Bottom-Up Improvement of the Boiler Feedwater System

- **Robert Bellitto**/Samco Technologies
- **Ramkumar Karlapudi**/Samco Technologies
- **Tom Harriz**/Jacobs

SAMCO
Separation from the ordinary

Jacobs
Challenging today.
Reinventing tomorrow.

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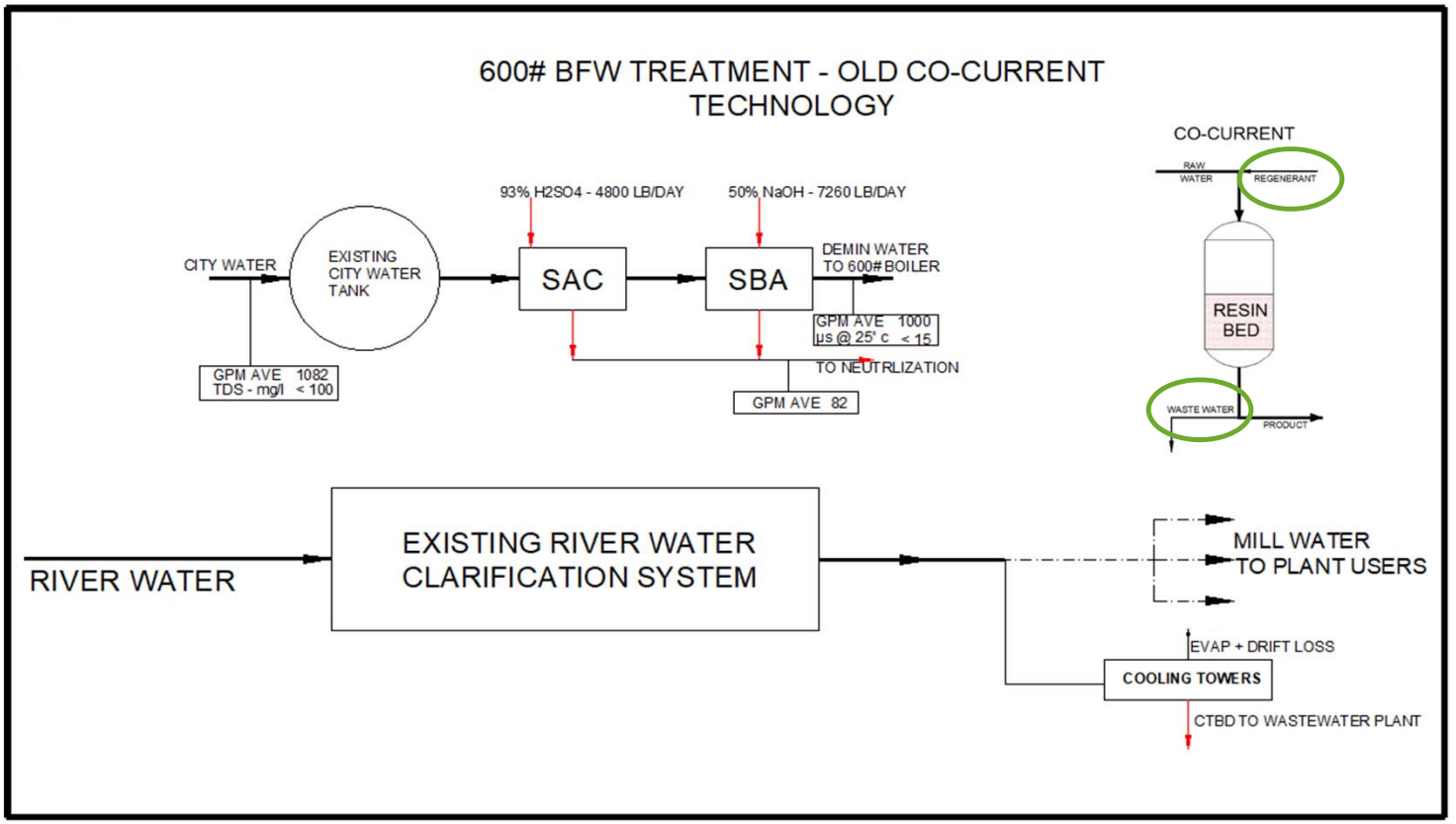
The Dilemma

- 600# Boiler Feedwater quality: <15 µS
- 1200# Boiler Feedwater quality: <0.1 µS

- How to upgrade a 1960s era Water Treatment System…

Typical Co-Current Regeneration



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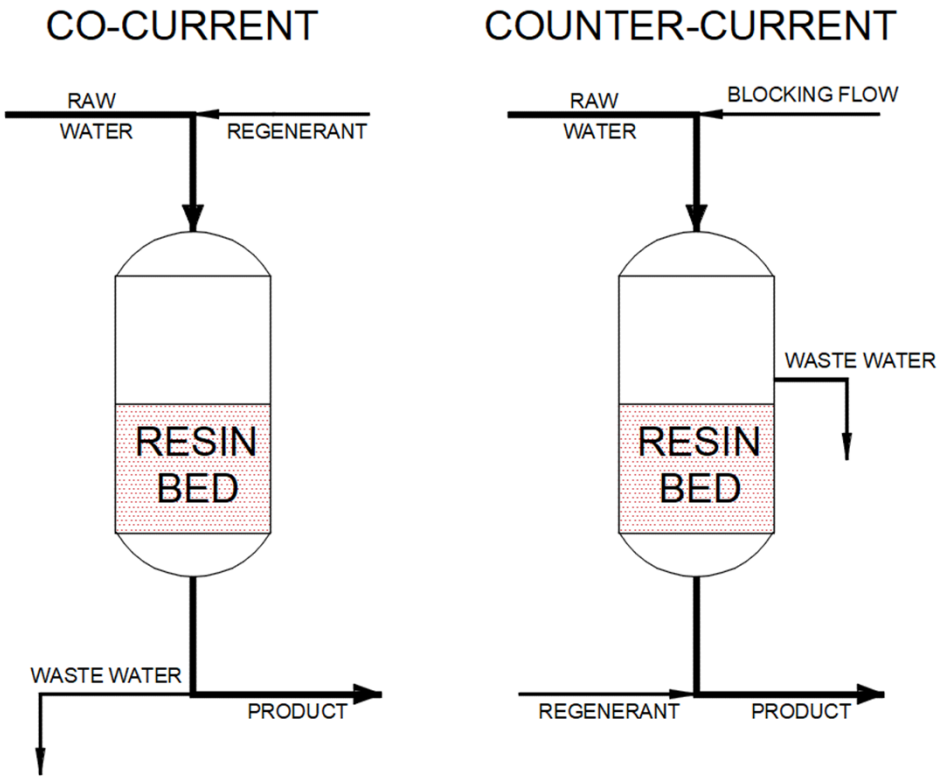
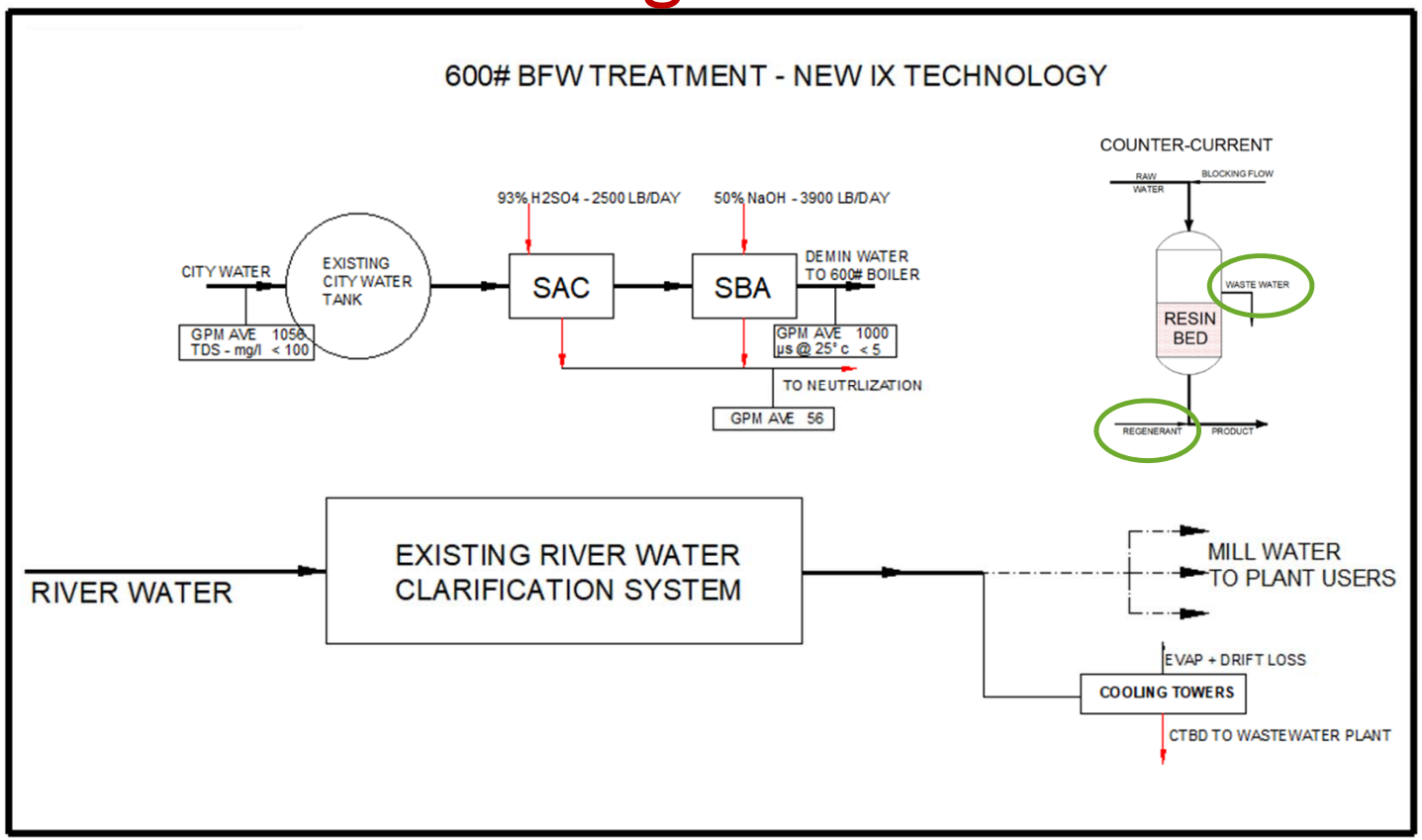
Its Just Plumbing …



Improved – Counter Current Regeneration



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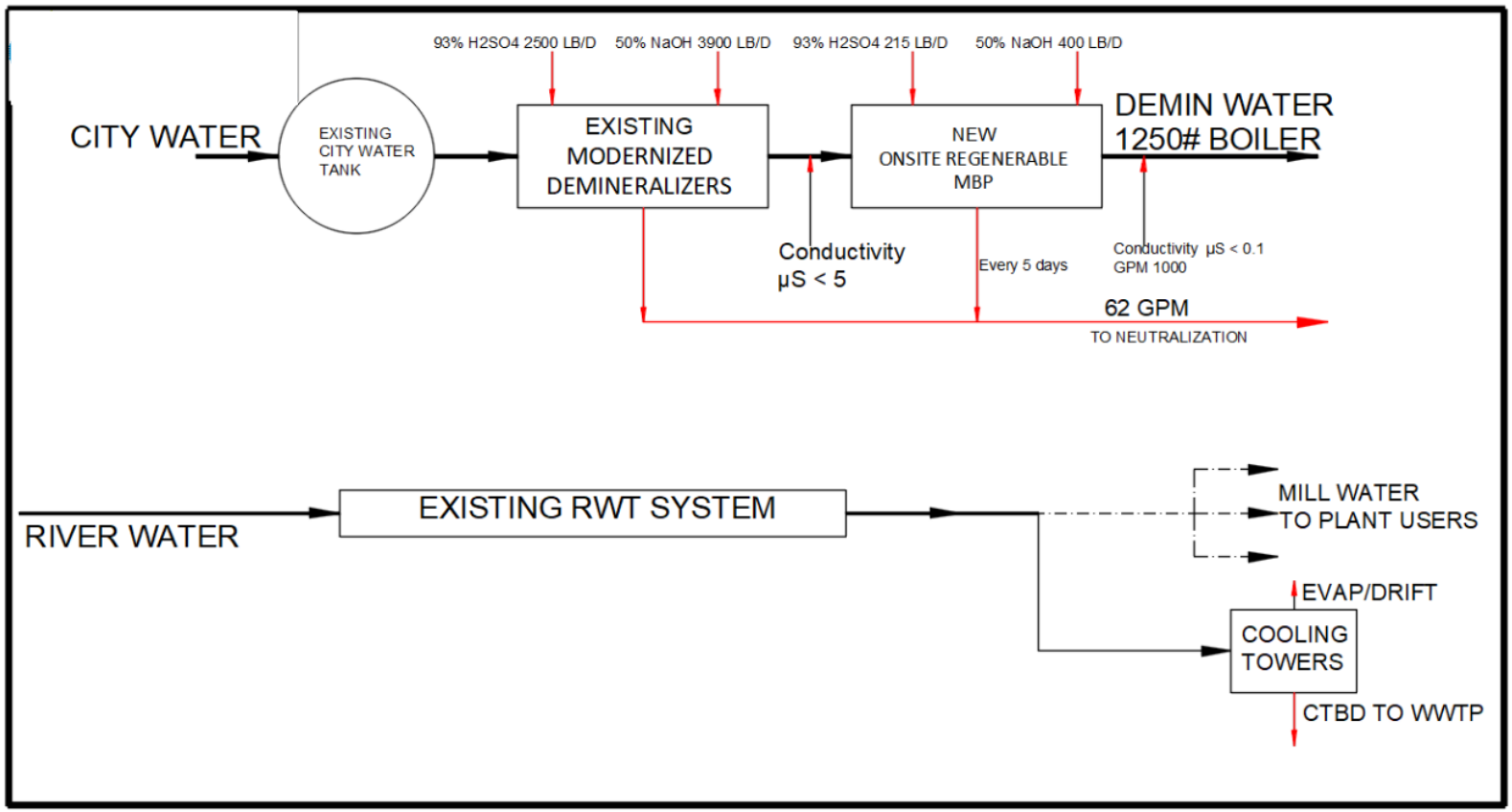
Conventional Add-On Solution



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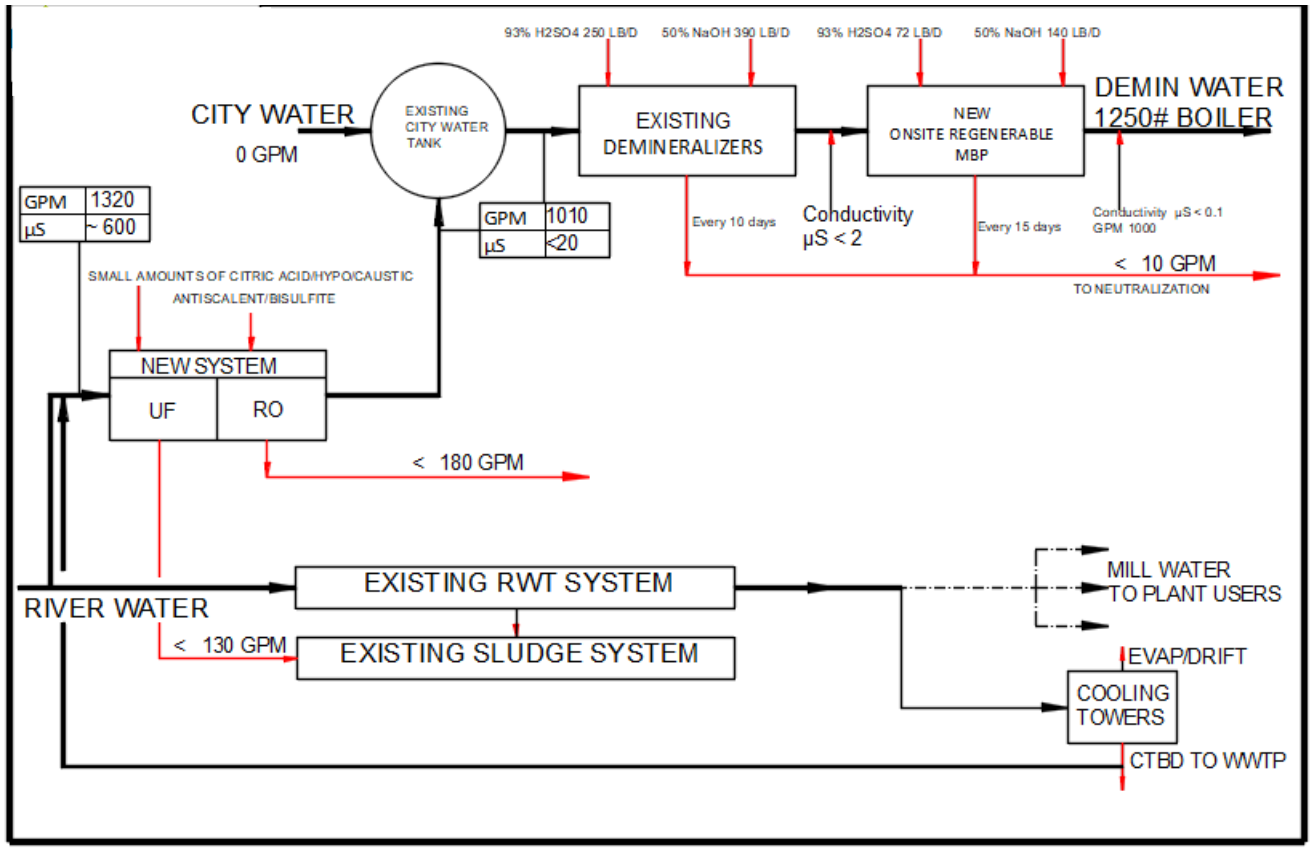
Bottom-Up Solution



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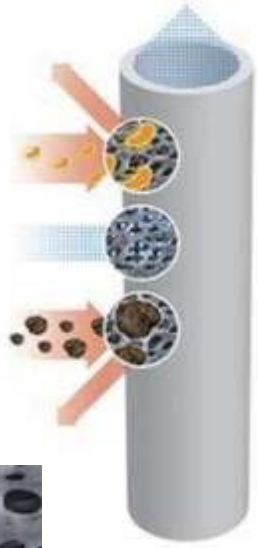
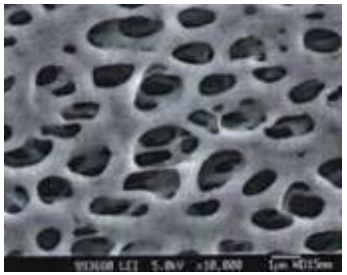
Ultrafiltration?

- Hollow strands of porous plastic fibers with billions of microscopic pores on the surface
- The pores are thousands of times smaller in diameter than a human hair
- Pores form a physical barrier to impurities but allow pure water molecules to pass
- Clean water is collected on the inside of fiber





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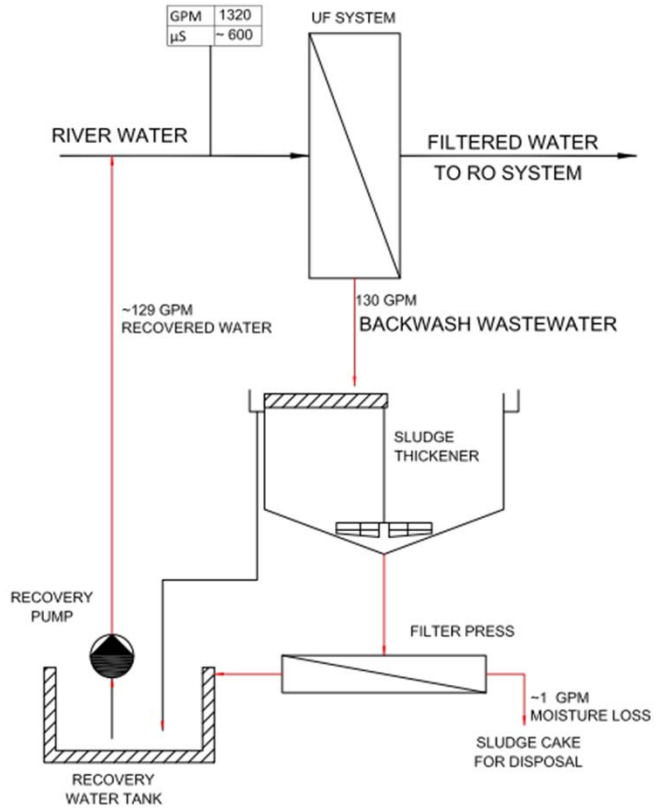
Added Water Savings Option



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Comparison

		600#	600#	1250#	1250#	1250#	1250#
		CoCurrent	CounterCurrent	Add MB	Add UF/RO	Add UF Sludge Dewatering	Add CTBD
H2SO4 @ Bulk Concentration	lb/D	4800	2500	2715	322	322	*
NaOH @ Bulk Concentration	lb/D	7200	3900	4300	530	530	*
Demin Water Conductivity @ 25˚C	µS	< 15	< 5	< 0.1	< 0.1	< 0.1	< 0.1
City Water Consumption	GPM	1082	1056	1062	0	0	0
Mill Water Consumption	GPM	0	0	0	1320	1290	?
Effluent % of product		8.2%	5.6%	6.2%	32.0%	29%	?
Citric Acid @ Bulk Concentration	lb/D	0	0	0	<5	<5	*
Caustic (UF) @ Bulk Concentration	lb/D	0	0	0	<10	<10	*
Hypo @ Bulk Concentration	lb/D	0	0	0	<50	<50	*
Antiscalent @ Bulk Concentration	lb/D	0	0	0	<100	<100	*
Bi-Sulfite @ Bulk Concentration	lb/D	0	0	0	<50	<50	*

* Will depend on how much CTBD is recovered

Benefits of UF/RO Pretreatment

1. Runtimes between IX regeneration increases by a factor of 10.
2. Chemical consumption (acid/caustic) reduced by a factor of 10 (compared to co-current DI). Using the UF/RO pretreatment, the benefit of converting from co-current to counter current regeneration of the IX is reduced, but endpoint quality is better with counter current regeneration.
3. Treated water conductivity from primary IX will improve by a factor of 2.
4. Mixed bed polishers may not be necessary to achieve DI quality, but a portable bottle exchange system (rental equipment) can be added to provide the last little bit of polishing.
5. TOC values entering the boiler will be less than 20 ppb due to the double membrane process (UF+RO); a positive barrier as pre-treatment to the ion exchange system.
6. The UF effluent is just dirty water. It has no chemical additives, so it can be either dumped entirely or the sludge can be thickened, and the water reclaimed as fresh surface water.
7. Savings from reduced city water demand and regeneration chemical usage.