GCA/TECHNOLOGY DIVISION

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FINAL
TRIP REPORT: Swift Agricultural Chemicals Corporation, Beaumont, Texas

FROM: Stephen V. Capone, GCA/Technology Division

TO: Eric A. Noble, EPA/ESED/ISB (MD-13)

PURPOSE: To obtain detailed information and data on the granular ammonium nitrate operations and control systems for the Background Information Document for New Sources in the Ammonium Nitrate Manufacturing Industry.

PLACE AND DATE: Swift Agricultural Chemicals Corporation
P.O. Box 2175, Beaumont, Texas on 6 September 1978

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DISCUSSION:

I. INTRODUCTION

This facility produces nitric acid, ammonia, urea and ammonium nitrate. The urea and ammonium nitrate solutions are blended to produce UAN solution and the ammonium nitrate is also solidified in a rotary drum granulator. This survey specifically investigated the production of ammonium nitrate solution and subsequent concentration, solidification, cooling and coating.

II. PROCESS — AMMONIUM NITRATE

Nitric acid, ammonia, and weak liquor recycle are fed to the neutralizer which operates at about 1 psig and a pH range of 2.5 to 7.0 (4.5 desired). The neutralizer is rated to produce 600 ton/day of 83 percent AN solution. The outlet ammonium nitrate solution is split with some of the 83 percent AN going to the UAN production facility and the remaining amount proceeding to the concentrators for subsequent solidification.

The 83 percent AN solution enters the first stage Swenson concentrator. This concentrator operates at 260°F and 19 in. W.C. of vacuum and concentrates the entering solution to 93 percent AN.

The second stage concentrator, which is fed the 93 percent AN from the first stage, is a falling film unit operating at 335°F and 27 in. W.C. of vacuum. AN melt exiting the second stage concentrator is 99 percent ammonium nitrate.

The 99 percent AN melt leaves the second stage concentrator and flows to the sprays in the rotary drum granulator. . . . . *See Note 1 . . . .

The 99 percent AN melt is sprayed onto a bed of seed granules at 350°F and increases the size of the particles by addition of successive "onion skin" layers.

Chilled air flows countercurrent to the movement of the AN granules through the rotary drum granulator. The granules exit the rotary drum at a temperature of . . . †See Note 2 . . The countercurrent chilled air flow rate can be changed by changing the scrubber liquor level (for small flow adjustments) or by adjusting dampers in the air duct on the discharge of the scrubber fan (for large flow adjustments). Changes in air flow through the rotary drum are made as necessary to maintain the bed of seed particles at about 232°F ± 5°F. These air flow adjustments also maintain the moisture of the granules leaving the granulator at no more than 0.2 percent of H_2O.

Granules leaving the rotary drum fall to a belt conveyor. A section of this conveyor is a weigh belt. The conveyor empties into an enclosed bucket elevator which transports the granules up to the screens.

The open top Rotex screens separate the granule stream into over-, under-, and product size. The oversize granules are crushed and added to the undersize granules as solid recycle to the granulator seed bed. The product size material proceeds to the cooling stage. A section of the conveyor to the cooler is a weigh belt.

The cooler is a rotary drum with chilled air flowing countercurrent to the movement of granules. The granules are cooled to 93°F by the time they leave the rotary drum cooler.

The cooled prills are then conveyed to a rotary drum coater. Swift does not inject an additive into the 99 percent AN melt. Instead, they coat the granules with kaolin clay containing 1 percent Petro-AG. It is desired that the final product contain 2 percent by weight of coating. If the coated granules contain less than 1-1/2 percent coating, they tend to cake in the warehouse and during shipment. However, if the coated granules contain more than 2-1/2 percent

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*See Item 1 - Confidential Addendum, Contact Eric Noble, U.S. EPA, 919-541-5213.

†See Item 2 - Confidential Addendum, Contact Eric Noble, U.S. EPA, 919-541-5213.

coating they generate excessive dust during subsequent handling. There is no air flow through the coater. The clay is added to the pipe containing the granules just before they enter the coater. Coating is delivered to the plant in bulk trucks and air unloaded to the storage bin.

The coated prills are conveyed to a closed bulk warehouse. The air inside the warehouse is dehumidified and maintained at 90°F. The product can be shipped in bulk railcars or trucks and some is bagged.

Figure 1 presents a flow sheet of the facility.

III. EMISSIONS AND EMISSIONS CONTROL

All the neutralizer overheads are passed through the tube side of a heat exchanger to preheat the liquid ammonia feed. However, not all the overheads are condensed and during the survey significant tailings were observed from the 12 in. diameter × 50 ft high stack venting the heat exchanger. The composition of the exhaust stream varies with pH; the higher the pH, the more NH_3 out the stack, and; the lower the pH, the more HNO_3 out the stack.

The overheads from the two stages of concentration provide the weak liquor used for scrubbing. The overheads from the flash tank on each stage are passed through a condenser that generates most of the vacuum in the concentrators. Steam jet ejectors pull a vacuum on the condensers to provide the remaining vacuum and to remove noncondensibles from the systems. The steam jets exhaust to atmosphere and are the only vents from the concentration steps. The condensed overheads flow to a surge or weak liquor tank used to supply the granulator scrubber. Figures 2 and 3 shows the configuration of the first and second stage concentrators, respectively. During the survey, no tailings were observed from the steam jet ejector exhausts. The steam jet ejector on the first stage exhausts about two stories above ground level. The second stage steam jet ejector exhaust is located at the top of the unused prill tower.

The cooling air which flows through the granulator is exhausted through a Joy Turbulaire "Type D" scrubber. However, this particular rotary drum has a "knockout" or "settling" chamber on the end of the rotary drum where the air exists. From the amount of material on the belt conveyor at the bottom of this chamber or breeching, the chamber appeared to remove a lot of the AN particulate that would normally go into the scrubber. The scrubber liquor is maintained at a concentration of 50 to 60 percent AN. Scrubber liquor is recycled as feed to the neutralizer.

The exhaust from the granulator scrubber was tested in February 1977. The emissions were found to vary between 2.02 lb/hr and 24.26 lb/hr (10.86 lb/hr average) of AN particulate. Testing was conducted as specified by the Compliance Sampling Manual of the Texas Air Control Board which required a heated sample probe and filter box. The results of the three test runs are presented in Table 1.

There is a dust pickup at the bottom of the enclosed recycle bucket elevator which exhausts into the granulator exhaust duct.

No emissions were observed from the open top Rotex screens.

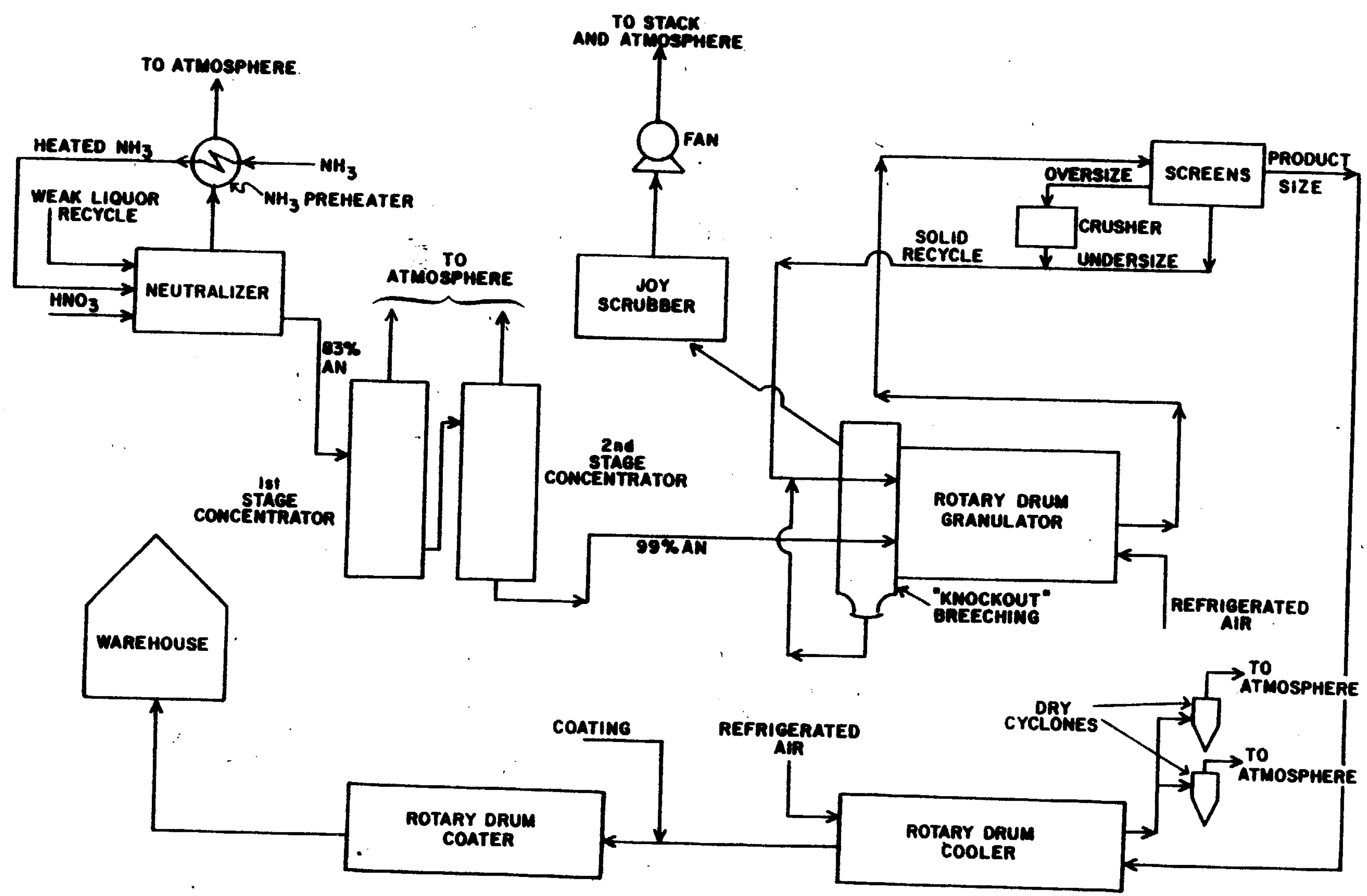

Figure 1. Ammonium nitrate granulation flow sheet, Swift Agricultural Chemicals, Beaumont, Texas.

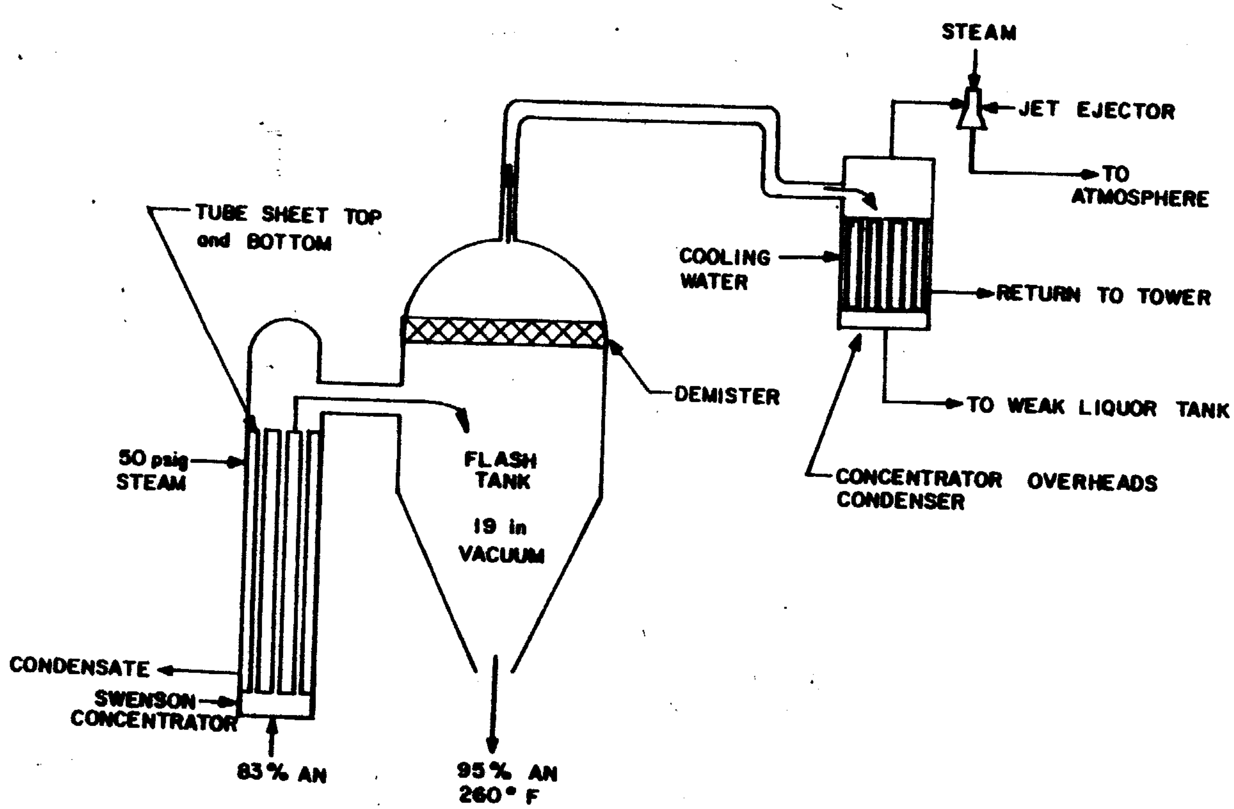

Figure 2. First stage concentrator, Swift Agricultural Chemicals, Beaumont, Texas.

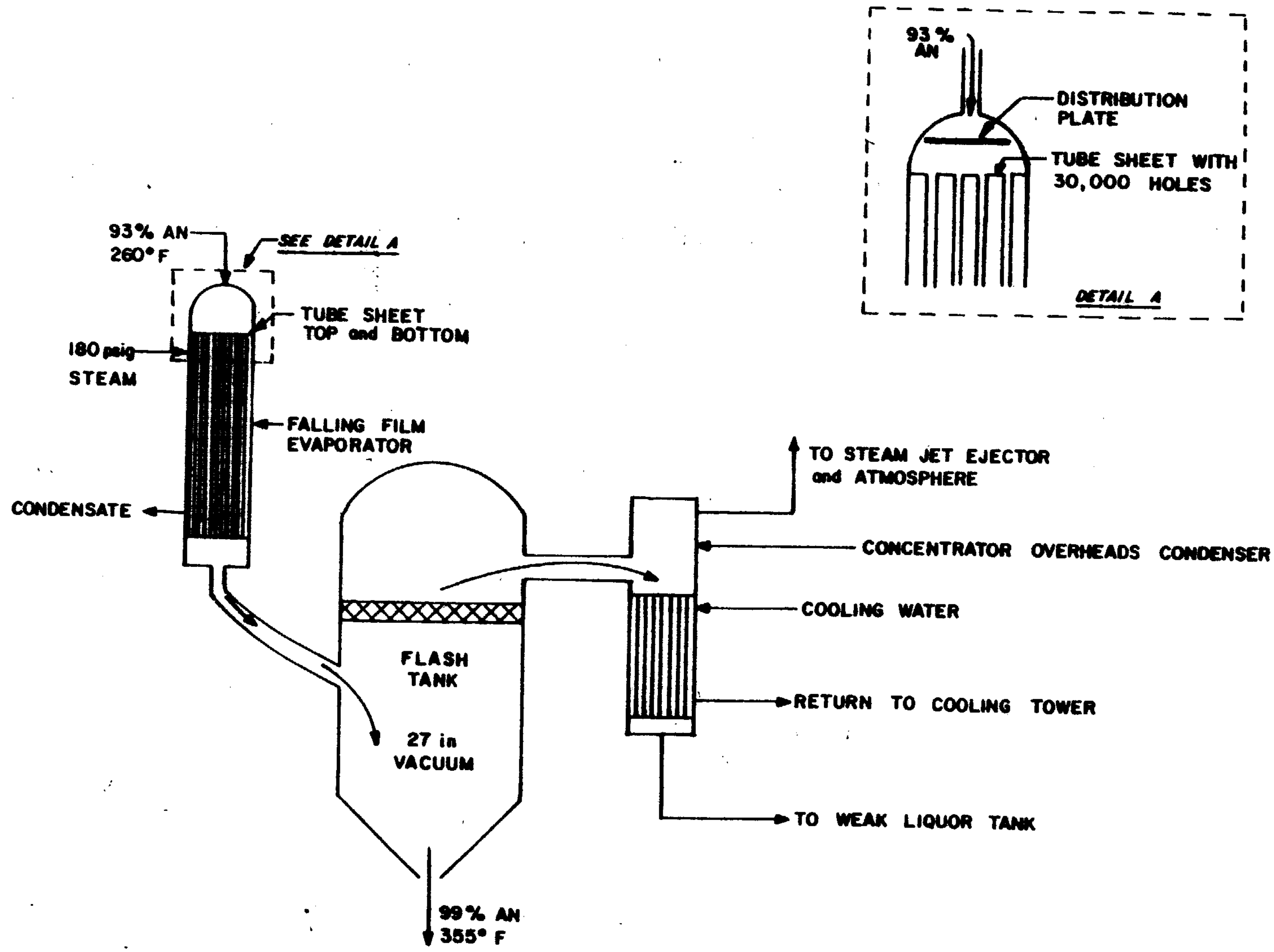

Figure 3. Second stage concentrator, Swift Agricultural Chemicals, Beaumont, Texas.

TABLE 1. SUMMARY OF SAMPLING RESULTS - FEBRUARY, 1977 — JOY SCRUBBER OUTLET SWIFT AGRICULTURAL CHEMICALS CORPORATION, BEAUMONT, TEXAS

Run No.	Sampling time, min	Stack scfm	Stack temperature °F	% Isokinetic	Pollutant mass rate		
					gr/scf	lb/hr	lb/ton of product*
1	60	44,594	111	93	0.0054	2.02	0.1212
2	60	43,999	113	93	0.0173	6.29	0.377
3	60	43,719	112	92	0.0669	24.26	1.46

*Production Rate = 16.67 ton/hr = 400 ton/day (assumed).

The cooling air passing through the rotary drum cooler is exhausted through two dry cyclones in parallel. During the plant survey, emissions from these cyclones were estimated at roughly 40 percent opacity. A strong odor of ammonia was evident in this exhaust. The air inside the building around the cooling drum was dusty but fugitive emission sources were not evident. The AN dust collected by the cyclones is returned to the remelt system for recycling.

The coating drum is located in a separate room adjacent to the granulation and cooling building. During the plant survey a significant amount of dust was puffing out of the seal between the coating drum and the inlet drop pipe and the room air was thick with dust. However, with the doors to the coating room closed, significant fugitive emissions were not observed. There is no air flow through the coating drum, however, there are two dust pickups which are exhausted to the coating storage bin baghouse. One pickup is between the coating drum and the product bucket elevator and the other is on the product bucket elevator. The baghouse on the coating storage bin is also used to control emissions when bulk trucks are air unloaded. No emissions were observed from the baghouse during the plant survey. Emissions from the coating area would be expected to consist primarily of the coating material.

There are no emission controls on the warehousing or bulk loading areas. No fugitive emissions were observed from the enclosed warehouse during the survey. Bagging and bulk loading were not in operation during the survey. Again, emissions from these areas would be expected to consist primarily of coating material.

IV. GENERAL

The rotary drum granulator at this plant began operation in 1976 and was installed to replace an uncontrolled prill tower which was in violation of applicable emission regulations. The remainder of the equipment is part of the original 1966 installation.

The plant personnel indicated satisfaction with the accuracy of the weigh belts but noted that only a small buildup of AN granules on the mechanism would influence the readings.

Plant personnel noted that the amount of coating desired in the final product is dependent on the relative humidity of the area. They have found 2 percent to be best for the Beaumont area which has a very high humidity. A drier climate could use less coating.

The prill tower at this plant was designed for LD prill production but was used primarily for HD prill production. The granulator was installed to replace the tower because of the high cost of controlling the tower. Plant personnel indicated that LD towers are typically taller than HD towers because the AN melt is only about 96 percent when making LD prills and is about 99.8 percent when making HD prills.

The plant personnel felt that the primary factor prohibiting increased production at this facility would be the increased water load in the plant at about 500 ton/day. They said that the granulator might be able to be run as high as 520 ton/day.

The pH of the AN granules is measured by melting 100 mg of granules and measuring the pH.

CONCLUSIONS/RECOMMENDATIONS:

The scrubber on the drum granulator appears to be doing a good job based on visible emissions.

The plant is one of only six C&I/Girdler drum granulators producing ammonium nitrate in the United States. It may be advantageous to sample emissions from this unit, especially since the scrubber inlet and outlet are amenable to testing. This is also the most recent installation of a drum granulator in ammonium nitrate service.

Although the dry cyclones on the cooler exhaust did not appear to be doing a good job controlling emissions, testing the inlet to them would provide data for characterization of uncontrolled emissions from a cooler of granulated product. The inlet to the cyclones is amenable to testing.