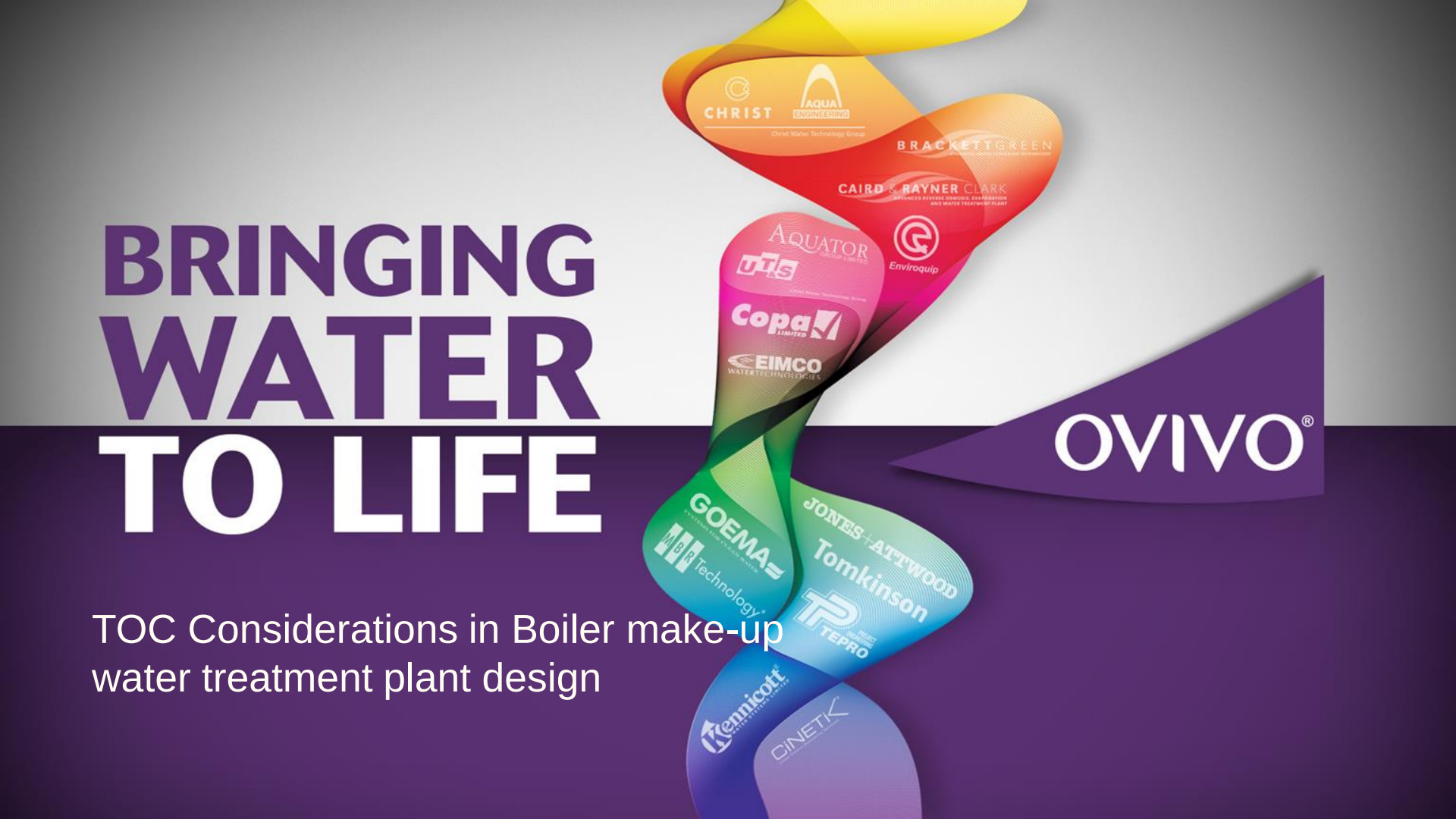
BRINGING
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TO LIFE
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AQUA ENGINEERING
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CAIRD & RAYNER CLARK
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OVIVO®
GOEMA
MET Technology
JONES ATTWOOD
Tomkinson
TEPRO
Kennicott
DINETIK
TOC Considerations in Boiler make-up
water treatment plant design

- Ovivo Energy are a specialist water treatment engineering company, brought about by the collection of several leading water treatment companies from around the world, including Kennicott, Brackett Green, EIMCO, Aqua Engineering.

- Through the application of BAT we are able to offer customers the full range of water treatment processes available to exceed the ever increasing demands for ultra pure feed water for todays super and ultra critical boilers.

- The vanguard for ‘better water quality’ we see is Total Organic Carbon (TOC) reduction with limits moving ever closer to < 50 ppb

Current TOC Specifications in Power Plants

- No specification in the past
  only 10 – 10 – 10 rule
  > 10 MΩ·cm = < 0.1 µS/cm
  < 10 ppb SiO_2
  < 10 ppb Na

- Since 1999: TOC < 200 ppb (VGB / (EU))

- In USA: TOC < 100 ppb
  (Electric Power Research Institute)

TOC = Total Organic Carbon (in general terms)

TOC	=	**POC**	+	**DOC**
		(Particulate OC)		(Dissolved OC)
		colloids		
		> 0.45 micron		< 0.45 micron
		not measured by		
		on-line TOC analysers		
		(only UV oxydation)		

Often the driving factor for selecting the correct boiler water make-up plant process.

DOC or Natural Organic Matter (NOM) can be divided in 5 forms:

1) Natural hydrophobic compounds (natural lipids released from bacteria and algae)

2) Polysaccharides, hydrophilic (HMW products from bacteria and algae)

3) LMW neutrals, hydrophilic (metabolic products like alcohols, aldehydes, ketones and amino acids)

4) LMW organic acids (short living advanced metabolic products)

5) Humic substances or humics (HMW by-products of bacterial decay)

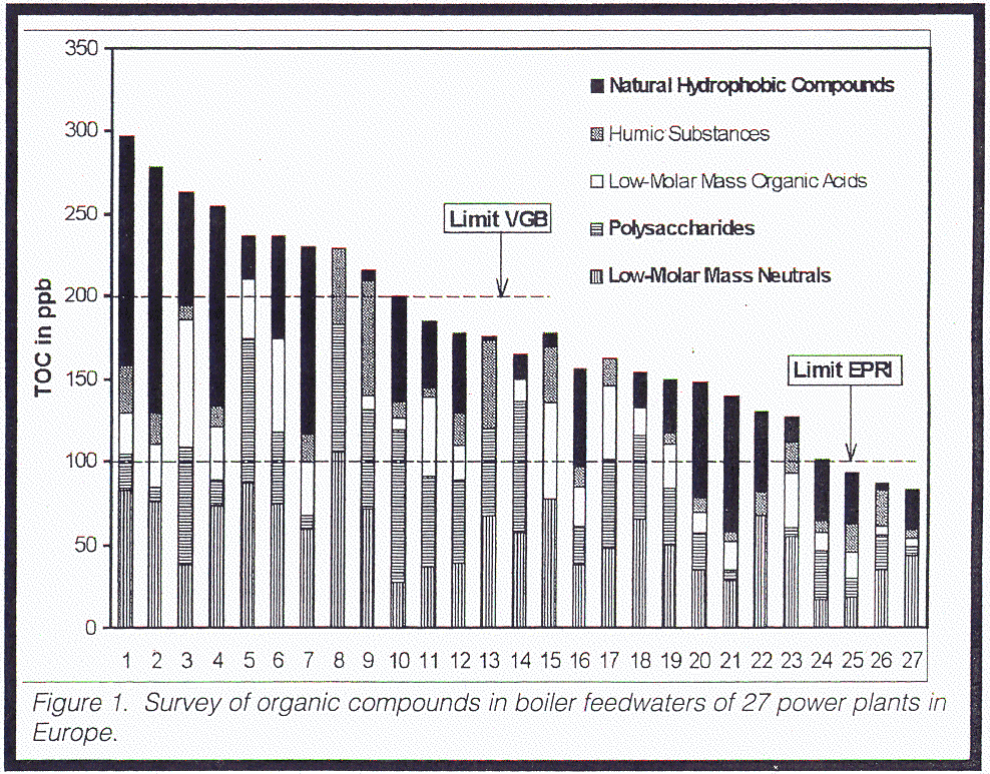

Figure 1. Survey of organic compounds in boiler feedwaters of 27 power plants in Europe.

TOC Characterisation to guarantee process

1) Each of these ‘types’ of NOM react differently to treatment processes , so the optimum process route relies on knowing the feedwater compostion of TOC (Characterisation of TOC) to enable the correct selection of process. i.e

Floculation, Clarification, Media filtration, Ion exchange, UF/RO, UV, Ozonation etc

Ovivo are able to run TOC Characterisation tests to determine the TOC make-up of samples and from our extensive experience in the power and semicon markets, recommend the optimum process route for our customers.

Conclusion

- Each process step has specific reduction rates for each NOM family
- TOC concentrations in raw water is not sufficient for an optimum design → high safety factor
- Detailed fractionation of TOC in major groups allow a precise design (if specific removal rates for each process are known)
- 80% removal can only be anticipated using conventional IX based systems
- 90-95% removal usual using RO based systems (single or twin pass RO).