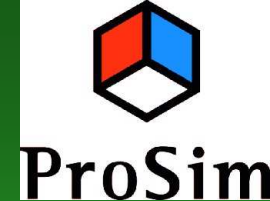




ANNA  
Ammonium Nitrate - Nitric Acid Producers Group  
2007 Conference  
Park City, Utah

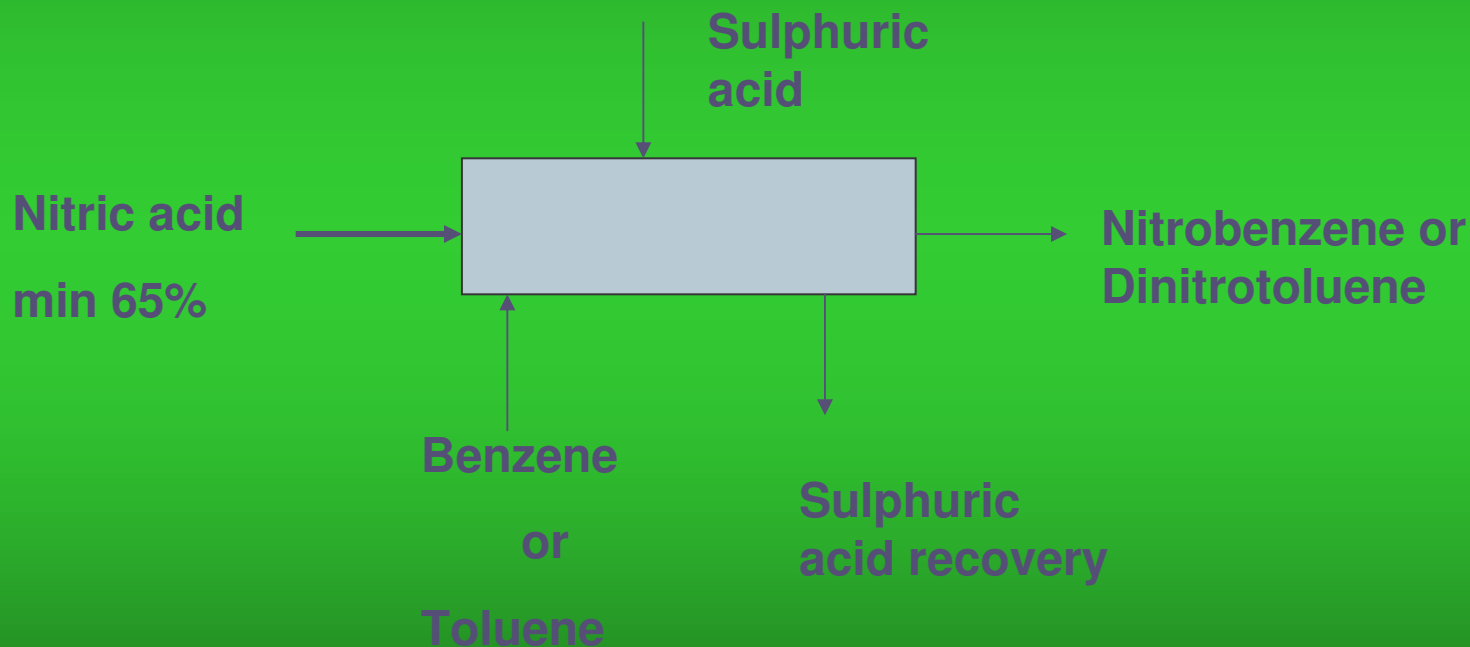


# Improving NA Concentration Through Modelling:

## Sensitivity Analysis on Pressure and Water Balances

- **Original designs by:**
  - In house programs
  - Equipment dedicated programs
    - » Absorber
    - » Cooler condensers
    - » Boiler
    - » Oxidation
  - Complexity of study out of normal conditions
  
- **Actual designs supported by simulation**
  - ProSimPlus HNO<sub>3</sub>

## • Azeotropic Nitric Acid (68%) for Nitration Units



- Capacity of Azeotropic Nitric Acid influenced by:
  - Pressure
  - Weather conditions



- Data from design stages

- Data from manufacturers

- **Data from design stages**
  - Heat Exchanger Surface
  - Design data from absorber/bleacher
  - Oxidation volume in pipes
  - Gas-Liquid Separators efficiency
  
- **Data from manufacturers**
  - Compressor efficiency
  - Compressor performance curves

- Water

- Pressure

- **Water**

- By reaction ( ammonia oxidation)
- From ambient air
- Water adding to the absorber

- **Pressure**

- According compressor performance curves



## •Water

–By reaction ( ammonia oxidation)

- Fixed by secondary air flow and ammonia/(ammonia + air) ratio

–From ambient air

- Controlled by saturation

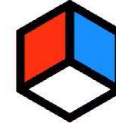
–Water adding to the absorber

- Fixed with a minimum flow



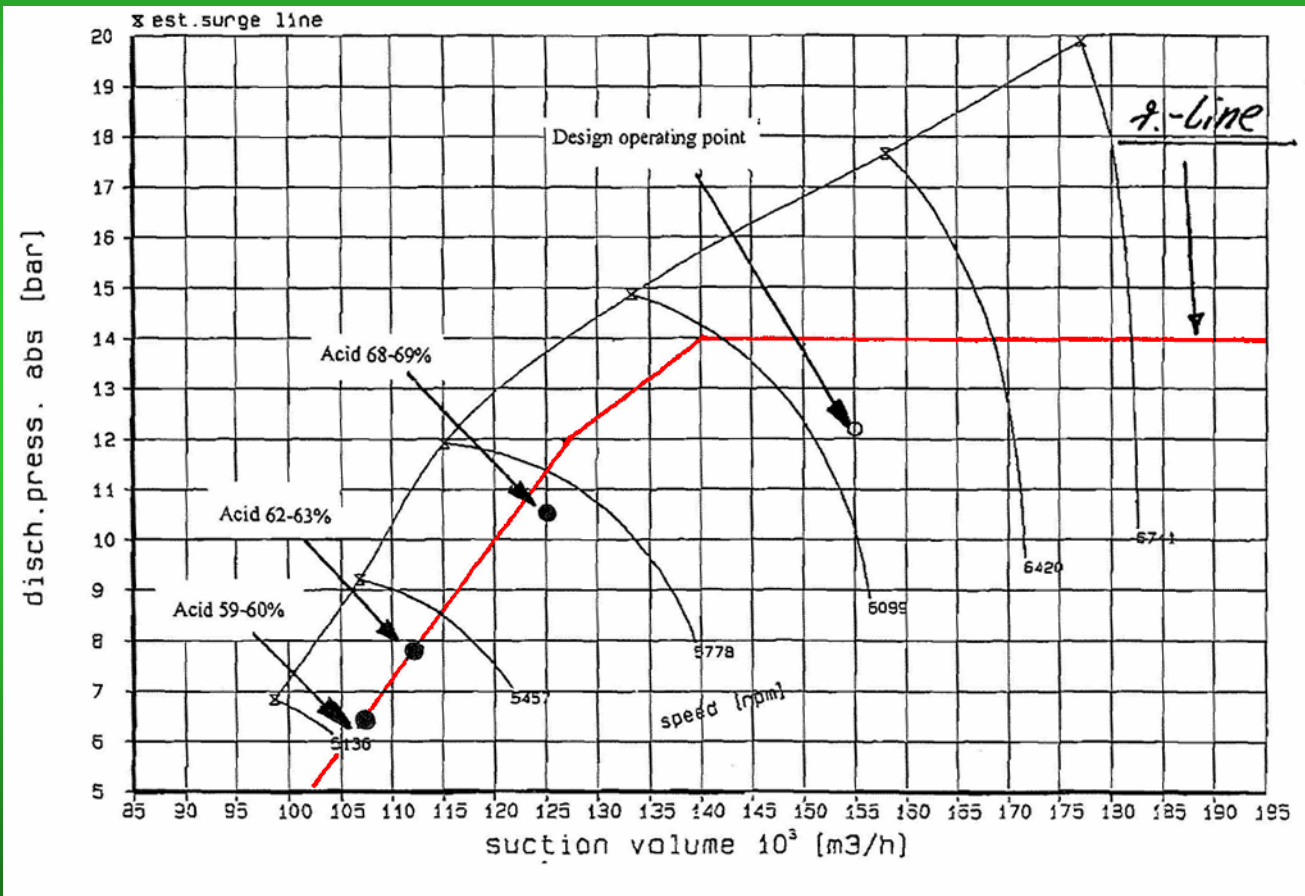
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# VARIABLES



ProSim

## • Pressure

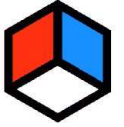






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# OPERATION DATA



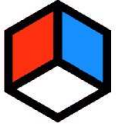
**ProSim**

<b>Air Flow</b>	<b>NO gas P</b>	<b>NA conc</b>	<b>NOX</b>
107000 Am <sup>3</sup> /h	6,3 bar g	59-60%	no data
112000 Am <sup>3</sup> /h	7,6 bar g	62-63%	630 ppm
120700 Am <sup>3</sup> /h	10,5 bar g	68-69%	225 ppm



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# CALCULATED AND OPERATION DATA



ProSim

## Air Flow

107000 Am<sup>3</sup>/h

112000 Am<sup>3</sup>/h

120700 Am<sup>3</sup>/h

## NO gas P

6,3 bar g

7,6 bar g

10,5 bar g

## NA conc

59-60%

62-63%

68-69%

## NOX

no data

995 ppm

630 ppm

605 ppm

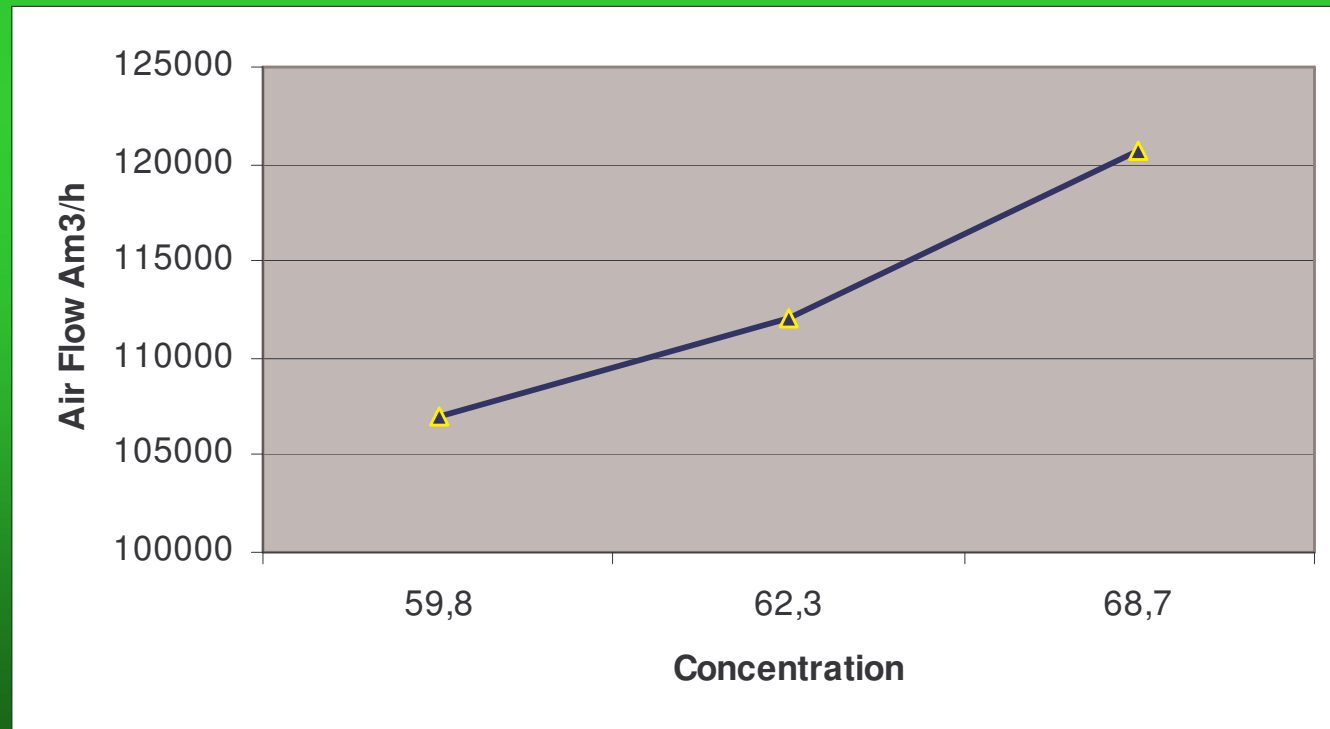
225 ppm

212 ppm

# OTHER CALCULATED AND OPERATION DATA

Data	Calculated	By Lab
Weak acid strength	28,7 %	28,0 %
Nitric acid temperature	49,4 C	48,5 %
HNO <sub>2</sub> in acid product	38 ppm	< 40 ppm

- Simulation values fit operation values
- Simulation can advance plant performance
- Minimum operation capacity 116000 Am<sup>3</sup>/h for 65 % conc



- 1) Simulation support design, but is not a design tool.
- 2) Simulation is the result of a mathematical model, the results must be checked by engineers for a right interpretation

**THANK YOU**