgated standards on new sources make that facility move expensive, the entire plant may have to close. Don't forget the customer. He must accept the product; because, with his equipment, he must be able to use the product at a cost that will allow him to make a profit.

7. In my opinion ammonium nitrate formed by bubbling ammonia through nitric acid provides minimum practical atmospheric emissions. Vapor phase formation of ammonium nitrate and subsequent solution of the vapors provide maximum atmospheric emissions. Vapors of Ammonium Nitrate are molecular in particle size and hence very difficult to capture for reprocessing.
8. Emission from concentrating ammonium nitrate to 99% are much greater than concentrating to 95% because of the difference in vapor pressures of the AN at the temperatures they are handled. However the North Carolina 99% evaporators have zero emissions because their effluent is completely captured in the barometric condensers.
9. I have no knowledge or experience to express an opinion on This question.
10. The North Carolina plant uses no coating.
11. Different amounts of coatings are applied to prills in different plants depending on the type of prills, moisture content and ultimate use.

#### Emission Control Equipment

1. Periodic maintenance is performed on the emission control system for the AN neutralizer as follows:
  - a. Leaks in the wet scrubber are repaired annually as necessary. About every four to six years the packing has to be partially or completely replaced. Each time the system is shut down the scrubber is inspected internally and externally. The demister pads are put in good working order as necessary or are replaced if they are damaged beyond repair.
  - b. The pH cells are maintained when necessary. Sometimes the repair or replacement occurs twelve times a year or as little as twice a year.