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Benzene exposures related to maintenance work and major turnarounds

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Introduction Ron Bomer

- 1981 – 1996 Senior Laboratory Technician
- 1997 – 1998 Safety Advisor Rotterdam Refinery
- 1999 Chemist Rotterdam Refinery
- 2000 – 2006 Industrial Hygienist NL
- 2007 – 2013 Industrial Hygiene Coordinator Benelux and mentor of IH of Esso Slagen (N)
- 2014 – 2018 Industrial Hygiene Coordinator NL & IH TA Advisor Europe
- 2009 – 2014 Member of ExxonMobil Regional Response Team EMEA
- 2009 – 2018 Member of ExxonMobil IH Centre of Excellence EMEA

Evolution of exposure limit for Benzene

The Netherlands

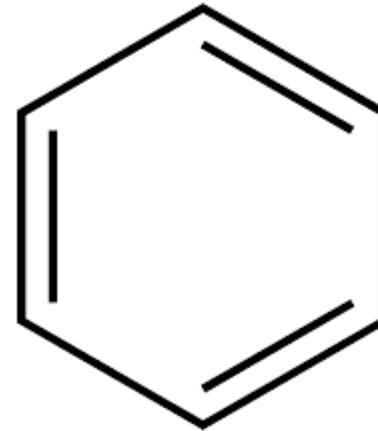
1985: 10 ppm

1999: 1 ppm

2003: 0.5 ppm (ExxonMobil)

2017: 0.2 ppm

2020+: 0.05 ppm (proposal Risk Assessment Committee ECHA)?



Turnaround of a world scale aromatics plant

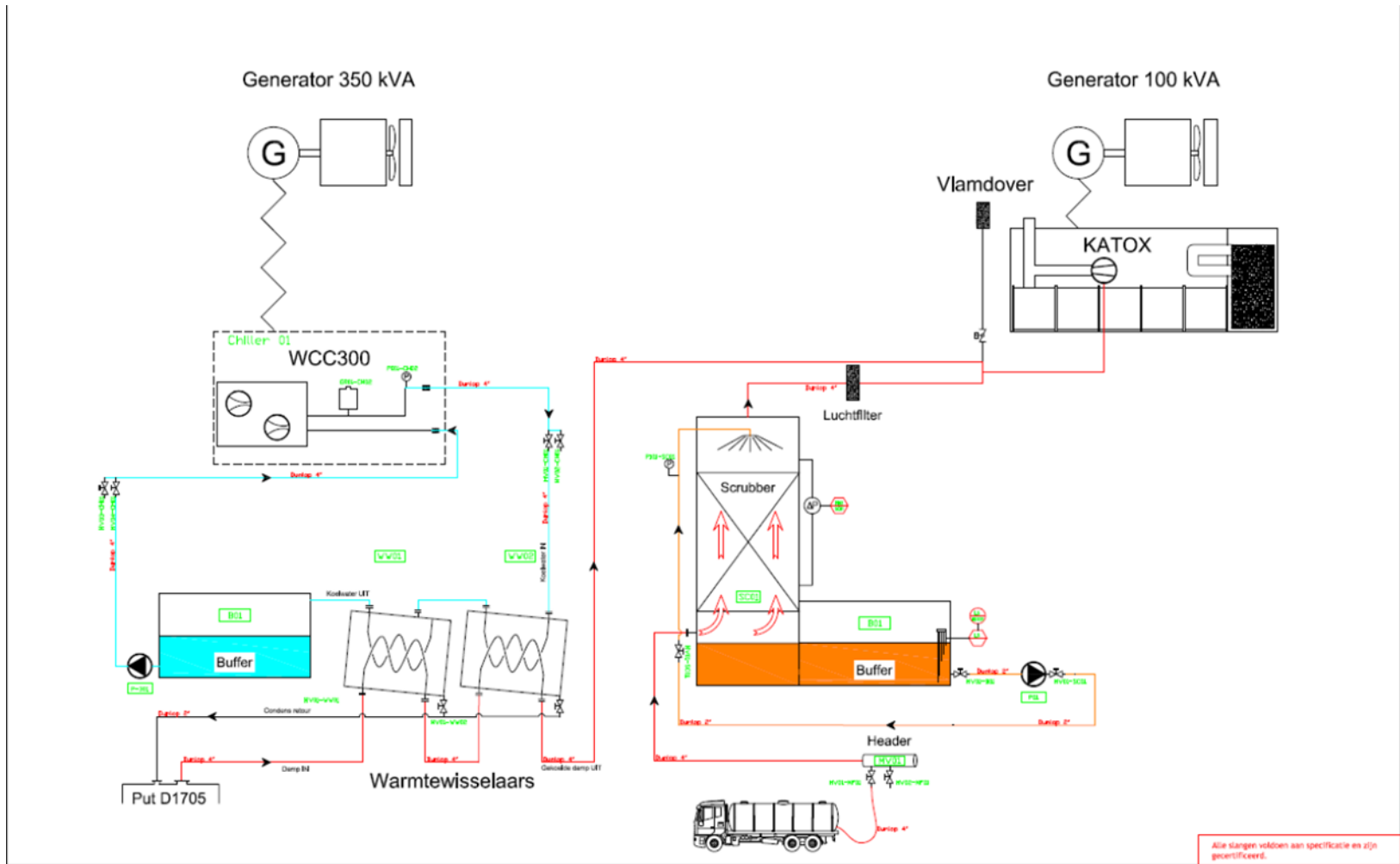
- Large Turnaround (>50 days) in 2014 with >1500 contractors on site.
- OEL Benzene 0.5 ppm (driven by ExxonMobil)
- Units involved in T/A:
 - Benzene loop (SFHU/SCN-, Sulfolane- & Benzene unit);
 - Xylene loop (p-Xylene crystalizer-, Parex-, o-Xylene & Isoformer unit);
 - Cyclohexane- & de-isopentanizer unit;
 - New Liquid Isoformer (connection to existing units).
- Objective:
 - Benzene emission reduction during shutdown;
 - **Zero** exposures above 0.5 ppm Benzene;
 - **Zero** reportable environmental incidents (air, water & soil) to authorities.

Turnaround of Aromatics Plant- Cont'd

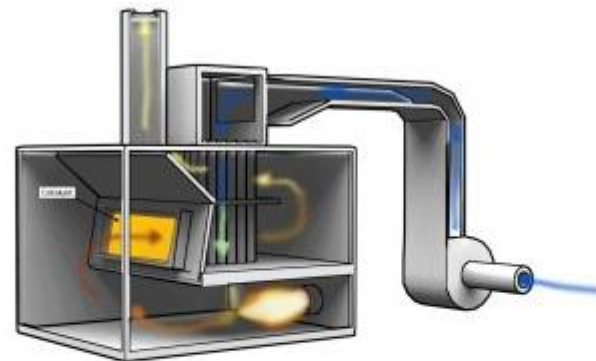
The following steps were taken:

- Waterwash at all units.
Water stored in dedicated tanks in order to achieve controlled draining to waste water treating plant (WWTP) in post T/A period.
- Chemical cleaning and steam out of several units
(removal of Benzene/Toluene/Xylenes and Iron Sulphide).
- Exhaust of sump (Hydrocarbons with >10wt% Benzene) processed by chiller, scrubber & KATOX (catalytic oxidatin skid) system.
- Vacuum trucks connected to scrubber and KATOX for vacuum to avoid emissions by exhaust of trucks followed by “discontinue” vacuum cleaning in the field.
- Unloading of vacuum trucks at dedicated storage containers (70 m³).
Containers are skimmed for HC's before controlled draining of water to WWTP.

KATOX



WCC300 MARK 2 FLUID CHILLER



Volatile Organic Compounds (VOCs) can be converted to carbon dioxide and water with a thermal oxidation reaction, operating typically above 750°C. Using catalytic recuperative or regenerative oxidiser this same reaction can be achieved at much lower temperatures in the presence of a catalyst. The resulting advantage over thermal oxidation is the potential reduction in support fuel use.

Benzene Emission Reduction

Result of all these actions:

- Zero emission of BTX around vacuum trucks
- Significant lower emissions during opening equipment and breaking flanges and decreased use of respiratory protective equipment
- Zero people exposed during shutdown
- No odor complaints from community
- No increased BTX at WWTP and no permit violations on water outlet to harbour
- No comments from local authorities

Turnaround of a Refinery (200 kbd)

- Large T/A (>50 days) in 2018 with >3500 contractors on site.
- OEL Benzene 0.2 ppm (driven by the Netherlands)
- Units involved in T/A and containing hydrocarbons with benzene:
 - Crude distiller & Crude Light Ends;
 - Coker Light Ends & Coker Naphtha Hydrofiner;
 - Gas treating units (Caustic, MEA & Merox);
 - Waste water treatment plant.
- Objective:
 - Benzene emission reduction during shutdown;
 - **Zero** exposures above 0.2 ppm Benzene;
 - **Zero** reportable environmental incidents (air, water & soil) to authorities.

Turnaround of Refinery - Cont'd

The following steps were taken:

- Waterwash at all units.
Water stored in dedicated crude tank in order to achieve controlled draining to waste water treating plant (WWTP) in post T/A period.
- Chemical cleaning and steam out of several units
(removal of Benzene/Toluene/Xylenes and Iron Sulphide).
- Soap wash of several drums to remove sludge from demisters and vortex breakers.
- Vacuum trucks connected to scrubber for vacuum to avoid emissions by exhaust of trucks followed by “discontinue” vacuum cleaning in the field.
- Unloading of vacuum trucks at dedicated storage containers (70 m³).
Containers are skimmed for HC's before controlled draining of water to WWTP.

Storage Containers



Benzene Emission Reduction

Results so far:

- Zero emission of BTX around vacuum trucks
- Significant lower emissions during opening equipment and breaking flanges (mainly below 0.2 ppm benzene) and decreased use of respiratory protective equipment
- Zero people exposed during shutdown
- No odor complaints from community
- No increased BTX at WWTP and no permit violations on water outlet to harbour

ExxonMobil