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TITLE

NOTES ON NITRIC ACID OXIDE ABSORPTION SYSTEM

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CAPACITY OF UO₃ PLANT

NOTES ON NITRIC OXIDE ABSORPTION SYSTEM

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INTRODUCTION

An overall UO₃ Plant capacity study is being made and will be reported in three parts. The study of the Nitric Oxide Absorption System is presented in this document and the capacity was found to be 600 tons U/month. A study of the UO₃ Plant Powder Unloading System has been made; (1) and it was found that with modifications, including a parallel unloading system for the Luckey pots, the unloading facilities could be made to handle (600) tons U/month. An examination will be made of the UO₃ Plant calcination capacity as soon as reliable capacity data are available, but the new gas fired Luckey pots will have to be operating on a full time basis before this study can be completed. Any changes that will be required to bring the calcination capacity up to (600) tons U/month will be presented in this document.

PURPOSE

The purpose of this document is to present a capacity study of the existing UO₃ Plant Nitric Oxide Absorption System.

SUMMARY AND CONCLUSIONS

The capacity of the existing UO₃ Plant Nitric Oxide Absorption System is 600 tons U/month.

An excessive amount of air leaks into the existing Absorption System through the decomposition pot agitator seals and lid gaskets; decreasing this inleakage will increase the capacity of the system.

RECOMMENDATION

It is recommended that different (in type or material) pot agitator seals and lid gaskets be installed to reduce the excessive air inleakage and thereby increase the capacity of the existing Nitric Oxide Absorption System.

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DISCUSSION

1. GENERAL

As a part of the overall UO_3 Plant capacity determination, a study was initiated last March to determine the capacity of the UO_3 Plant Nitric Oxide Absorption System. In an attempt to establish past maximum instantaneous production rates, operating data for the month of October, 1953, a month of higher than average production, were examined to find short periods of high production. When the Luckey pot test runs were started in April, their operating data ~~was~~^{were} studied and showed periods of higher instantaneous production than were encountered in October. The search of old data was discontinued and data from current Luckey pot tests were considered.

The source of the operating data was the charts of the various recording instruments, the daily operating reports, and some special hand recorded data. The following readings were available:

- A. Process or reflux water flow to the top of the T-A1 Absorber.
- B. Flow of off-gas (essentially air) from the top of T-A1.
- C. Specific Gravity of the acid leaving T-A1.
- D. Pressure drop across the trays of T-A1.
- E. Flow of gas in the fume vent header as it entered the E-A2 Gas Cooler.
- F. Specific gravity of the acid in the C-3 collection tank.
- G. Flow of acid from the C-3 collection tank.
- H. Vacuum in the fume vent header at the decomposition pots.
- I. Temperature of the process water to T-A1.
- J. Temperature of the off-gas from T-A1.
- K. Temperature of the acid from T-A1.
- L. Temperature of the gas leaving the E-A2 Gas Cooler.

Using these data, material balance calculations were made around the T-A1 Absorber and the E-A2 Gas Cooler to determine the amount of

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NO₂ absorbed in each unit. A sample calculation showing the method of calculation and the assumptions involved is appended. Instantaneous production rates for periods varying from 1 to 5 hours were calculated for 25 cases.

The T-A1 absorber was on a purge method of operation during all periods for which data were obtained. This method consists of running process water to the Absorber at a rate of about 0.4 gpm until the specific gravity of the acid on the bottom plate is about 1.2. Then the process water is turned on full flow (about 2.5 gpm) until the specific gravity reaches about 1.1 when the 0.4 gpm rate is resumed. By doing this, the chloride ions which tend to build up in the Absorber are flushed out in the nitric acid at frequent intervals before a harmful (to the stainless steel) concentration accumulates. The effect of this purge method of operation on the material balance calculations is discussed in the following section on Results.

The present capacity of the Nitric Oxide Absorption System could be increased by reducing the amount of air that leaks into the system through the decomposition pots. Approximate average values for air leakage into the system and vacuum in the fume vent header for past months were provided by Technical Section and are given in Table II. The recent 280 scfm leakage rate is 180 scfm over the design rate of 100 scfm. This excessive inleakage decreases the amount of NO₂ absorbed by decreasing the NO₂ absorption rate and decreasing the gas residence time in the absorption equipment. The NO₂ absorption rate depends on the concentration of NO₂ in the pot gas, and air, by dilution, reduces the NO₂ concentration. The gas residence time is an inverse function of the gas flow rate, and since air inleakage increases the flow rate, the residence time in the absorption equipment is decreased.

The additional effect of NO reoxidation time influences the E-A2 Gas Cooler operation, but is most important in the T-A1 Absorber. Absorption is believed to take place according to the following reaction:

With the NO being reoxidized to NO₂ by the oxygen in the air from inleakage or nitric acid scrubbing:

The rate of reoxidation varies as the square of the partial pressure of NO, and with excessive air in the pot gas the partial pressure of NO is reduced by dilution. The resulting decrease in the rate of reoxidation means less NO₂ is available for absorption. The amount of reoxidized NO₂ formed varies directly with the residence time between absorption plates, and this is decreased by the increased gas flow rates caused by excessive air inleakage.

The main sources of air inleakage are believed to be the seals on the pot agitators and the pot lid gaskets. The badly corroded fume vent header from the pot room to E-A2 which was recently replaced was not a chief source of inleakage. This was shown by comparing T-A1 off gas and pressure drop readings taken before and after the installation of the new line. A decrease in vacuum in the fume vent header at the pots and the gradual increase in air inleakage (see Table II) since January is believed to be due to wearing of the agitator seals. Another probable source of leakage is the Teflon pot lid gaskets which tend to become permanently compressed with time, therefore losing their sealing ability. The installation of better agitator seals and pot lid gaskets should reduce the present excessive air inleakage and increase the present capacity of the Nitric Oxide Absorption System.

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2. RESULTS

The Luckey pot test runs of April 12 and 20 indicate that the T-A1 Absorber can absorb NO_2 at the rate of about 9 - 10 mols/hr. Other cases, from the October data and Luckey pot runs, show that 10 - 11 mols NO_2 /hr is the maximum absorption rate in the E-A2 Gas Cooler. With the proper amounts of water vapor and NO_2 in the decomposition gases (see below), the T-A1 Absorber and E-A2 Gas Cooler should each operate at its maximum capacity giving a total absorption rate of 20 - 21 mols NO_2 /hr. Converting this to a production figure, the maximum instantaneous capacity of the combined units is about 30 tons U/day or 720 tons U/month at 80% efficiency. The maximum capacity of a single run was 25 tons U/day (case 21) with NO_2 corresponding to 14.5 tons U/day being absorbed in the Cooler and 10.5 tons U/day in the Absorber.

It was found that the overall composition of the gas off the decomposition pots affects the distribution of NO_2 absorption in the Cooler and the Absorber. When the gas mixture contains larger amounts of water vapor and smaller amounts of NO_2 , the major portion of the NO_2 absorption takes place in the E-A2 Gas Cooler. With less water vapor and more NO_2 , most of the absorption is done in the T-A1 Nitric Oxide Absorber. A very large excess of water causes the E-A2 Gas Cooler to be overloaded due to the large heat of condensation load and the resulting high temperature of the cooler exit gas causes inefficient absorption in the T-A1 Absorber. With a very small amount of water vapor in the decomposition gases, only a little NO_2 is absorbed in the cooler and at high production rates the T-A1 Absorber might become overloaded. These situations were encountered in the Luckey pot test runs on April 12 and 20, and are explained as follows:

On April 12 a large amount of water boil-off from other pots accompanied the Luckey pot NO_2 fuming period causing overloading of

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of the E-A2 Gas Cooler and resulting in poor NO_2 absorption in the T-A1 Absorber. When a large amount of water boil-off accompanies heavy nitric oxide fuming, most of the cooling capacity of the Gas Cooler is used to condense the water vapor in the gas, and the Cooler cannot cool the exit gas to the design outlet temperature ($100^\circ\text{F}.$) On April 12th, the average temperature of the gas from the Cooler was 123°F with a maximum of 135°F . This higher temperature reduces the efficiency of the absorption in the Cooler, but more important than that, it causes the Absorber to operate above its design temperature ($100^\circ\text{F}.$) This results in poor nitric oxide absorption and reoxidation in the Absorber which was indicated by the reddish-brown fumes in the off gas.

On April 20 there was an unusually small amount of water boil-off from other pots during the Luckey pot NO_2 evolution. This resulted in very low NO_2 absorption in the E-A2 Gas Cooler which, in turn, caused the Absorber to operate near its maximum capacity. With only a small amount of water vapor in the gas to Cooler, Nitric Oxide absorption in the Cooler is curtailed, since the amount of nitric oxide absorbed depends directly on the amount of water present. The gas from the cooler is cooled below the design temperature due to the small latent heat load and the bulk of the absorption takes place in the Absorber. At periods of high nitric oxide evolution (high production rates) the Absorber is apt to become overloaded because the Cooler is not removing its share of the nitric oxide fumes. This condition was not reached in the April 20th run since the nitric oxide fuming rate was not great enough. Since the Nitric Oxide Absorption System is operated in conjunction with the batchhouse decomposition pots, the scheduling difficulties that arise in trying to maintain the proper H_2O to NO_2 ratio reduce its capacity from 720 tons U/month to about 600 tons U/month.

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The effect of the surge method of operation described above on the material balance calculations can be seen in Table I, "Results of Material Balance Calculations Around E-A2 and T-A1." For cases where the process water was on full during most or all of the considered time interval, the amount of NO_2 absorbed in T-A1 is much higher than when the process water flow was about 0.4 gpm. The actual process water flow is not tabulated but the "acid flow from T-A1" is a direct indication of the process water flow.

It was estimated by noting the change in slope of the chart recorded curve of T-A1 acid specific gravity vs time, that at 2.5 gpm process water flow, the liquid hold-up time in T-A1 was about 20-25 minutes. The hold-up time at 0.4 gpm would then be about 2-2.5 hours.

Due to this long hold-up time and the constant changing of specific gravity of the product acid, it was difficult to get a true indication of the T-A1 absorption load. For cases of full or near full process water flow, allowance was made for the 20 minute hold-up time in reading the average specific gravity of the acid from T-A1. Because of the relatively short time intervals (less than 5 hours) considered, the 2-2.5 hour T-A1 hold-up time at 0.4 gpm was too long to accurately make allowance for, and the specific gravity of the acid from T-A1 was taken as the average chart reading over the actual time interval. In most cases, this value was probably too low because the acid that was actually made during the time interval was still up in the Absorber and of higher strength than the exit acid. Since the specific gravity of the Absorber acid was used directly in figuring the T-A1 absorption load, the loads for cases with 0.4 gpm process water are probably quite low, but the loads for 2.5 gpm should be fairly accurate.

This surge method of operation will not be used in the Nitric Oxide Absorption Method outlined in HW-32471, "Nitric Acid Recovery - UO_3 Plant." Instead, the chloride ions will be removed with a continuous surge which will allow the absorber to operate in a steady state and which will result in the production of acid of more uniform strength.

Attempts were made to correlate some of the results to determine such things as how the volume ratio of water vapor to NO_2 in the gas from the pots (air free) affected the amount of NO_2 absorbed in the Cooler and the strength of acid formed in the Cooler (see figs. 1 and 2.) No firm correlations were found, but as was expected, the trends definitely showed that at constant production rates the amount of NO_2 absorbed in the Gas Cooler increased and the strength of acid decreased with increasing water to NO_2 ratio.

A graphical breakdown of the typical pressure drops and vacuum at various points in the Absorption System is shown in Figure 3.

APPENDIXSAMPLE CALCULATION FOR CASE NUMBER 21, May 23, 1954, 9-11 A.M.A. DATA -- VALUES ARE THE AVERAGE FOR THE 2 HOUR INTERVAL

1. T-A1 reflux water flow rate	= 2.5 gpm
2. T-A1 off gas chart reading	= 0.92
3. Sp. Gr. of acid from T-A1	= 1.1615
4. Δ P across T-A1 Trays	= 38.5 in H ₂ O
5. Fume vent gas chart reading	= 0.76
6. Sp. Gr. of acid in C-3	= 1.260
7. C-3 acid flow chart reading	= 0.81
8. Fume vent header vacuum at pots	= 3 in H ₂ O
9. Temperature of T-A1 reflux water	= 79°F
10. Temperature of T-A1 off gas	= 77°F
11. Temperature of acid from T-A1	= 82°F
12. Temperature of gas from E-A2	= 90°F

B. CALCULATIONS1. Total Amount of Process Water to T-A1 Absorber

The Absorber was being purged of Chloride ions during this run and the process water was on full flow. When the process water is on full, the flow gauge reads off scale. The full flow was estimated by reading the recorded drop in level in the X-14 distilled water head tank, converting it to gallons, and dividing by the appropriate time interval. Values for full flow varied from 2.8 to 2.3 gpm with the average about 2.5 gpm.

$$2.5 \text{ gpm} \times 120 \text{ min.} \times \frac{8.33 \text{ lbs}}{\text{gal}} = 2500 \text{ lbs H}_2\text{O}$$

2. Average Strength of Acid Formed on Bottom Plate of T-A1

The average specific gravity of the acid on the bottom plate over the time interval involved is corrected for temperature and the acid strength is read from tables.

$$\begin{array}{r} \text{Sp. Gr.} = 1.1615 \text{ at } 82^{\circ}\text{F} \\ \quad .0097 \text{ Correction} \\ \hline 1.1712 \text{ at } 60^{\circ}\text{F} \end{array}$$

$$\text{Acid} = 28\% \text{ HNO}_3$$

3. MOLS OF NO₂ Absorbed in T-A1

The amount of process water divided by the percent of water in the acid from T-A1 gives the amount of acid from T-A1. Allowance is made for the water used up in forming the acid. From the amount of acid formed in T-A1 the number of mols of NO₂ absorbed is found.

$$\frac{1 \text{ -- } 0.28 \text{ lbs H}_2\text{O}}{\text{lbs acid}} \times \left(\frac{2500 \text{ lbs of process water}}{0.28 \text{ lb HNO}_3} \times \frac{1 \text{ mol H}_2\text{O used up}}{2 \text{ mols HNO}_3 \text{ formed}} \times \frac{1 \text{ mol HNO}_3}{63 \text{ lb HNO}_3} \times \frac{18 \text{ lb H}_2\text{O}}{1 \text{ mol H}_2\text{O}} \right) = \frac{3289 \text{ lbs}}{\text{acid}}$$

$$3289 \text{ lbs acid} \times \frac{0.28 \text{ lbs HNO}_3}{\text{lb acid}} \times \frac{1 \text{ mol HNO}_3}{63 \text{ lbs HNO}_3} = 14.62 \text{ mols HNO}_3$$

For every mol of HNO₃ formed, a mol of NO₂ is absorbed.

$$\text{NO}_2 \text{ absorbed in T-A1} = 14.62 \text{ mols}$$

4. Total Gallons of Acid From C-3 Storage Tank

The average chart reading for the interval times the chart factor times the interval gives the total gallons of acid formed in the system.

$$0.81 \text{ chart reading} \times 5 \text{ gpm} \times 120 \text{ min.} = 486 \text{ gals. acid}$$

5. Average Strength of Acid Collected in C-3

The average specific gravity of the acid in C-3 for the interval is corrected for temperature and the acid strength is read from tables.

$$\begin{array}{r} \text{Sp. Gr.} = 1.260 \text{ at } 90^{\circ}\text{F} \\ \quad .013 \text{ Correction} \\ \hline 1.273 \text{ at } 60^{\circ}\text{F} \end{array}$$

$$\text{Acid} = 43.2\% \text{ HNO}_3$$

6. Total Mols of NO₂ Absorbed in System

The system includes both T-A1 and E-A2. The total gallons of acid from C-3 is converted to pounds and multiplied by the acid strength to get the pounds and mols of HNO₃ formed.

$$486 \text{ gals. acid} (8.33 \times 1.260) \frac{\text{lbs acid}}{\text{gal acid}} = 5101 \text{ lbs acid}$$

$$5101 \text{ lbs acid} \times 0.432 \frac{\text{lb HNO}_3}{\text{lb acid}} = 2204 \text{ lbs HNO}_3$$

$$2204 \text{ lbs HNO}_3 \times \frac{1 \text{ mol HNO}_3}{63 \text{ lbs HNO}_3} = 34.98 \text{ mols HNO}_3 \text{ or NO}_2$$

7. Mols of NO₂ Absorbed in E-A2

By difference:

$$34.98 \text{ mols total} - 14.62 \text{ mols from T-A1} = 20.36 \text{ mols NO}_2 \text{ absorbed in E-A2}$$

8. Total Amount of Water Removed in E-A2

This is the sum of the combined water used in forming the acid made in E-A2 and the free water in the acid from E-A2. The free water is the difference between the free water from C-3 and the free water from T-A1.

$$a. \text{ Combined water} = \frac{1 \text{ mol H}_2\text{O}}{2 \text{ mol HNO}_3} \times 20.36 \text{ mols HNO}_3 = 10.2 \text{ mols H}_2\text{O}$$

b. Free water

$$1. \text{ From C-3} = 5101 \text{ lbs acid} \times 0.568 \frac{\text{lbs H}_2\text{O}}{\text{lb acid}} \times \frac{1 \text{ mol H}_2\text{O}}{18 \text{ lbs H}_2\text{O}} = 161.0 \text{ mols H}_2\text{O}$$

$$2. \text{ From T-A1} = 3289 \text{ lbs acid} \times 0.72 \frac{\text{lbs H}_2\text{O}}{\text{lb acid}} \times \frac{1 \text{ mol H}_2\text{O}}{18 \text{ lbs H}_2\text{O}} = 131.6 \text{ mols H}_2\text{O}$$

$$3. \text{ From E-A2} \quad 161.0 - 131.6 = 29.4 \text{ mols H}_2\text{O}$$

c. Total

$$29.4 + 10.2 = 39.6 \text{ Mols. H}_2\text{O removed in E-A2}$$

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9. Average Strength of Acid From E-A2

This is calculated directly from the mols of HNO_3 formed and the amount of free water removed.

$$\text{H}_2\text{O} = 29.4 \text{ mols} \times 18 \frac{\text{lbs}}{\text{mol}} = 529 \text{ lbs}$$

$$\text{HNO}_3 = 20.36 \text{ mols} \times 63 \frac{\text{lbs}}{\text{mol}} = 1283 \text{ lbs}$$

$$\text{Strength} = \frac{1283}{1283 + 529} \times 100 = 70.8\% \text{ HNO}_3 *$$

10. Measured Mols of Gas From Pots to E-A2

The average chart reading for the time interval was multiplied by the chart factor and corrected for temperature and pressure to give the cfm at standard conditions. This was converted to mols.

$$.76 \text{ chart reading} \times 800 \text{ cfm} \times 1.271 \text{ chart correction}$$

$$= 773 \text{ cfm at line conditions}$$

$$773 \text{ cfm} \times \frac{492^\circ\text{R}}{670^\circ\text{R}} \times \frac{14.5 \text{ psi}}{14.7 \text{ psi}} = 560 \text{ cfm at S.C.}$$

$$\frac{560 \text{ cfm}}{359 \frac{\text{ft}^3}{\text{mol}}} \times 120 \text{ min} = 187 \text{ mols of gas to E-A2}$$

11. Composition of Gas From Decomposition Pots.

a. H_2O = water removed in E-A2 / humidity in gas from E-A2

Let x = mols H_2O as humidity

$$X = 0.0516 \frac{\text{mols H}_2\text{O}}{\text{mols dry gas}} (187 - 20.4 - 39.6 - x) \text{ mols dry gas}$$

$$1.0516X = 6.55$$

$$X = 6.2 \text{ mols H}_2\text{O}$$

$$\text{Total H}_2\text{O from pots} = 39.6 \text{ mols} + 6.2 \text{ mols} = 45.8 \text{ mols}$$

b. NO_2 = total NO_2 absorbed in system (the NO_2 in the off gas is assumed to be negligible) = 34.98 mols

$$\text{c. } \text{O}_2 = 1/4 \times \text{NO}_2 = 1/4 \times 34.98 = 8.8 \text{ mols}$$

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d. Summary

	<u>Mols</u>	<u>Volume %</u>
H ₂ O =	45.8	51.1
NO ₂ =	35.0	39.1
O ₂ =	<u>8.8</u>	<u>9.8</u>
Total =	89.6	100.00

12. Calculated Air Leakage into System Before E-A2

This is the difference between the mols of gas into E-A2
and the mols of gas off the pots.

187 mols of gas into E-A2 - 89.6 mols of gas off pots
= 97.4 mols of air in

13. Measured Air Leakage into System

This is assumed to be the amount of off gas from T-A1 and is
found by multiplying the chart reading by the chart factor, correcting
it for temperature and pressure, and converting it to mols.

.92 chart reading x 300 cfm x 1.167 correction = 322 cfm

$$322 \text{ cfm} \times \frac{492^\circ\text{R}}{537^\circ\text{F}} \times \frac{350 \text{ in H}_2\text{O}}{407 \text{ in H}_2\text{O}} \times 1.005 \text{ sp. gr. correction} = 350 \text{ cfm}$$
~~= 255 cfm at s.c.~~

$$\frac{255 \text{ cfm}}{359 \frac{\text{ft}^3}{\text{mol}}} \times 120 \text{ min.} = 85 \text{ mols air in}$$

14. Instantaneous Production Rate for 2 Hour Interval

The total amount of NO₂ absorbed in the system is converted to the
corresponding amount of uranium processed using the following decompo-
sition reaction:

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$$\frac{34.98 \text{ mols NO}_2}{2 \text{ hours}} \times \frac{1 \text{ mol U}}{2 \text{ mols NO}_2} \times \frac{238 \text{ lbs U}}{\text{mol U}} \times \frac{1 \text{ ton}}{2000 \text{ lbs}} \times \frac{24 \text{ hrs}}{\text{day}} =$$

$$24.98 \frac{\text{Tons U}}{\text{Day}}$$

- * The strength of acid from E-A2 is exceptionally high. This is due to the high production rate and the small ratio of H₂O to NO₂ in the gas from the pots:
51.1% H₂O/39.1% NO₂ = 1.31. A ratio in the range from about 3 to 6 depending on the production rate gives about 40% acid from the cooler.

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TABLE 1
RESULTS OF MATERIAL BALANCE CALCULATIONS
AROUND E-A2 AND T-A1

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Case	Date and Time	Production Rate, Tons U/day	Total NO ₂ Absorbed Mols/hr	NO ₂ Absorbed in E-A2 Mols/hr	NO ₂ Absorbed in T-A1 Mols/hr	% Acid from E-A2	Acid flow from E-A2 GPM	% Acid from T-A1	Acid flow from T-A1 GPM	Air leakage into ^{system} pots CFM at S.C.	Volume Ratio of H ₂ O to NO ₂ in gas from pots
1	10-20-53 6-7 am	5.2	3.6	0.7	2.9	7.4	1.23	30.2	1.03	232	9.62
2	10-24-53 1-3 am	12.7	8.9	3.9	5.0	35.5	1.13	38.4	1.34	271	3.26
3	10-31-53 7-8:30 am	14.5	10.1	8.6	1.5	43.2	1.99	33.1	0.47	250	4.56
4	11-1-53 10:30 am-12:30 pm	14.7	10.3	8.7	1.6	42.2	2.04	35.7	0.47	253	4.57
5	10-26-53 12-1 am	16.4	11.4	8.8	2.6	47.4	1.80	39.2	0.68	270	3.67
6	10-27-53 11:30 pm-3:50 am	16.4	11.5	10.5	1.0	43.5	2.30	25.0	0.44	274	4.70
7	4-9-54 9:20-12:20 am	-	-	-	1.1	-	-	25.5	0.47	253	-
8	4-14-54 1-4 pm	-	-	-	2.7	-	-	26.2	1.12	240	-
9	4-16-54 6-11 am	-	-	-	1.9	-	-	24.5	0.84	243	-
10	4-20-54 12:30-2 pm	17.6	12.3	3.1	9.2	72.9	0.38	38.9	2.40	250	0.56
11	4-12-54 1-6 pm	-	-	-	9.9	-	-	35.3	2.94	237	-
12	1-18-54 8:15-10:15 pm	9.0	6.3	4.7	1.6	28.5	1.75	30.8	0.57	253	9.63
13	4-29-54 3-6 pm	21.7	15.2	9.3	5.9	67.1	1.24	25.3	2.55	247	1.67

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14	5-8-54 12-4 pm	15.4	10.7	9.7	1.0	41.1	2.36	25.3	0.45	250	5.74
15	5-10-54 7-11 am	19.0	13.3	12.1	1.2	41.4	2.94	23.4	0.55	235	5.51
16	5-11-54 7-9 am	23.3	16.3	8.6	7.7	50.0	1.63	30.1	2.75	231	2.44
17	5-12-54 9-11 am	-	-	-	5.5	-	-	22.9	2.67	234	-
18	5-20-54 6:30-10 am	23.0	16.1	10.5	5.6	45.3	2.27	32.0	1.86	245	3.51
19	5-21-54 2-5 am	15.4	10.8	9.8	1.0	37.5	2.66	24.0	0.44	-	6.33
20	5-21-54 7-11 pm	19.3	13.5	7.6	5.9	41.6	1.84	31.5	1.99	250	3.45
21	5-23-54 9-11 am	25.0	17.5	10.2	7.3	70.8	1.34	28.0	2.83	255	1.34
22	5-24-54 4-7 pm	19.5	13.6	7.2	6.4	46.0	1.54	34.2	1.96	250	2.75
23	5-25-54 3-6 pm	19.6	13.7	8.9	4.8	53.6	1.56	27.3	1.93	249	2.64
24	6-13-54 8-11 am	18.3	12.8	6.7	6.1	39.8	1.71	36.0	1.76	244	3.45
25	6-16-54 5-8 am	17.3	12.1	5.2	6.9	34.1	1.59	37.6	1.89	255	3.47

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TABLE II

AIR INLEAKAGE AND POT VACUUM

<u>Month</u>	<u>Average Vacuum in Fume Vent Header at Pots, in H₂O</u>	<u>Average Air Leakage into Nitric Oxide Absorption System at 50 pots/day, scfm</u>	<u>Remarks</u>
December, 1953	1.3	270	About 50 scfm in through T-Al jet seal leg
January, 1954 (7th thru 31st)	3.4	245	New seal leg installed
February, 1954	3.7	260	
March, 1954	3.5	270	
April, 1954	2.8	280	
May, 1954	2.5	285	

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Figure 1

The Effect of Pot Gas Composition on the Amount of

NO_2 Absorbed in E-A2 as a Function of Instantaneous

Production Rates

Mols of NO_2 Absorbed in E-A2 per hr.

23.0 Tons U/day
19.5 Tons U/day
17.5 Tons U/day

Volume Ratio of H_2O to NO_2 in Gas to E-A2
(Air free basis)

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Figure 2.

The Effect of Pot Gas Composition on the Strength of
Acid Formed in E-A2 as a Function of Instantaneous
Production Rates

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Figure 3

Typical Pressure Drops for

Nitric Oxide Absorption System

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