

# Smart fouling prevention with MOL®LIK Catalyst

Jan Koppe - MOL Katalysatortechnik GmbH

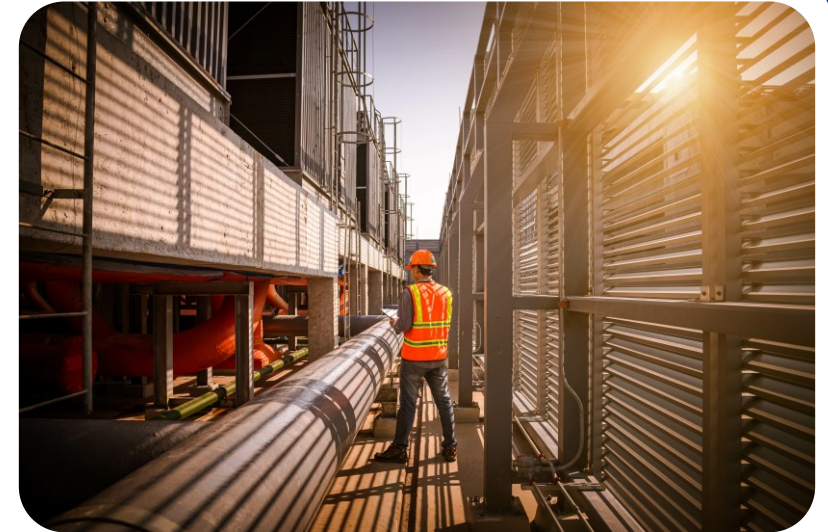
18<sup>th</sup> September 2020

**VISION ZERO.**  
NULL UNFÄLLE – GESUND ARBEITEN!  
Wir machen mit!



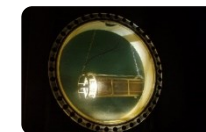
# Agenda

- 1) Catalytic water treatment – What is possible?
- 2) Implementing a MOL<sup>®</sup>System
- 3) Ideas for Common Project Follow-up



**Projects objective:**

**Ensuring a compliant cooling water operation with moderate maintenance efforts.**



## Assessment from the Federal Institute for Occupational Safety and Health (BaUA) from 3<sup>rd</sup> March 2017:

*„[...] das MOL<sup>®</sup>LIK-Verfahren in der ... beschriebenen Wirkweise und Bestimmung [unterfällt] nicht der Biozid-Verordnung (EU) Nr. 528/2012) [...]“*

*Translation:* The MOL<sup>®</sup>LIK-technology with the described principle of working is not subject to the European Biocides Regulation Nr. 528/2012



Cooling circuits



Membrane-Systems



Storage-Tanks



Process-Water



HVAC

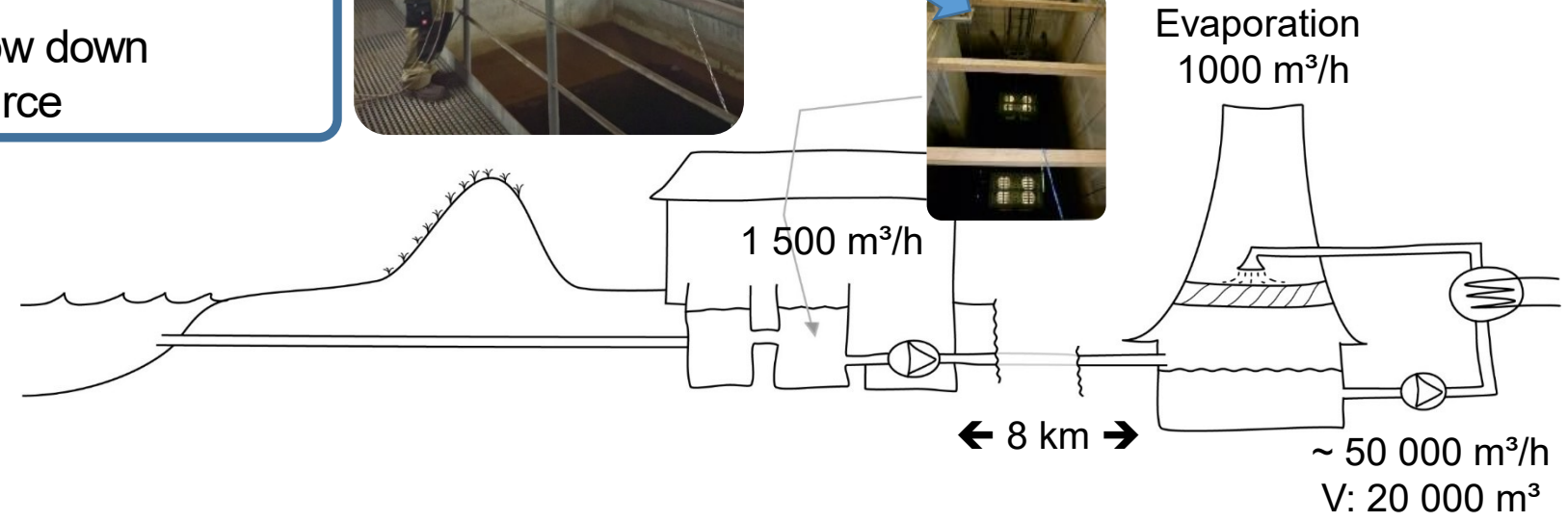
One technology – so many possibilities!



# What is possible?

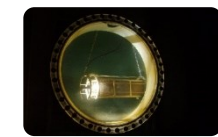
Coal Power Plant Rostock/Warnemünde - Germany

Kraftwerk Rostock KNG



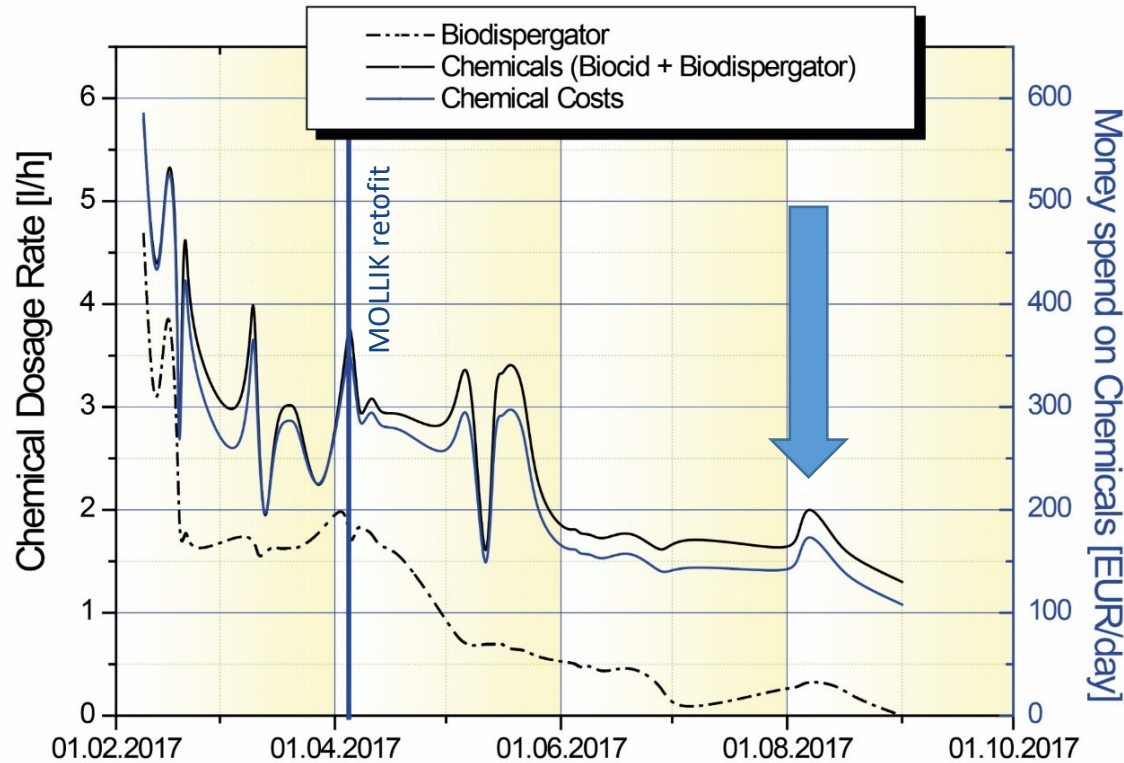
Customers Benefit

- Everything within the guidelines
- Stable cooling water quality
- None biocides required
- Improved COC
- Usage of blow down as energy source



# Development of Chemicals at 25 MW Cooling Tower

What is happen with chemicals efficiency?



**Customers Benefit** Better  $\Delta T$  (~1.2 K)  
Improved chemicals efficiency



Make-up: Condensate from sugar production		
25 MW Cooling Tower	Conventional	MOL <sup>®</sup> LIK Project
Total money spend at chemicals	200 till 600 EUR/day	Step by step Reduced to 100 EUR/day
	Feb - March (59 days) 21000 EUR	April -14 <sup>th</sup> September (167 days) 28500 EUR
Money saved at chemicals	<b>0.00 EUR</b>	<b>&gt; 31 000 EUR</b>

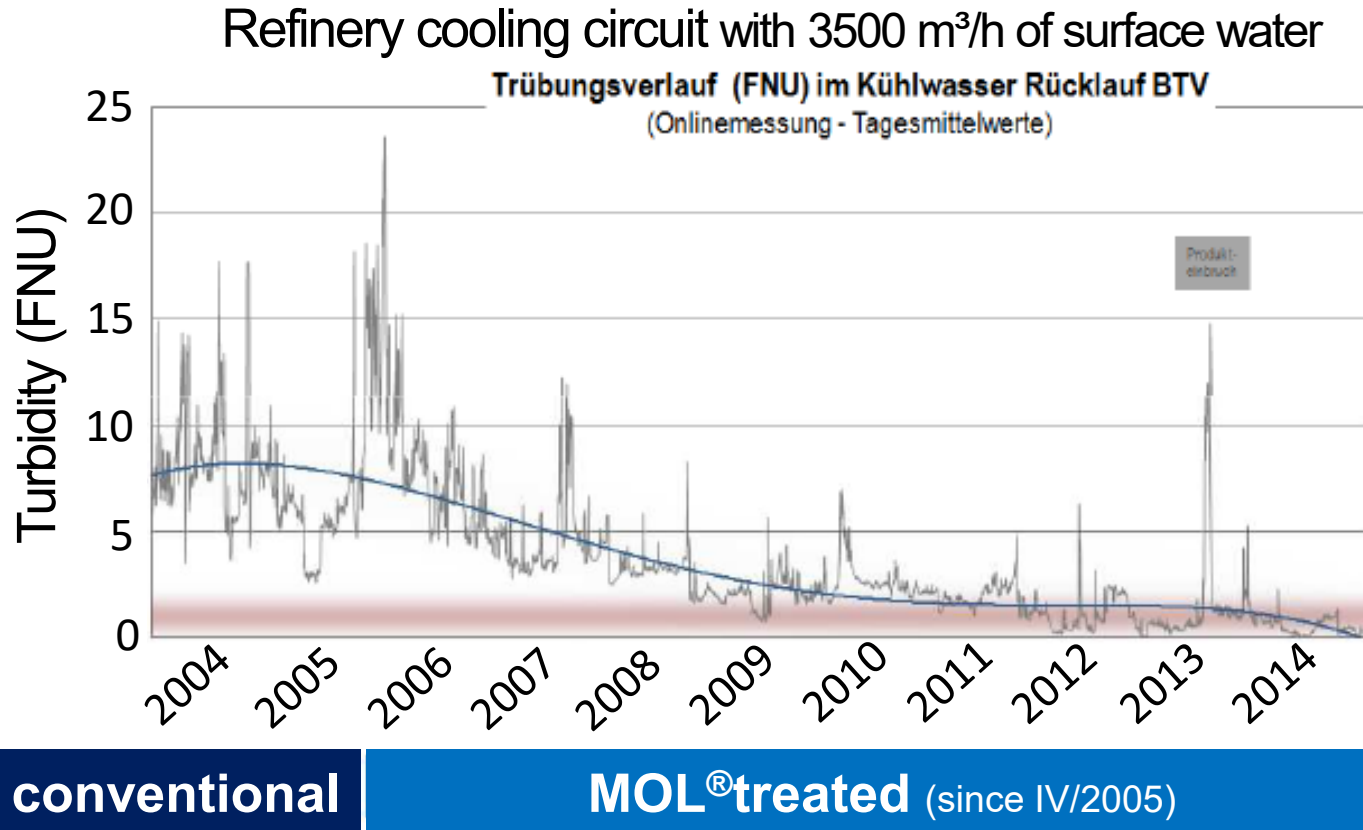
Based on:  
Water Structures & Membrane Systems  
Koppe, J. & Battagello, G. // 2<sup>nd</sup> International MerWaterDays 2017

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...MOL<sup>®</sup>LIK projects are optimizing the chemical demand



# Development of Turbidity at refinery cooling water

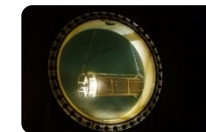


Based on: BAYERNOIL Journal 04/2014 – p 23



## Customers Benefit

- Stable performance
- Less cleaning & chemicals
- Satisfy legal obligations



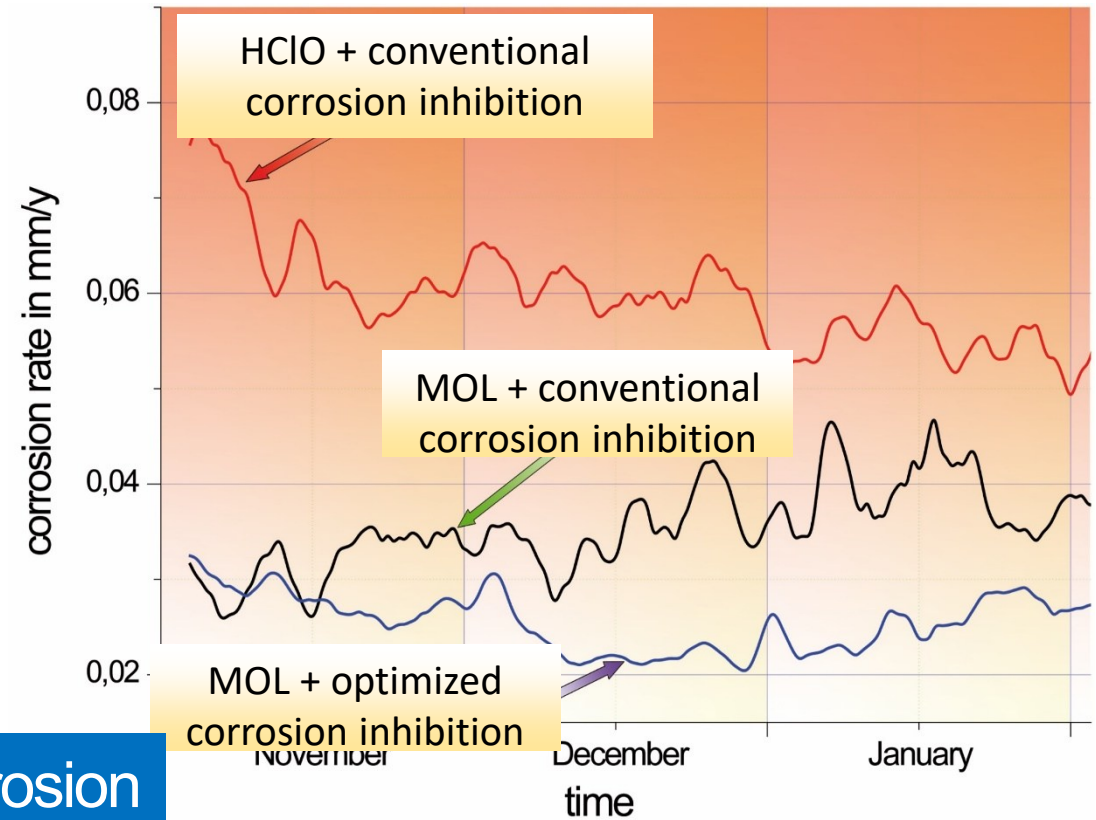
# Development of Corrosion rate at cooling water

- Lukoil
- Bayernoil
- Gaspromneft
- Natural-draft cooling towers
- CLARIANT

All Russian projects supported by



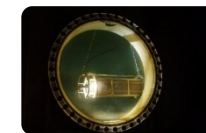
Minimizing Deposits → Less Troubles with Corrosion



Based on:  
Passivschichten - wlb - September 2009

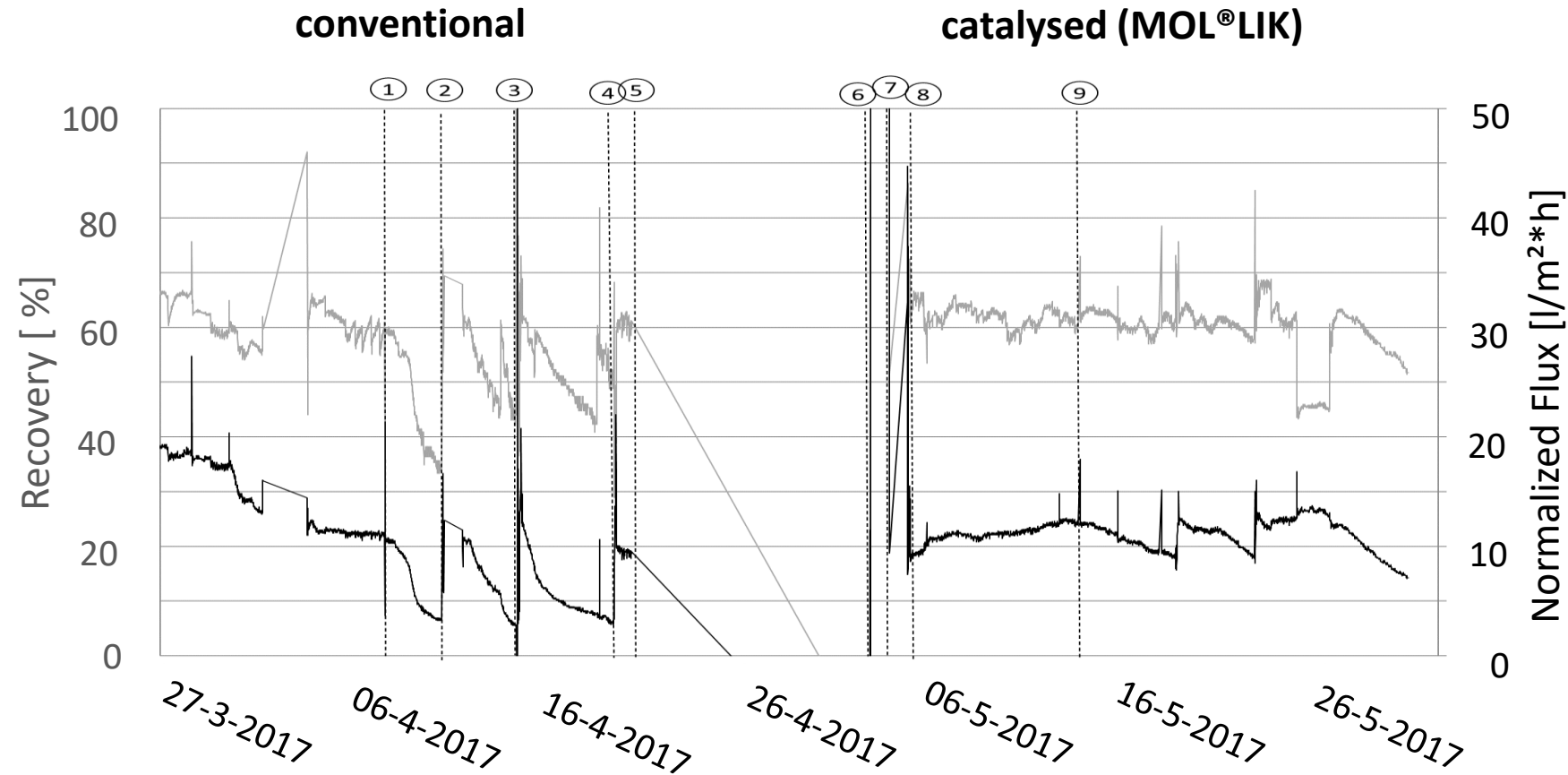
MOL Katalysatortechnik GmbH & PCK Raffinerie GmbH

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# Water reuse – Catalytic benefit @ Membranes



Based on: Reyniers, S.; Depuydt, V.: Chemicalienvrije Afvalwater Recuperatie in de VoEdingsindustrie – CARVE Project Meeting - Tussentijdse meeting; 23<sup>th</sup> June 2017;



**Customers Benefit**  
**Increased flow**  
**Reduced CIP**

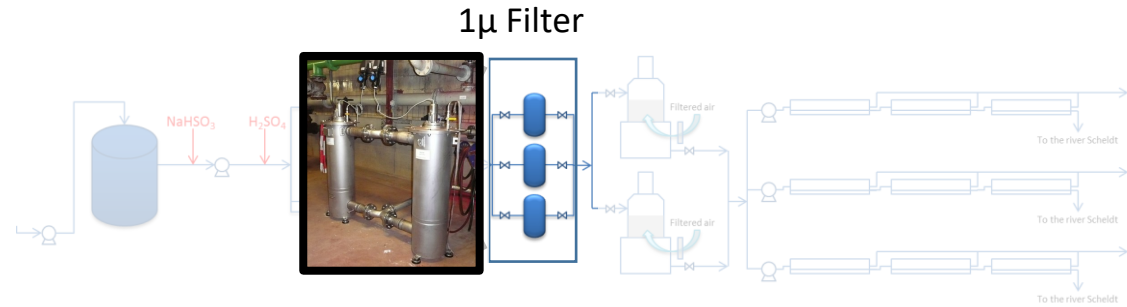




# Membrane Systems @ Surface Water



aquatreat<sup>®</sup>

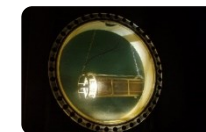


## RO-Prefilters @ INESCO plant in Antwerp/Belgium

WTU Inesco

	Conventional	MOL <sup>®</sup> LIK
Average Flow Rate	40 m <sup>3</sup> /h till 90 m <sup>3</sup> /h	65 m <sup>3</sup> /h till 100 m <sup>3</sup> /h
Average difference pressure	0.1 till 0.3 bar	0.05 till 0.1 bar
CIP-Intervall	2 till 3 days	30 days

Performance of filters in challenging area with different strategies



# Membrane Systems @ Surface Water

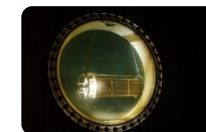
**MOL<sup>®</sup>LIK-Effect on Membranes Performance** of INESCO plant in Antwerp/Belgium



- ✓ **Rising** efficiency of chemicals
- ✓ **No biofouling** on RO membranes
- ✓ **Continuously flow rate** of 120 m<sup>3</sup>/h
- ✓ **Reducing CIP** more than 50 %
- ✓ **Increasing** membrane **life time**

CAPEX: 60 000 EUR

OPEX: 7 000 EUR

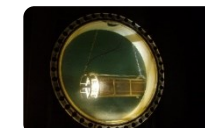
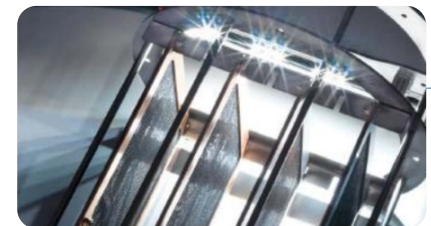




# Financial Facts

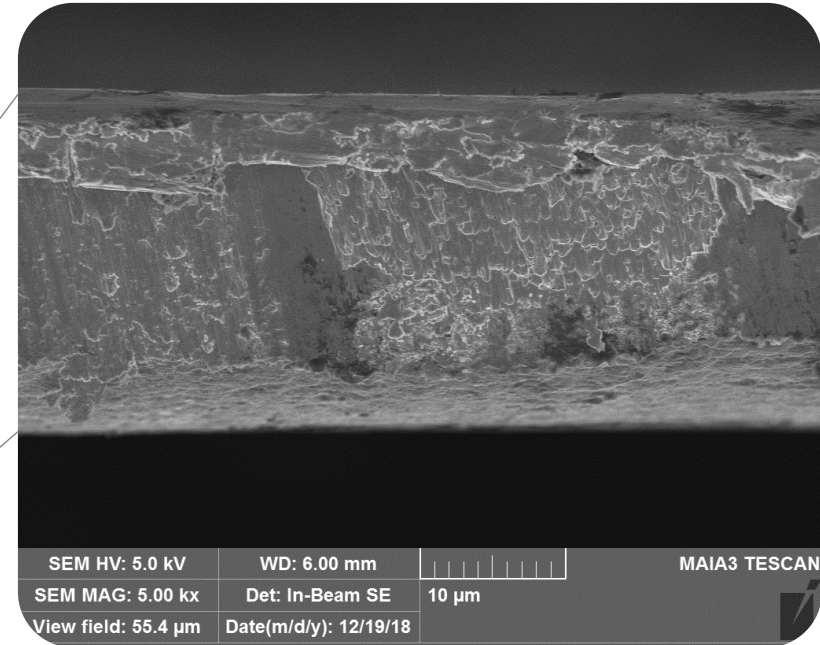
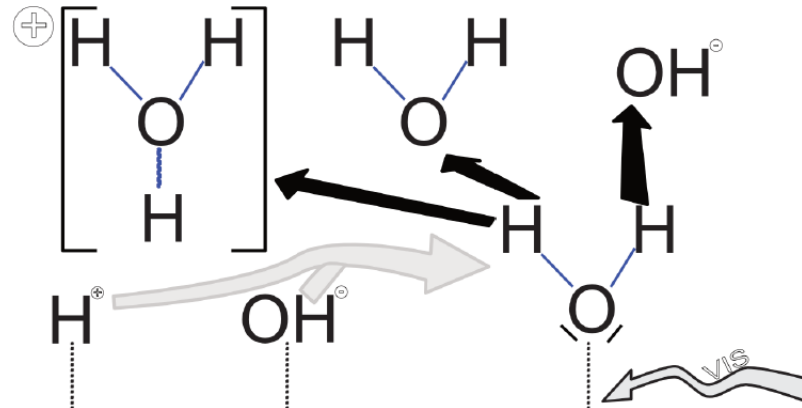
Kind of System	Details	CAPEX	OPEX
<b>Power Plant</b>	Make-up: 1 500 m <sup>3</sup> /h // Cooling Capacity: 600 MW Make-up Quality: Sea Water Circulation rate: ~ 50 000 m <sup>3</sup> /h Volume: 20 000 m <sup>3</sup> // COC: 2.0 till 3.0	110 000 EUR	7 000 EUR/Year
<b>Cell Cooling Tower</b>	Make-up: 70 m <sup>3</sup> /h // Cooling Capacity: 25 MW Make-up Quality: Condensate (from sugar production) combined with decarbonized water Circulation rate: ~ 2 500 m <sup>3</sup> /h Volume: 320 m <sup>3</sup> // COC: ~ 5.0	110 000 EUR	3 000 EUR/Year
<b>RO</b>	Make-up: 4 m <sup>3</sup> /day // Quality: MBR-Water	500 EUR	100 EUR/Year
<b>RO</b>	Make-up: 250 till 450 m <sup>3</sup> /h // Quality: Surface-Water Permeate-Capacity: 3 x 120 m <sup>3</sup> /h	60 000 EUR	7 000 EUR/Year

Life time of the MOL<sup>®</sup>LIK catalyst: 10 years



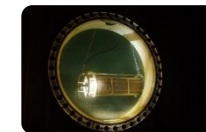
# Water & Catalysis – the tool for small gas bubbles

The catalyst – a mineral metal combination



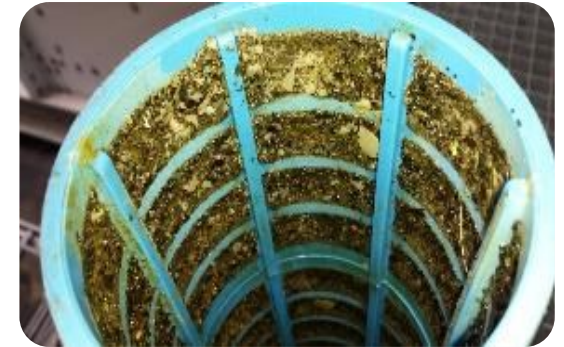
Professor Dr. Su Benshueng  
Engineering Research Institute  
Beijing University of Chemical Technology

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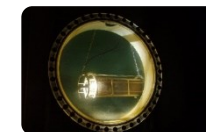
# Implementing a MOL<sup>®</sup>System

Cleaning before MOL <sup>®</sup> LIK	Not cleaning before MOL <sup>®</sup> LIK
Stays clean from day 1	Takes longer
	A risk of blocked filters
	Filters exchanged more frequently



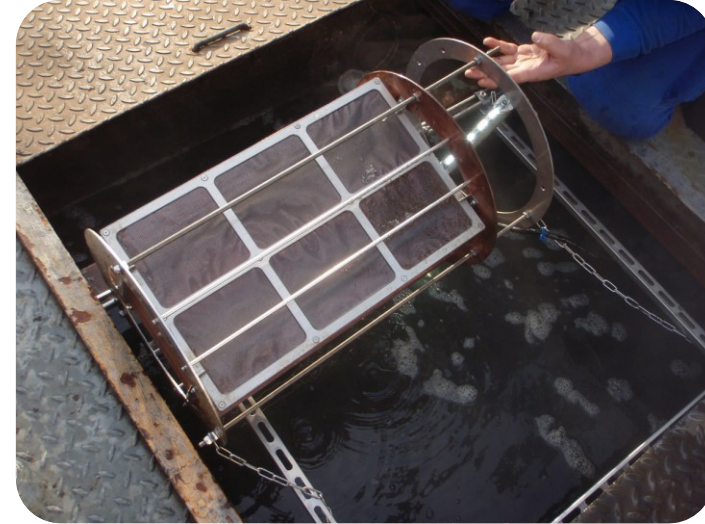
Source: E. Mazo Bedia

We recommend a conventional cleaning of your system before installing MOL<sup>®</sup>LIK!



# Installation

- ✓ The catalyst should be covered by a sufficient water level
- ✓ The water should not flow against the catalyst foils, but through the openings
- ✓ Please follow also the instructions contained in the user manuals





# Maintenance & Service

Parameter	Recommended Interval	Target value/target condition
Check of the equipment	Weekly	Check of the water level and led-module <b>The MOL<sup>®</sup>LIK-catalyst must be completely covered by water.</b>
Control the circulating water for detached deposits.	Every 2 till 6 weeks	Detached deposits should be removed from the circulating water <ul style="list-style-type: none"> <li>Therefore, partially replace the water.</li> </ul>
Check of the MOL <sup>®</sup> LIK unit for possible deposits.	Every 2 till 6 weeks	Such deposits can reduce the MOL <sup>®</sup> LIK-effect. <ul style="list-style-type: none"> <li>Remove these deposits gently (e.g. with a soft brush &amp; slight water flow)</li> </ul>
Functional check by an authorized service technician.	Annually	





Chemicals	Demand	
	kg/h	kg/a
SUEZ SPECTRUS OX1272 [Biocide] NaOCl + NaOH		
SUEZ DEPOSITROL BL6502 [Deposit control agent] C <sub>2</sub> H <sub>4</sub> Na <sub>4</sub> O <sub>7</sub> P <sub>2</sub> Phosphonic acid, (1-hydroxyethylidene)bis-, sodium salt		
STP polymer [Stress Tolerant Polymer]		
Anything more???		

*Data of technical situation at selected application*

→ **Targets:**

1. Reducing the issues with deposits
2. Optimisation chemical demand

→ **With MOL<sup>®</sup>LIK:**

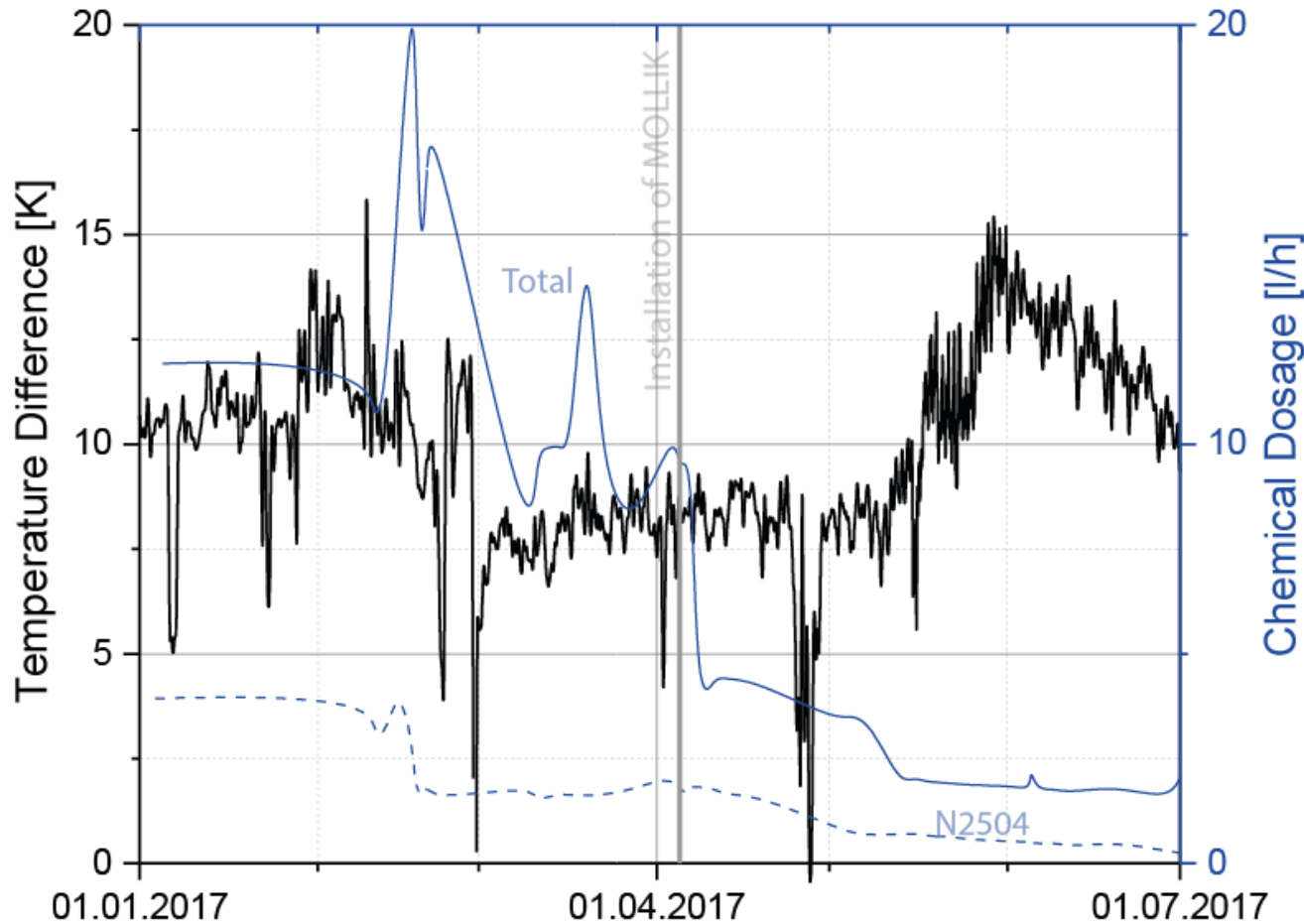
1. Reduction of biocides
2. Rising efficiency of hardness stabilizers & corrosion inhibitors

Question: Are there any information on current chemical dosing situation?



# Development of Chemicals – what is possible with MOL<sup>®</sup>LIK

What is happen by excess chemical dosage – further effects?



	conventional	MOL <sup>®</sup> LIK Project
Average N2504	1.7 l/h 18 <sup>th</sup> Feb. until 4 <sup>th</sup> April	0.42 l/h 5 <sup>th</sup> June until 1 <sup>st</sup> July (last value 0.2 l/h)
➤ 75 % reduction		
Average N8514+	10.8 l/h 18 <sup>th</sup> Feb. until 4 <sup>th</sup> April	1.4 l/h 5 <sup>th</sup> June until 1 <sup>st</sup> July (last value 1.5 l/h)
➤ 85 % reduction		

...Optimization @ chemical dosage → improving cooling performance



## Ideas of common project Follow-up:

- **Make-up & Cooling Water** (every two weeks)
  - **LSI / COC / Conductivity / Calcium Retention** of cooling water
  - **Iron / Copper / Turbidity** (only in case of troubles) of cooling water
  - Detailed history of so far used products  
(What? How much? How often?)
- **Cooling tower**
  - **Microbiological condition** (Legionella)
  - **Circulation pump performance** and **temperature trend**
  - Date of last cleaning & approximate cleaning frequency with required efforts
  - Photographic documentation
- **Heat exchangers**
  - **Flow** and temperature trend
  - **k-values**
  - Maintenance procedure
- **Backwash properties/ Differential pressure** of filters in cooling circuit

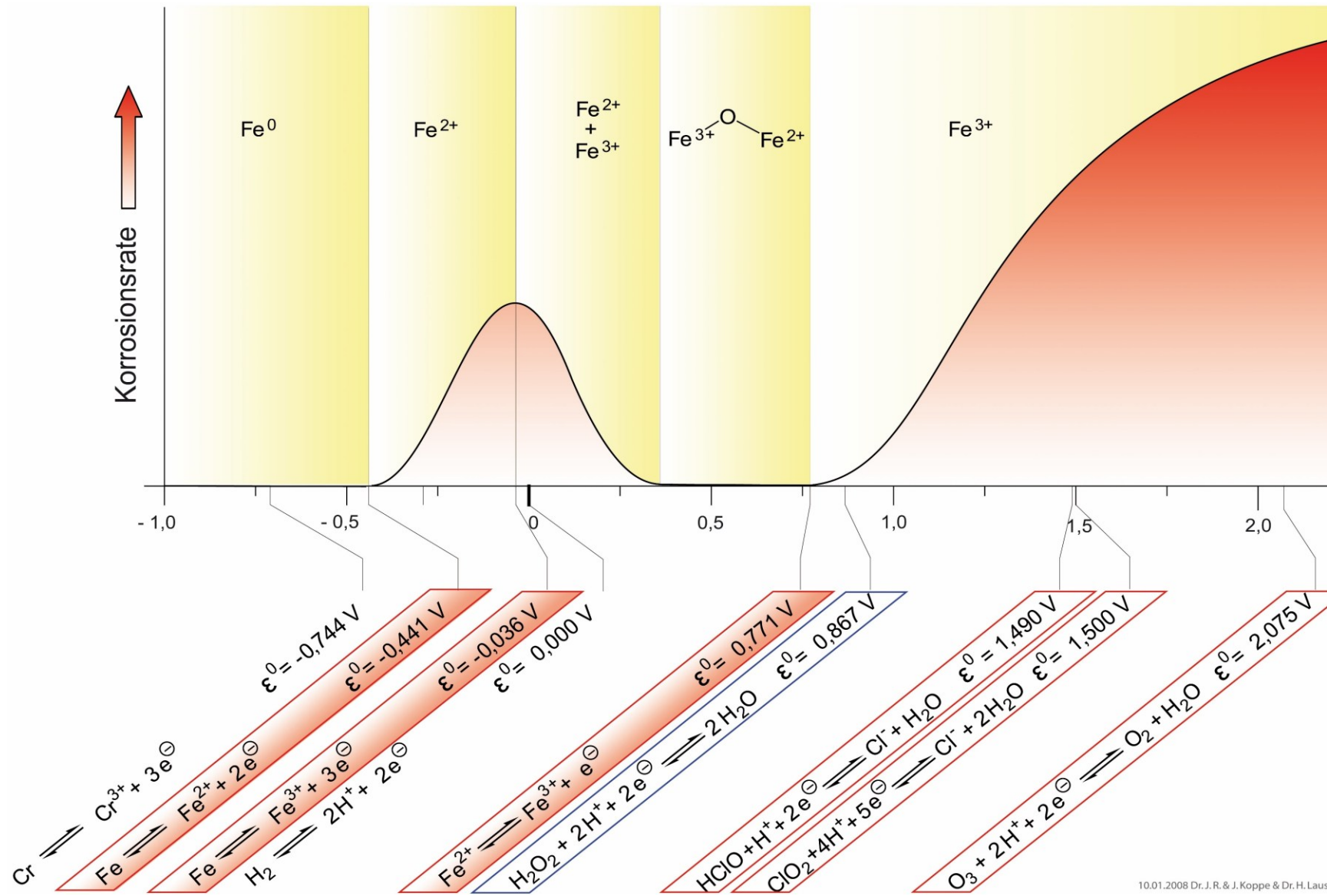
Selected data are also required for the time frame before the installation of MOL<sup>®</sup>LIK, with continuous sending to MOLKAT during the project



Thanks on your attention



# Korrosion & Wasser



10.01.2008 Dr. J. R. & J. Koppe & Dr. H. Lausch

# Korrosion & Wasser

