



Essential Expertise  
for Water, Energy and Air <sup>SM</sup>

**Effective Water Treatment For Textile  
Industry,  
Workshop on Energy Management in  
Textile Sector, Bhilwara, July 17, 2010**

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## Who We Are

World leader in our core markets of water treatment and industrial process services with \$5.0 billion in sales in 2009.

Global Corporate and Research Headquarters in Naperville, Illinois. Nalco's 10,500 employees work with more than 60,000 customers in 130 countries in industry, Government and institutions.



# Key Strength



Our greatest asset is our  
**people**

+

**their knowledge about  
water chemistry**

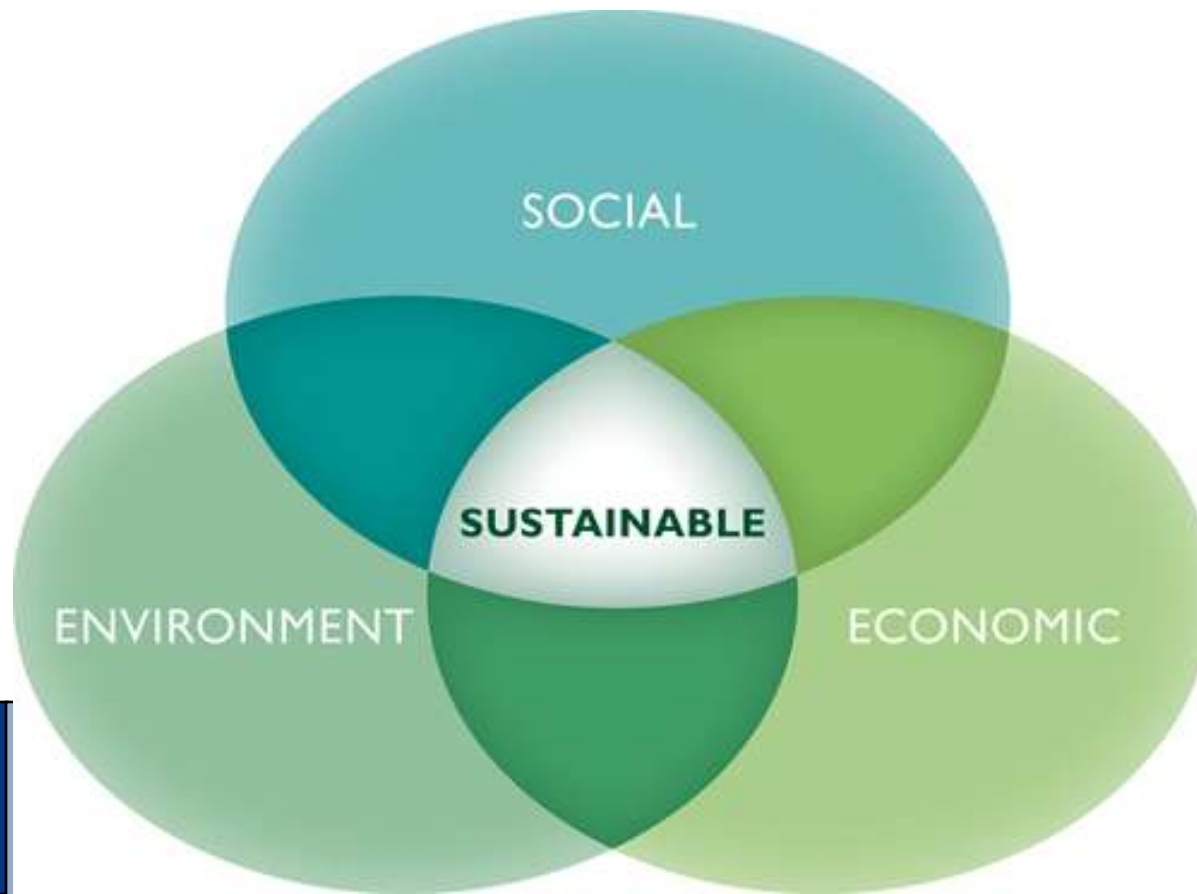
&

**Understanding  
Industry's process water  
requirements**



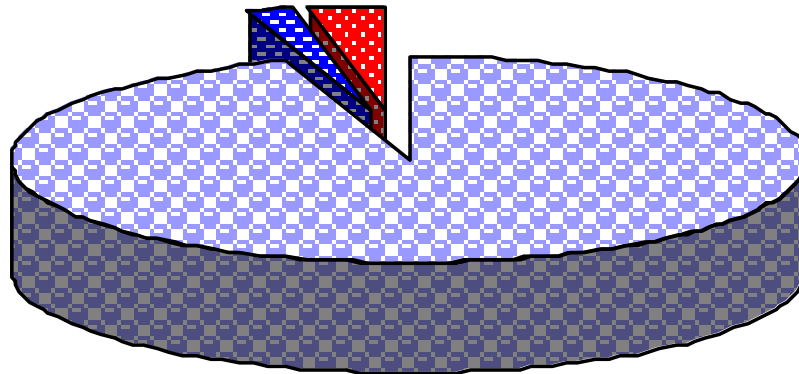
# Nalco Mission Statement

*Our primary reason to exist is to create value for our customers by developing and implementing innovative, differentiated solutions that are financially, technically and environmentally sustainable.*



# Global Water Availability

■ SEA 95-96%   ■ Frozen Water 2%   ■ Fresh Water 2-3%



• **The availability of Fresh water is only 2-3% . Hence need to treat waste water & reuse it.**

# Pollution Problems In Textile Industry

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- Color
- Dissolved Solids
- Toxic Metals
- Residual Chlorine
- Non-biodegradable Organics
- High BOD, COD etc.

# Advanced Methods of Treatment

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- Adsorption
- Ion Exchange
- Membrane Filtration like Reverse Osmosis, Ultra Filtration, Nano Filtration etc
- Ozonation
- Evaporation

# Effluent Treatment

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- Primary Treatment
- Secondary Treatment
- Tertiary Treatment
- Treatment for any special need

# Selection of Advanced Treatment Methods

- Proper selection and application of individual or combination the advance treatment methods in textile industry can effectively make recovery of water and/or salts from effluent streams for their reuse in production process.
- Along with the recovery and reuse of water and salt, the advance methods can also be applied to meet stringent environmental or regulatory requirements such as zero effluent discharge.
- Membrane filtrations can produce treated water with high purity.
- Treatment system like activated carbon adsorption and ozonation can be used to make the effluent suitable for use in membrane filtration.
- The evaporation system and crystallizer combination can recover salt.
- Nanofiltration on other hand allows passage salt with the permeate, which when used in dyeing process, requires less addition of salt.



# Economics of Treatment Scheme for Recovery of Water & Glauber Salt

Particulars	Primary treatment	Primary + Reverse osmosis	Primary + Reverse osmosis + multiple effect evaporator crystalliser
Capital cost (Rs. Lakhs)	45	137	192
Annualized capital cost [@ 15% p.a. interests & depreciation, plant life 10 years] (Rs. Lakh)	8.96	27.29	38.25
Operation and maintenance cost (Rs. Lakh/annum)	21.0	36.0	64.8
Annual burden (Annualised cost + O&M cost) Rs. Lakh	29.96	63.29	103.05
Annual burden /annual turnover ratio (%)	2.99	6.33	10.30
Treatment cost Rs./KL (without interest & depreciation)	13.46	23.07	41.53
Treatment cost Rs./KL (with interest & depreciation)	19.18	40.57	66.05

# Details of Recovery & Savings

Quantity of water recovered	=	382.05 + 21.25 + 60
	=	463.75 KLD
	=	12057.5 KL per month
	=	144690 KL per year
Cost of water @ Rs. 50/KL	=	Rs. 72,34,500/ per year
Cost of recovered salt (as reported by industry)	=	Rs. 0.35 lakh per month = Rs. 4.20 lakhs per year
Total recovery	=	72.34 + 4.20 = Rs. 76.54 lakhs/year
Loss / Saving	=	Rs. 103.05 – 76.54 = 26.51 lakh/year (Loss)
Saving (without taking into interest and depreciation)	=	76.54 – 64.8 = Rs. 11.74 lakhs per year

# Treatment Methods & their suitability for process water requirements

Parameter	Membrane filtration system						Standards for process water for textile industry (IS: 241-1992)		
	Reverse osmosis filtration				Nano filtration	Ultra filtration	General purpose	Wool Scouring	Bleaching dyeing & subsequent processes
	1	2	3	4	1	1			
pH	6.03	5.76	7.51	7.15	8.19	6.93	6.0-8.5	6.0-8.5	6.0-8.5
Total suspended solids, mg/l	6	6	3	10	105	36			
Total dissolved solids, mg/l	922	196	462	642	45680	5034			
Chemical oxygen demand, mg/l	26	17	21	81	364	88			
Biochemical oxygen demand, mg/l	1	2	6	1	65	5			
Total hardness, mg/l		Nil	Nil	80	51		50	2	2
Chloride, mg/l	314	34	190	240	38069	2200	100		
Sulphate, mg/l				17		285	100		
Colour, Hazen units	Colourless	Colourless		20		20	20	70	5
Iron/ manganese, mg/l	1.30			0.32			0.25	0.1	0.1

# Benefits of Advanced Treatment Methods

- Application of appropriate advance treatment methods while reducing the pollution problems, enable industry to recover water and salt.
- The quality of permeate from membrane filtration systems is reasonably good for reuse in textile operation.
- Returns on account of reuse of water and salt can off set recurring cost of treatment system.
- The reverse osmosis system can produce permeate water with TDS as low as 196 mg/l. Low TDS water when used in textile processing minimizes consumption of sequestering agents which are added to suppress effect of TDS in chemical treatment of cloth.

# Benefits Contd ....

- Use of reverse osmosis permeate can lead to water conservation by way of reduction in number of washes in fabric processing.
- The permeate water has negligible hardness. This avoids use of chemicals required for water softening. Corrosion and scale formation in sensitive parts like flow sensors, temperature sensors etc. can be minimized, which leads to less maintenance cost, less breakdown and more output and energy savings.
- When the condensate water from evaporation system having low TDS is used as boiler feed water, the efficiency of boiler can be improved since formation of scale on the boiler tubes is reduced. This in turn reduces fuel consumption and maintenance cost.

# Benefits Contd.....

- Use of Nanofiltration system permeates salt water (brine) but rejects other contaminants from effluent stream. The brine when reused in dyeing requires less additional salt. Crystallization also facilitates recovery of salt.
- While recovering the salts these methods also reduce problems relating to disposal of high TDS effluent streams of the Textile Industry.
- The recycling and reuse of the treated effluent and salt directly conserve natural resources and a step towards sustainable development. Installation of advance treatment methods along with recycling arrangement gives goodwill in the market.

# Limitations of Advanced Treatment Methods

- For advance treatment like reverse osmosis, different units such as sand filter, activated carbon adsorption, iron and manganese filter etc. may be required to meet the feed effluent requirement.
- Maintaining desired effluent quality at each stage requires regular monitoring. The treatment system may require trained manpower to operate.
- Activated carbon and other media are periodically required to be replaced or regenerated.

# Limitations

## Contd.....

- Performance of membrane filtration largely depends on the performance of primary treatment system. Consistency in primary treatment system is of prime importance.
- The evaporators used for effluent volume reduction or concentration are not free from trouble. They require frequent cleaning to remove scale deposition on tube walls.
- In some membrane units, COD value in treated water was observed to be as high as 81 mg/l. Colour content was also found to be 20 hazen units. These pollutants can cause adverse effect on some of the textile processing operations like bleaching.
- Reverse osmosis technology is extensively being used for water purification. There is also problem in disposal of reject from membrane as it has high pollution load and its treatment is difficult.

# Some options for effluent management in textile industries

Treatment method	Option I		Option II		Option III		Option IV	
	Segregation of effluent streams		Segregation of effluent streams		Segregation of streams		Combined effluent treatment	Combined effluent treatment
	High polluting	Low polluting	High polluting	Low polluting	High polluting	Low polluting		
Primary <sup>1</sup> treatment	√	√		√		√	√	√
Secondary <sup>2</sup> /tertiary <sup>3</sup> treatment		√		√		√	√	√
Reverse osmosis		√		√			√	
Nanofiltration			√					
Evaporation/drying system/ solar evaporation etc.	√	√	√	√	√		√	
Crystallization	√							
Potential benefits:								
Recycling/reuse of treated effluent		√		√			√	
Reuse/disposal of treated effluent						√		√
Recycling/reuse of salt	√		√					
Zero discharge		√		√			√	

<sup>1</sup>Oil and grease removal, coagulation, settling, neutralization, filtration etc.

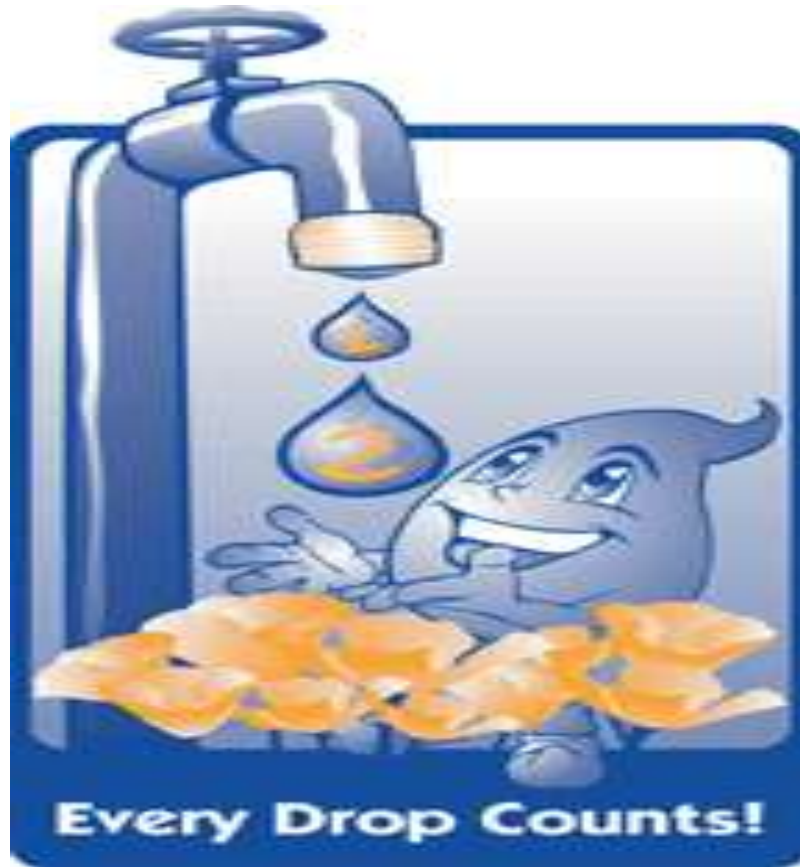
<sup>2</sup>Biological treatment units.

<sup>3</sup>Adsorption, ion exchange, oxidation including ozonation/chlorination, iron/manganese removal etc.

# Conclusion

- The advance treatment methods, while reducing the pollution problems also give scope for recovery and recycle of water and salts.
- The highly polluting effluent stream can be segregated and treated separately. This stream has low volume and as such, it can be disposed of through solar evaporation pond where adequate land is available. In case of land constraints, this waste steam can be concentrated to further reduce volume using suitable evaporation system.
- With the application of reverse osmosis, the effluent stream can be made suitable for reuse in production process itself. The reject stream of reverse osmosis to is be treated along with high polluting effluent stream.
- Dye bath effluent is to be treated using a Nanofiltration system and wash water effluent with reverse osmosis. Nanofiltration allows maximum passage of the salt with no colour in the permeate. As such, the permeate can be directly recycled back to dye bath so as to minimize fresh addition of salt.

# Save/Recycle Water



***Thank You !***