ALL IN FOR SAFETY

- Eastman is committed to enabling a safe and secure workplace for our team members, customers, and clients
- Ultimate goal of zero injuries and process safety incidents worldwide
- Safety is personal and everyone is accountable to work as safely as possible

Each person is ALL IN FOR SAFETY. Every shift, every day, here and away from work, in all activities
Aniline Chemistry

\[
\text{benzene} + \text{HNO}_3 \xrightarrow{\text{H}_2\text{SO}_4, \text{sulfuric acid}} \text{nitrobenzene} + \text{H}_2\text{O}
\]

\[
\text{nitrobenzene} + 3*\text{H}_2 \xrightarrow{\text{Pd}} \text{Aniline (aminobenzene)} + 2*\text{H}_2\text{O}
\]
Nitrobenzene
Nitrator
Nitrobenzene Column
Nitrator
October 4, 1960

Eastman’s Aniline Plant Explosion

Lodal, P. N. *Process Safety Progress*, vol. 23, 2004, 221-228

This Photo by Unknown Author is licensed under CC BY-ND
- 16 dead
- 48 hospitalized
- >250 injured
Aniline Plant Explosion Video

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It was a sunny Tuesday afternoon with all signs of Eastman Chemical Company's plant preparing to resume its operations for the day. Two men, Howard Young and D.J. Jenkins, were working on a transformer.

But then tragedy struck. A transformer exploded, sending debris flying through the air. Two men, including Howard Young, were killed in the blast. Eleven others were injured.

The blast left a crater in the ground and caused extensive damage to the nearby buildings. The explosion was heard for miles around.

Kingsport Times

Blast Toll 13

Eleven Identified. Two Lost, Presumed Dead

Darkest day 50 years ago
Aniline Chemistry

苯 + 硝酸

\[
\text{H}_2\text{SO}_4 \quad \text{硫酸}
\]

\[
\text{硝基苯} + \text{水}
\]

硝基苯 + 3*氢

\[
\text{钯}
\]

\[
\text{苯胺} (\text{胺基苯}) + 2*水
\]
Process flow diagram
“…the cause of the nitrobenzene column failure and initiation detonation is not known”

-Jan. 31, 1961 incident report
“…using newer analysis techniques and obtaining physical property data…have allowed us to piece together a possible scenario…”

Normal Conditions
Conditions on Oct. 4, 1960

19% Water
63% Nitric Acid
18% Nitrobenzene
A residue curve describes the change of the composition of the liquid phase of a chemical mixture during continuous evaporation at the condition of vapor-liquid equilibrium (open distillation). Multiple residue curves for a single system are called residue curve maps.
Residue curve map – Normal operating conditions

Ideal distillation mixture

Nitric Acid
86
Nitrobenzene
210
Water
100
Max Azeo
121
Min Azeo
99

Ideal distillation mixture
Residue curve map – Out of shock range

Ideal distillation mixture

Min Azeo 99
Max Azeo 121

Composition on 10/4/1960

Normal operating range

Nitric Acid 86
Nitrobenzene 210
Water 100
Residue curve map – Detonation

Composition on 10/4/1960

Nitric Acid
86
Nitrobenzene
210
Water
100
Max Azeo
121
Min Azeo
99
Two Liquid Phases
100°

Shock-sensitive region (unknown until data acquired from post-accident study)
"The farther back one can look, the farther forward one can see."

--Winston Churchill