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FINAL TRIP REPORT: W. R. Grace and Company, Agricultural Chemical Memphis, Tennessee

UREA
AP-42 Section 6.14
Reference Number 6

FROM: Mark I. Bornstein, Stephen V. Capone

TO: Eric Noble

PURPOSE: To obtain detailed information and data on the prilled urea operation and control systems for the Draft Background Information Document for New Sources in the Urea Manufacturing Industry

PLACE AND DATE: W. R. Grace and Company, Agricultural Chemicals Group, P. O. Box 27147, Memphis, Tennessee 38127 on 22 June 1978

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DISCUSSION:

I. PROCESS-UREA

There is one urea production line at this facility. Urea solution is produced using the SNAM PROGETTI total recycle process built by C and I Girdler. . . . . [a]Note 1 . . . . . The plant first started operation October 1975.

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[a]Note 1 - See Item 1, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

Solid urea is produced in a . . [a]Note 2 . . prill tower . . . . [b]Note 3 . . . . . During the plant tour . . [c]Note 4 . . . of feed grade urea was being produced. A process flow diagram is shown in Figure 1.

There were no major emission points from the solution production area, since all streams are recycled back through the process. Only a waste water stream designed for 50 ppm NH_3 and 200 ppm urea is present from the bottom of the stripper. . . . . [d]Note 5 . . . . . .

The concentrator is a two-stage vacuum evaporator. Product entering the evaporator is concentrated . . . . . [e]Note 6 . . . . . The concentrated molten urea is immediately pumped to the prill tower . . [f]Note 7 . where it is sprayed under pressure . . . . [g]Note 8 . . . . . Biuret concentration is approximately 1 percent in the finished product.

. . . . . [h]Note 9 . . . . . A formaldehyde additive is used for anticaking and is injected into the molten urea prior to prilling.

. . . . . [i]Note 10 . . . . . .

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[a]Note 2 - See Item 2, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[b]Note 3 - See Item 3, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[c]Note 4 - See Item 4, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[d]Note 5 - See Item 5, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[e]Note 6 - See Item 6, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[f]Note 7 - See Item 7, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[g]Note 8 - See Item 8, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[h]Note 9 - See Item 9, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[i]Note 10 - See Item 10, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

The main part of the tower is the cooling zone. . . . . .
. . . . . .
. . . . . .
. . . . . [a]Note 11 . . . . . .
. . . . . .
. . . . . On the roof of the prill tower are located the . . . . . [b]Note 12 . . . . . scrubbers. . . . . .
. . . . . [c]Note 13 . . . . . .
. . . . . The number of scrubbers in operation at any one time depends on several factors: feed rate of urea melt, prill size desired, and ambient temperature and humidity. . . . . .
. . . . . [d]Note 14 . . . . . .
. . . . . .

After the product is screened the prills are sent to storage using conveyor belts. . . . . .
. . . . . [e]Note 15 . . . . . .
. . . . . The transfer points on the conveyor belts are controlled by a . . [f]Note 16 . . wet scrubber. Company officials did not know the pressure drop of the scrubber but estimated the efficiency to be about 65 percent.

The final product is stored in a covered warehouse, however, several open doors allowed fugitive emissions to escape the building. The product is transported to the storage area using enclosed belt conveyors and is stored in large piles on the floor. The prills free fall from a conveyor to the top of the pile. There were no noticeable emissions from this operation. Front-end loaders move the urea from storage to another conveyor belt where it is transported to delumping screens to remove caked material. The urea is then bagged in automatic corner fill baggers or is bulk shipped in trucks and railcars. A majority of their final product is bulk shipped. Neither the bagging nor the bulk handling were in operation during the visit. A baghouse which is an intergral part of the automatic bagging operation should be sufficient to adequately control particulate emissions. Material collected by the baghouse is redissolved and set back to the process.

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[a]Note 11 - See Item 11, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[b]Note 12 - See Item 12, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[c]Note 13 - See Item 13, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[d]Note 14 - See Item 14, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[e]Note 15 - See Item 15, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[f]Note 16 - See Item 16, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

II. EMISSION AND EMISSION CONTROL

As noted earlier there are no major emission points from the urea solution portion of the production facility. All major streams for this total recycle plant are controlled using standard process stream controls (i.e., recycling streams, total condensers). There are no emissions from the concentration step since the overheads from this operation are also recycled.

This is the only plant visited to date with a prill tower which was originally designed to be controlled. The only emission tests conducted at the plant have been on the . . . . [a]Note 17 . . . . . scrubbers used on the prill tower. When the plant was originally designed . . . . . [b]Note 18 . . . . . .

Scrubber liquor used for the . . [c]Note 19 . . scrubbers comes from . . . . . [d]Note 20 . . . . . A bleed stream is taken from the scrubber liquor holding tank and . . . . . [e]Note 21 . . . . . This stream is then recycled back to the evaporator. A specific gravity meter is used to monitor the concentration of scrubbing liquor. Stack tests were conducted on one scrubber using a hat type portable stack 2 feet in diameter. . . . . [f]Note 22 . . . . . It was therefore necessary to situate the portable stack on the outlet of the scrubber so that a representative flow rate could be obtained.

Stack test results conducted between March and April of 1976 show an emission rate between 0.008 and 0.016 gr/scf. Table 1 shows a summary of the results.

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[a]Note 17 - See Item 17, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[b]Note 18 - See Item 18, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[c]Note 19 - See Item 19, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[d]Note 20 - See Item 20, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[e]Note 21 - See Item 21, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[f]Note 22 - See Item 22, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

TABLE 1. SUMMARY OF RESULTS

Date	Product prill grade	Production rate, tons/day	No. of scrubbers operating	Emission rate, gr/scf	Tower air flow, scf/min	Emission rate lb. part./ton product
3/30/76	Fertilizer	[a]Note 23	[a]Note 23	0.009	[a]Note 23	0.765
4/1/76	Fertilizer			0.008		0.679
4/19/76	Fertilizer			0.009		0.821
3/23/76	Feed			0.016		1.116
3/24/76	Feed			0.012		0.799
4/5/76	Feed			0.014		0.651

[a]Note 23 - See Item 23, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

Approximately 10 percent opacity was exiting from the . .[a]Note 24 . scrubbers. Both inlet and outlet locations are available for stack testing. Either the small portable hat type stack used by the company for compliance testing or a larger full size stack extension can be used to provide a sampling site for the outlet. The inlet to the scrubber can be tested in the prilling room or the fan room. An elevator is available at the prill tower to transport sampling equipment.

A . . [b]Note 25 . . wet scrubber is used to control emissions from several product transfer points throughout the plant. The pressure drop across the scrubber was not known by plant personnel, however, they estimated the efficienty to be about 65 percent. This piece of equipment is readily testable since it is located at ground level and has a stack.

The other piece of control equipment at the plant is a baghouse used on their automatic bagging operation. The bagging operation works on a slightly pressurized system and the exhaust from this system is sent to the baghouse for product recovery. The material collected by the baghouse is re-dissolved and sent back to the process. Because of the known efficiencies of baghouses it may not be necessary to test this operation. However, if tests are necessary this piece of equipment is located on a one story roof and is accessible.

III. GENERAL

Three grades of urea are capable of being produced in the prill tower: fertilizer, feed and industrial or technical grade. The grade urea produced determines the number of scrubbers required to be operating. Because fertilizer grade urea is a larger prill more air is required for cooling . . . . . [c]Note 26 . . . . . The exit air from fertilizer grade urea will also be at a higher temperature compared to feed grade and will cause a more persistent plume.

It took W. R. Grace approximately 1-1/2 years to develop the final design of the . . [d]Note 27 . . scrubbers and for this reason they would like to maintain these modifications confidential.

A major problem with the prill tower scrubbers is the fans. Their fans are induced draft for the prill tower and forced draft for the scrubbers.
. . . . . .
. . . . . [e]Note 28 . . . . . .
. . . . . .
. . . . . .

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[a]Note 24 - See Item 24, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[b]Note 25 - See Item 25, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[c]Note 26 - See Item 26, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[d]Note 27 - See Item 27, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[e]Note 28 - See Item 28, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

The company chose a prill tower over a granulator for solid urea production because they felt it was less costly to operate, required less personnel, and used less land area. . . . . [a]Note 29 . . . . . .

IV. CONCLUSIONS AND RECOMMENDATIONS

The control equipment employed by W. R. Grace may be best available control technology. The . . [b]Note 30 . . scrubbers used on the prill tower controlled the total air flow through the tower and a . . [c]Note 31 . . wet scrubber used to control transfer points in the plant also appeared to be doing a good job. No visible emissions were observed from this piece of equipment. The use of a baghouse on the bagging operation resulted in a method of recovering useful product and at the same time reduced emissions from this operation.

The overall plant operation was run in a professional manner. The process was well controlled and process parameters were continually monitored and recorded at least every 2 hours. The facility was clean and well maintained.

The following pieces of equipment should be tested:

1. . . . . [d]Note 32 . . . . . scrubbers on the prill tower
2. . . [e]Note 33 . . wet scrubber on transfer points
3. Baghouse on bagging operation.

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[a]Note 29 - See Item 29, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[b]Note 30 - See Item 30, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[c]Note 31 - See Item 31, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[d]Note 32 - See Item 32, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

[e]Note 33 - See Item 33, Confidential Addendum, Contact Eric Noble, EPA, (919) 541-5213

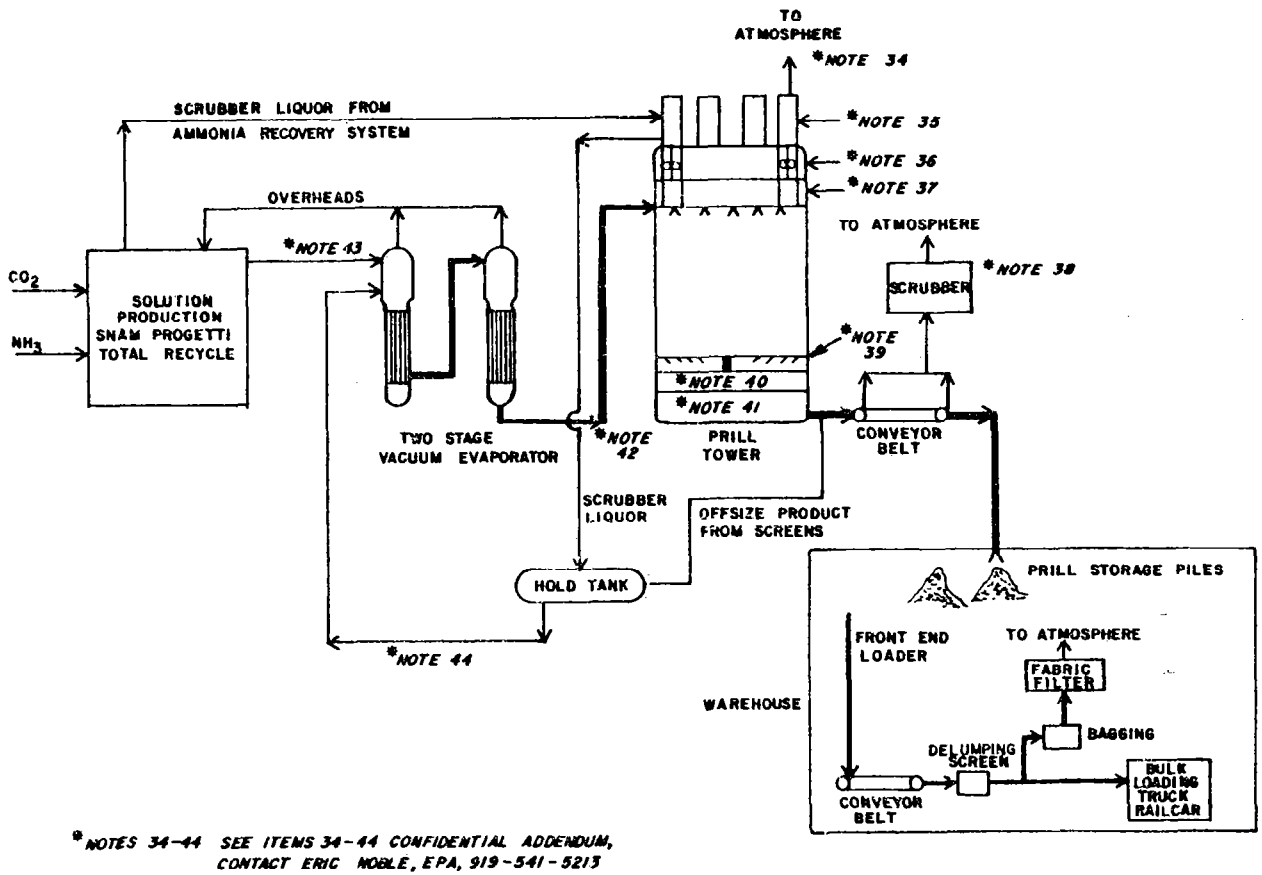

Figure C-4. Production Flow Diagram, Plant D