



Drinking Water Quality

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**DRINKING WATER : SIMULTANEOUS NEED
FOR ADEQUATE DISINFECTION AND
MINIMIZATION OF DBPs.
PRACTICAL EXPERIENCES**

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Chlorinated drinking water : simultaneous need for adequate disinfection and minimization of DBPs.

PRACTICAL EXPERIENCES

AGENDA

1. Importance of Drinking Water Disinfection
2. Disinfection By Products: Limits & Reduction Techniques
3. Practical Plant Experiences:
 - A. Plant A: ClO_2 + GAC introduction
 - B. Plant B: GAC introduction
4. Conclusions

Chimica D'Agostino SpA



Founded in 1947 in Bari,

Chimica D'Agostino produces:

- Inorganic Coagulants: Iron and Aluminium salts used in Water Treatment.
- Liquid and Powder Detergents and Food Processing Sanitizers
- Liquid and Water-Soluble Fertilizers



ALBANIAN BRANCH:

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During the exhibition you can meet us in our booth

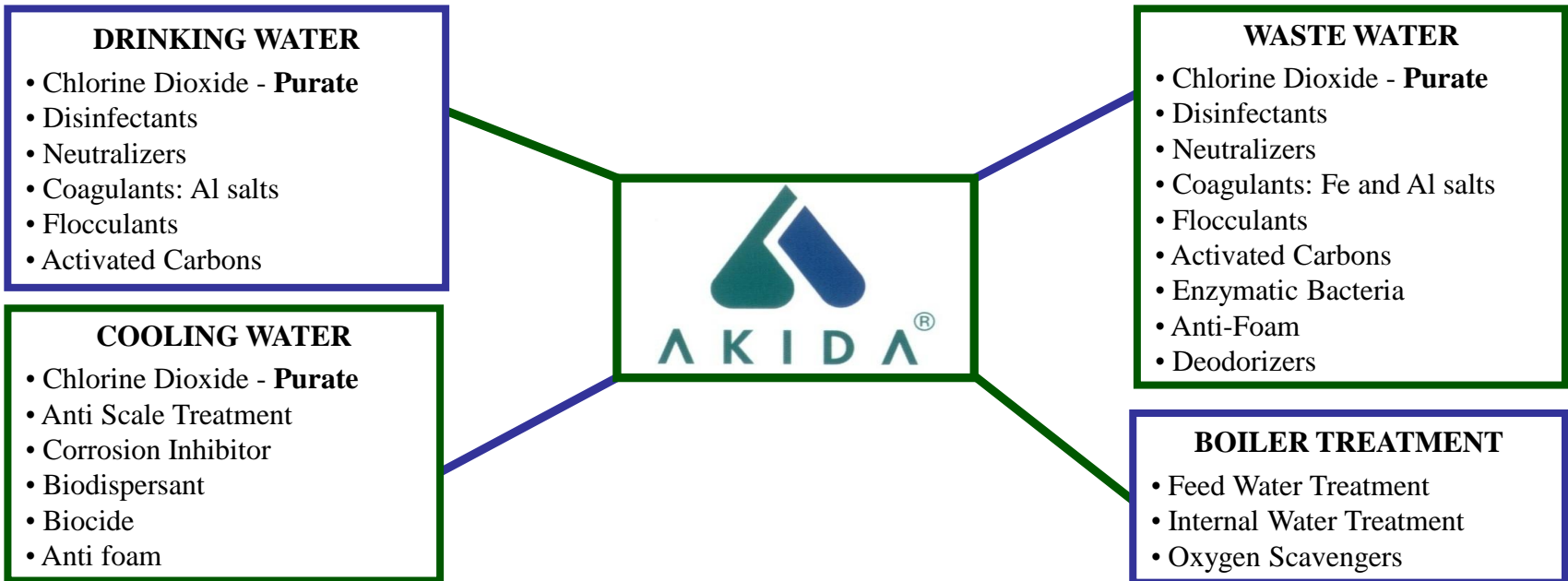


Chimica D'Agostino SpA

AKIDA is the name of the Water Treatment specialized branch.

AKIFLOC is the trade name of our coagulants and flocculants.

AKIDA is a service-oriented organization based on skilled technical specialists, capable to give full support to our customers.



SICAV, our subsidiary, produces and reactivates Activated Carbons.



Drinking Water Disinfection

“Efficient Disinfection must **NEVER** be compromised”

WHO – World Health Organization
Guidelines for Drinking Water Quality

According to WHO data and estimates:

3.4 million people, mostly children, **die annually** from
water-related diseases

EUROPE: over **13.500 deaths/y** (5.3% of all deaths)
estimated for children aged 0–14 years

In 14 European countries, between 2000 – 2007 :
354 outbreaks of waterborne diseases related to
drinking-water. Over **47.617 episodes** of illness

Drinking Water Disinfection

Great importance of disinfection:

- Disactivation of Pathogenic Microbes: Bacteria, Virus, Protozoa

Safe drinking water → protect the public

CHEMICAL or PHYSICAL DISINFECTION

- **Chlorine: Most Used**
- Chlorine Dioxide
- Ozone
- UV radiation
- Efficiency
- Stability/Persistence
- Ease of application
- Cost

➤ **DBPs: Disinfection By Products**

Drinking Water Disinfection

	CHLORINE DIOXIDE	CHLORINE	OZONE	UV
Production method	On site production by chemicals	Cl ₂ , Gas NaClO, liquid CaClO, solid	Air or Oxygen; Electricity	Electricity
Solubility in water	Good (10 times more than chlorine)	Low	Very low	N/A - Highly influenced by water turbidity
Persistence in water	Days	Days	Minutes	NO residuals
Biocidal Efficiency	High	Medium	Very High	Medium
pH Influence	NO Influence	Extreme	Low	NO Influence
DBP (Disinfection By Products)	Chlorites; Chlorates	THM, AOX and other chlorinated organics: Pot. Carcinogenic	Bromates: Pot. Carcinogenic	Nitrites
Total Cost	Medium	Low	High	High

*Comparison of the characteristics of the main disinfectants used in drinking water treatment.
Adapted from EPA 815-R-99-014, April 1999*

Disinfection By Products

- **WHO: Guideline Values for 15 DBPs**

- **EU- Directive 98/83/CE (THM4 = 100 µg/l (T, D) + 1 THM5)**

Disinfection by-products	Guideline value ^a (µg/litre)	Remarks
Bromate	10 ^b (A, T)	
Bromodichloromethane	60 ^b	
Bromoform	100	
Chlorate	700 (D)	
Chlorite	700 (D)	
Chloroform	300	
Cyanogen chloride	70	For cyanide as total cyanogenic compounds
Dibromoacetonitrile	70	
Dibromochloromethane	100	
Dichloroacetate	50 ^b (T, D)	
Dichloroacetonitrile	50 (P)	
Monochloroacetate	20	
1,1,1-Trichloroethane (NDMA)	100	
Trichloroacetate	200	
Trichlorophenol, 2,4,6	200 (C)	
Trihalomethanes		The sum of the ratio of the concentration of each to its respective guideline value should not exceed 1

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out

or DBPs

THM reduced limits:

Denmark, Netherlands: **25 µg/l**

Austria, Italy: **30 µg/l**

Germany, Hungary, Luxembourg: **50 µg/l**

→ Possible reduction in the next EU directive

Disinfection By Products

Basic strategies for DBPs reduction:

- Addition of different disinfectants to the existing treatment:
 - **Ozone:** - High investment and costs
 - Only for PRE-disinfection
 - **ClO₂ :** good choice for THM reduction
 - ClO₂ + Chlorine : synergistic effect
 - Very pure ClO₂: No Chlorine → NO THM
 - For both PRE & POST-disinfection
- PURATE Technology**

Disinfection By Products

Basic strategies for DBPs reduction:

- **Reduction of DBPs' precursors in the raw water:**
 - Water Safety Plan: protection of the source
 - Filtration or Absorption of precursors
 - **Powder ACTIVATED CARBONS**
- **Non-chemical disinfection: UV or membranes**
 - Not applicable to medium-large plant: **COSTS**
- **Removal of DBPs prior to water distribution:**
 - Dedicated Techniques (resins, special treatments)
 - Absorption on **Granular ACTIVATED CARBONS**

Activated Carbons

Powdered: PAC – Single use: Dosed in the raw water and removed in the sedimentation phase: **seasonal use**

Granular : GAC – Fixed filtering beds: **efficient use**

Used for the removal from the water of:

- Taste and Odour, TOC & DOC, Pesticides and organic compounds, cyano-bacterial toxins

Made from various substances:

- Coal, Coconut shell, Wood

→ **Raw material has a huge influence on properties and performances**

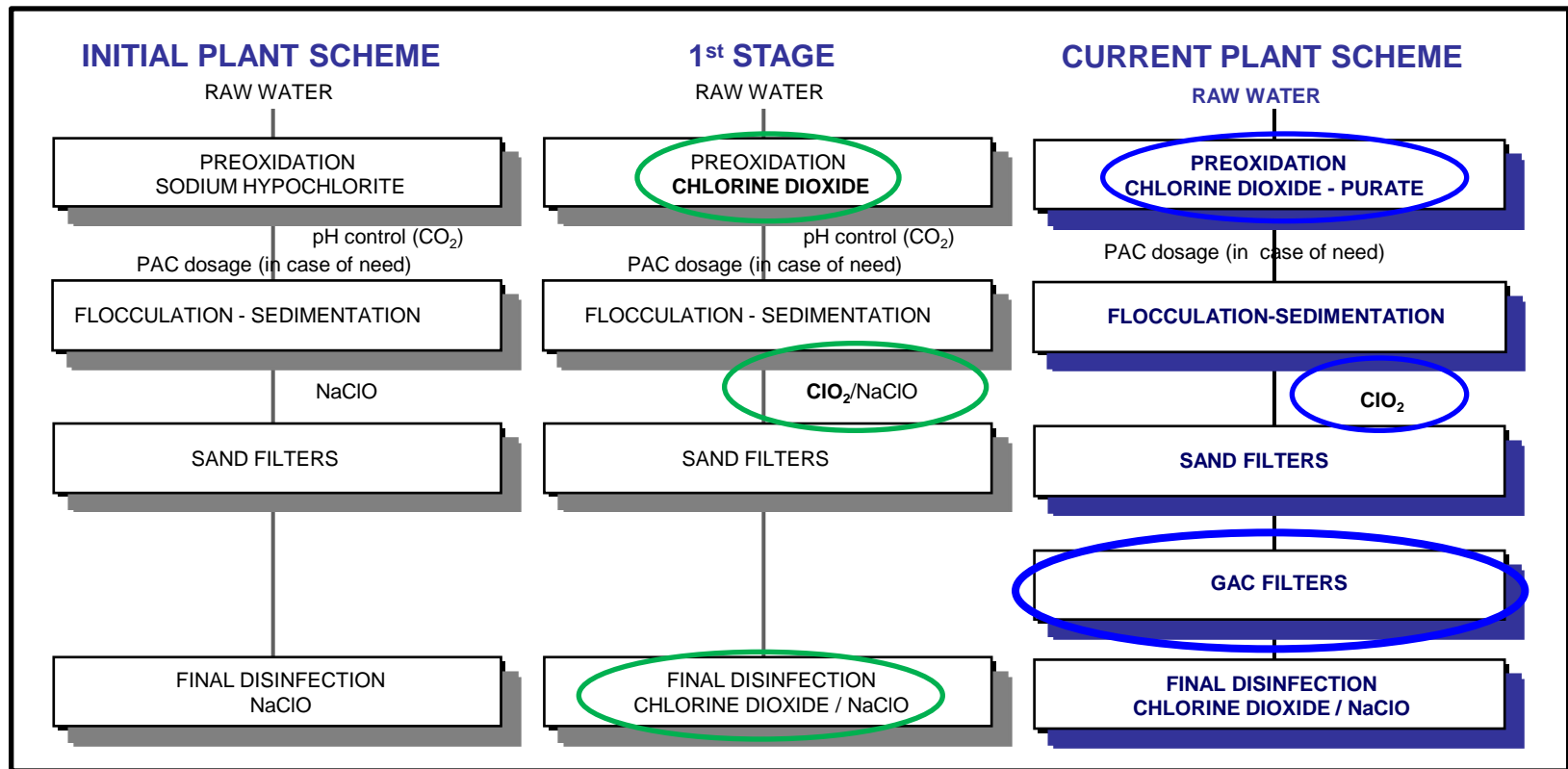
When GAC is exhausted can be reactivated

ENVIRONMENTAL FRIENDLY

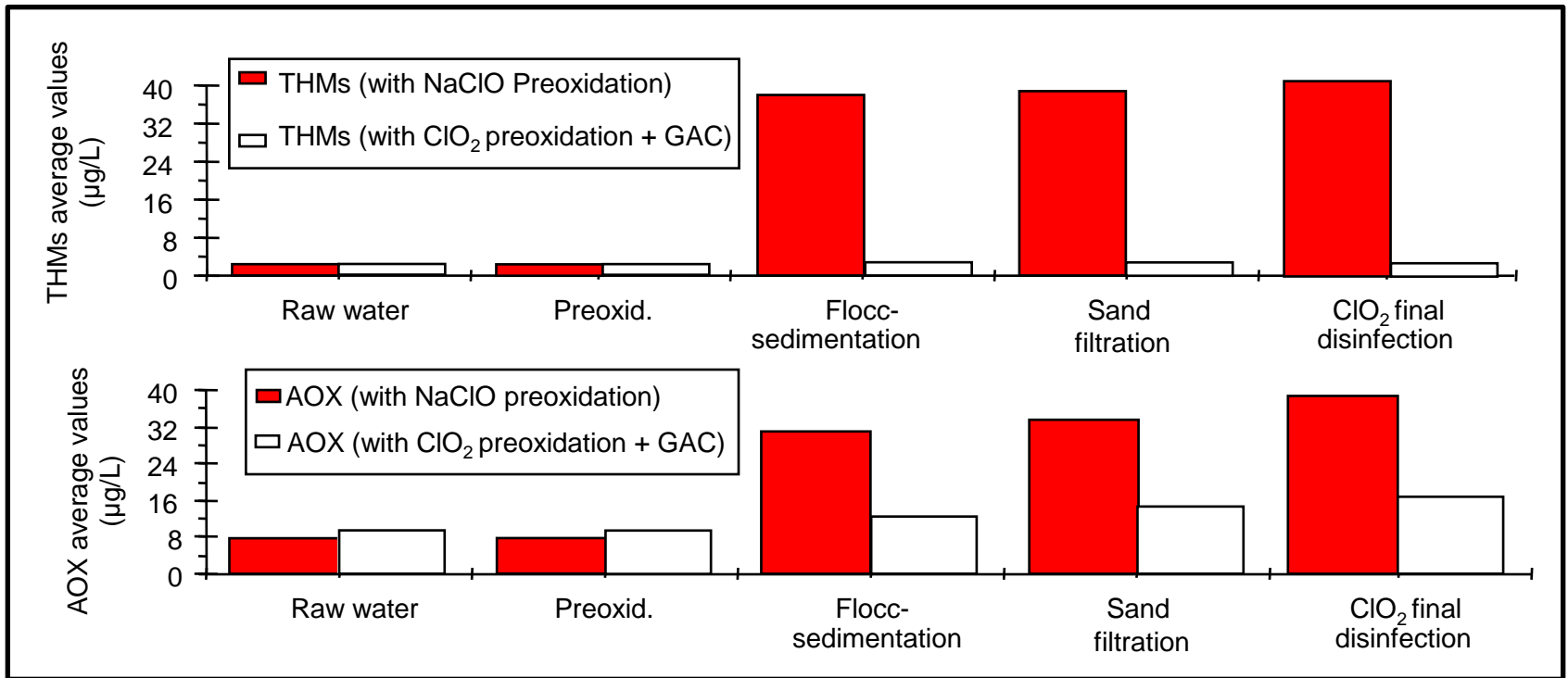
Practical Experience: Plant A

Drinking Water TP – Production: about 57 Mm³/y

- Raw water from a river: high variability
- Raw water class.: A3 (need for a deep chemical & physical treatm.)



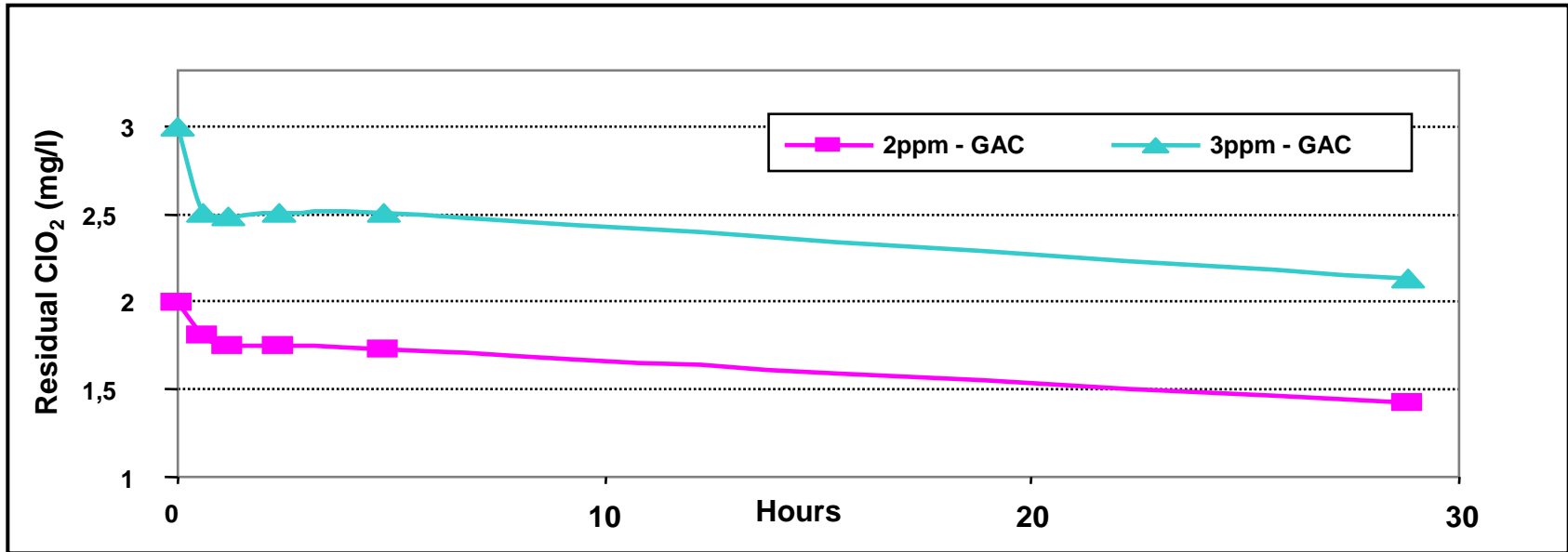
Practical Experience: Plant A



Thanks to the use of ClO₂ and GAC filtration:

- Huge reduction of THMs : up to **-85%**
- Reduction of AOX: about **-50%**

Practical Experience: Plant A



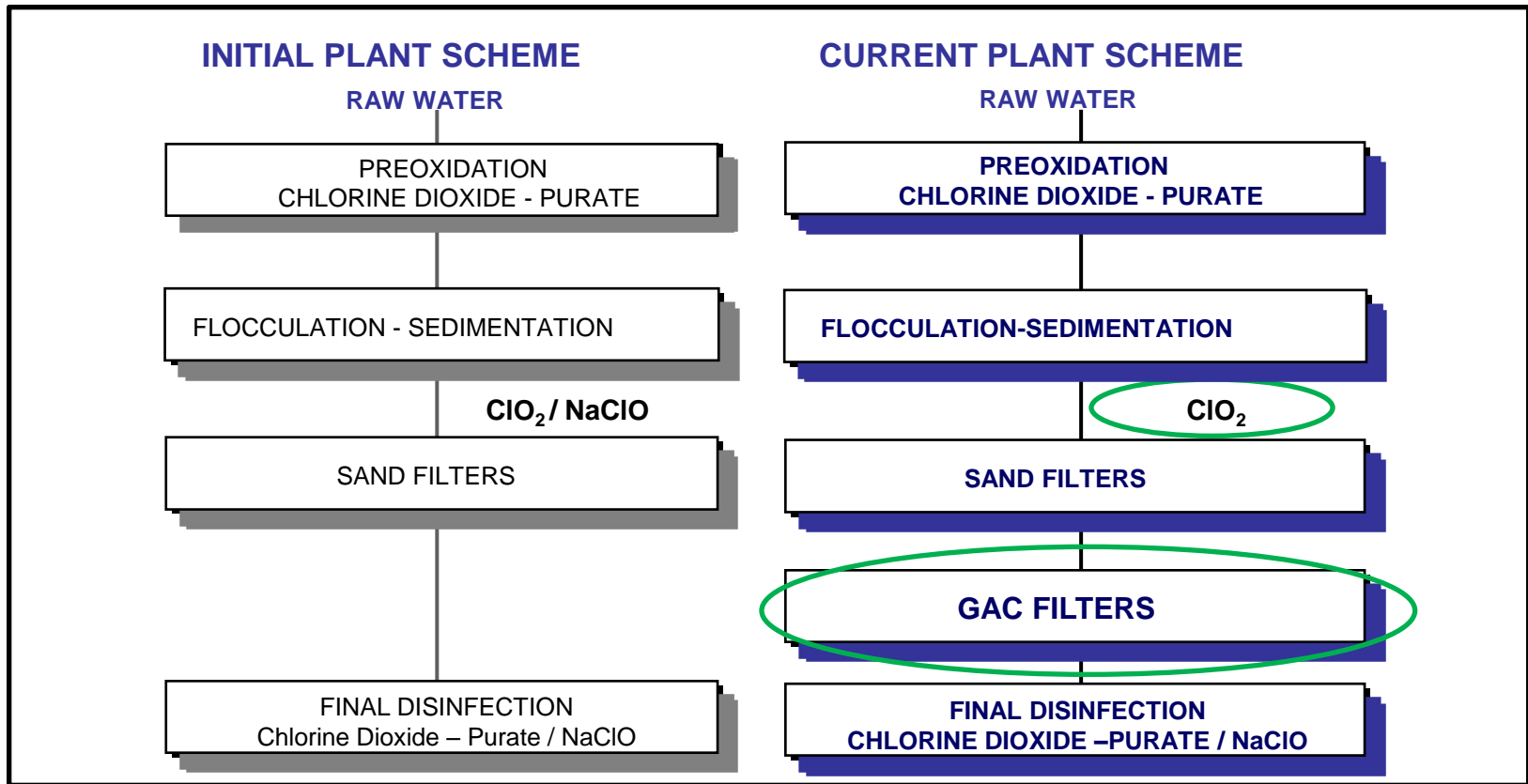
Thanks to the use of GAC filtration:

- Very low levels of TOC and oxidable organics in the treated water:
 - High stability of disinfectant residual
 - Low level of DBPs at the consumers tap

Practical Experience: Plant B

Drinking Water TP – Production: about 114 Mm³/y

- Raw water from a reservoir: seasonal variability
- Raw water class.: A3 (need for a deep chemical & physical treatm.)



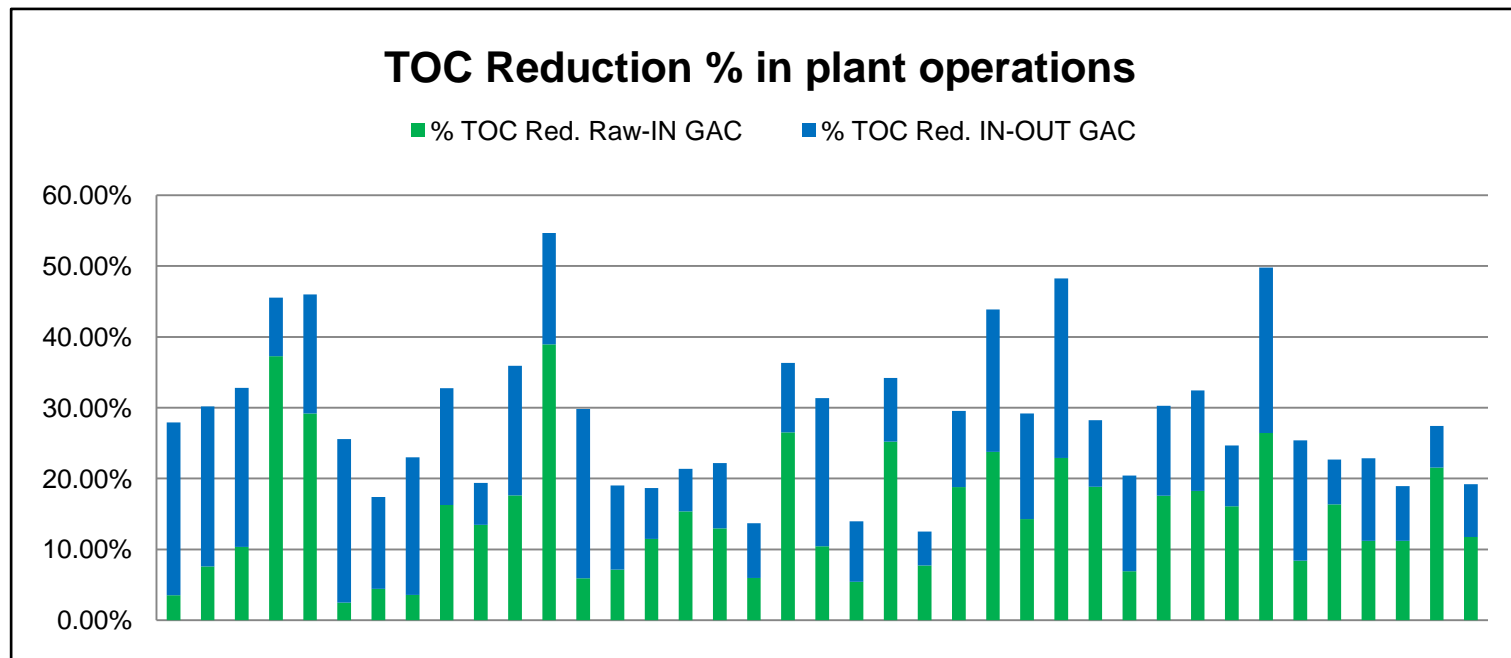
Practical Experience: Plant B

Long distribution network: **up to 72 hours before distribution**

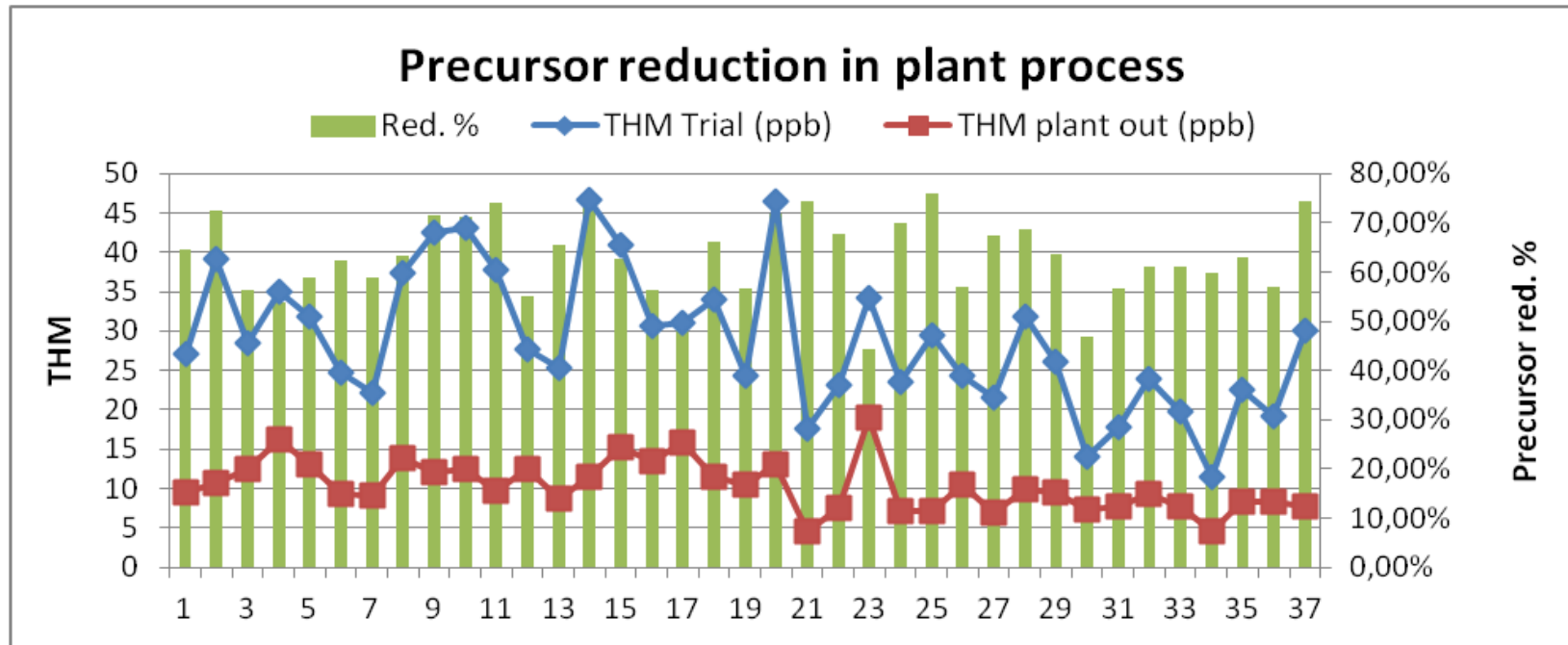
- Need of intermediate chlorination with dedicated stations
- Necessary to **minimize THM and TOC** level at the exit of the plant

THM Reduction: ClO₂ – Purate

TOC Reduction: GAC



Practical Experience: Plant B



Thanks to the use of ClO₂ and GAC filtration:

- Av. reduction of **50%** of the expected THMs
 - High oxidation efficiency of Chlorine Dioxide
 - Further reduction of precursors by GAC

CONCLUSIONS

Control and reduction of DBPs is paramount in drinking water treatment.

An efficient strategy must be composed of different actions, starting from **Water Safety Plans**

Use of **Chlorine Dioxide (ClO₂)** and **Activated Carbons** can provide many advantages:

DBPs reduction

TOC and Oxidables reduction

Absorption of toxins & organic pollutants

Better management of the distribution network

→ BETTER WATER QUALITY

Chimica D'Agostino technicians are ready to be your partner



DR. **FR. D'AGOSTINO** s.p.a.

www.chimicadagostino.com

**THANKS
FOR YOUR KIND ATTENTION**

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