



# Removal of BTEX and PAHs from Chemical Wastewater

Equipment Capacity/Flow Rate  
Low Flow

Compounds of Concern  
BTEX & PAHs

Influent Concentration  
BTEX: 10-12mg/L  
PAHs 0.005µg/L

Treatment Targets  
>60%

Unit Energy Consumption  
tbc

## Background

The Nyex™ range of wastewater treatment technologies are well suited for the final removal of persistent organic contaminants.

BTEX compounds are among the most abundantly produced chemicals in the world and PAHs are a class of chemicals which occur naturally in coal, oil and gasoline. These contaminants therefore present a common challenge for the oil and gas industry in waste streams, including produced water as well as wastewater from the refinery.

A sustainable solution for their removal, without chemical dosing or the production of secondary waste is in high demand.

Produced water is a by-product of oil and gas extraction and the composition of this water can vary greatly, which can cause challenges when it comes to treatment.

Traditionally, produced water has been disposed directly to the sea or injected into disposal wells.

Nowadays, oil and gas organisations are considering more environmentally considerate alternatives, such as onsite

treatment which enables this contaminated water to be safely reused.

Refinery wastewater refers to effluent from the processing facility which can start out with very high levels of contamination and hazardous chemicals.

Following a pre-treatment step, Nyex™ is extremely effective at destroying the remaining hard-to-degrade chemicals so that this water can be safely reused or discharged in-line with the strictest regulatory limits.



For treatment to remain consistently effective, a flexible process like Nyex™ is ideal, as it is easily adjusted to suit the varying contamination loading, without over-treating which increases operational costs.



## The Projects

Arvia have partnered with companies to remove contaminants commonly found in wastewater from the Oil and Gas industry, including BTEX (referring to the chemicals benzene, toluene, ethylbenzene and xylene) and PAHs (Poly Aromatic Hydrocarbons).

BTEX are volatile organic compounds (VOCs) and aromatic hydrocarbons which occur naturally in crude oil, so they are typically found in refinery wastewater. They can also be found in sea water where gas and petroleum deposits are being taken.

PAHs are hydrocarbons (organic compounds containing only carbon and hydrogen) which are made up of multiple aromatic rings and are often very persistent in nature.

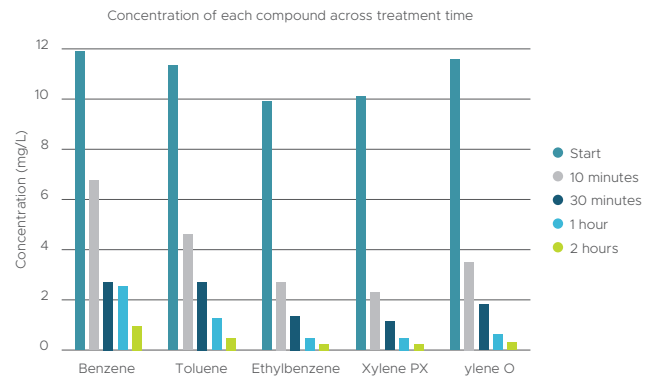
## The Results

### BTEX Treatment Results

For the BTEX study, the compounds used were benzene, toluene, ethylbenzene, ortho-xylene (xylene O) and para-xylene (xylene P). The starting solution for the experiment was composed of a mixture of approximately 10-12mg/L of each of the 5 compounds.

As these compounds are commonly found together, treatment was conducted on a mixture of these contaminants (further trials can be conducted for single compound enquiries, as required).

The focus of the trials was to reduce the concentrations to as low as possible. The Nyex-e electrochemical oxidation system was selected, resulting in the treatment profiles detailed in Figure 1.

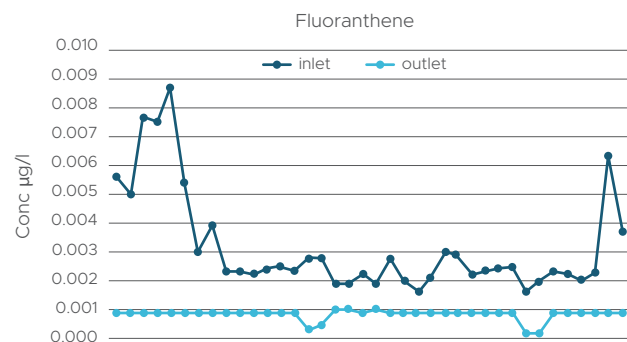


The trial showed that BTEX compounds can be oxidised down to low levels. Trials achieved over 96% removal on average (average of the 5 compounds). Dependant on individual concentration targets, treatment can be prolonged, or parameters adjusted, to reach levels in line with strict regulation.

### PAH Treatment Results

Due to concentrations being much lower for PAHs (in the  $\mu\text{g/L}$  range), the Nyex-a system was selected because this process overcomes mass transport limitations. The combination of adsorption with electrochemical oxidation in the Nyex-a system means treatment is targeted to the localised (adsorbed) contaminant, where the highly reactive hydroxyl radicals are produced.

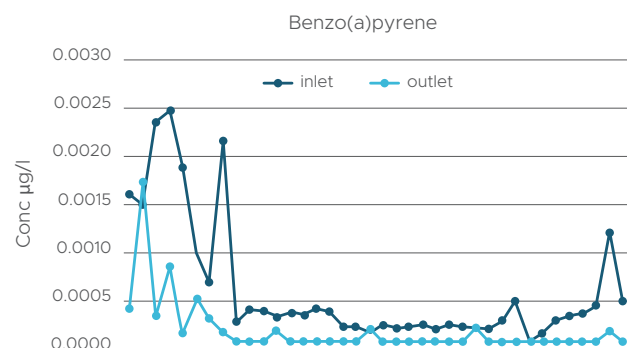
Fluoranthene and benzo(a)pyrene were treated from a live wastewater stream over a 9-month period, achieving an average of >68.3% and >62.6% removal respectively as evidenced in Figures 2 and 3.



### Benzo Results

The outlet value is often at the limit of quantification of the instrument, for example  $<0.001 \mu\text{g/L}$ . This work demonstrates the efficiencies of the Nyex-a process, even when working at low and varying inlet concentrations, consistently removing the contaminants over a long treatment period.

For more information on the Nyex-e or Nyex-a processes, or to find out about trials for single compound enquiries CONTACT US to arrange for one of our consultants to analyse your wastewater.



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Get in touch to discuss your company's treatment challenges and arrange a treatability trial on your wastewater today.