IEX 2008 Cambridge 8–9 July 2008

CONDENSATE POLISHING PLANT WITH SEPARATE BEDS EXCEEDS ALL EXPECTATIONS

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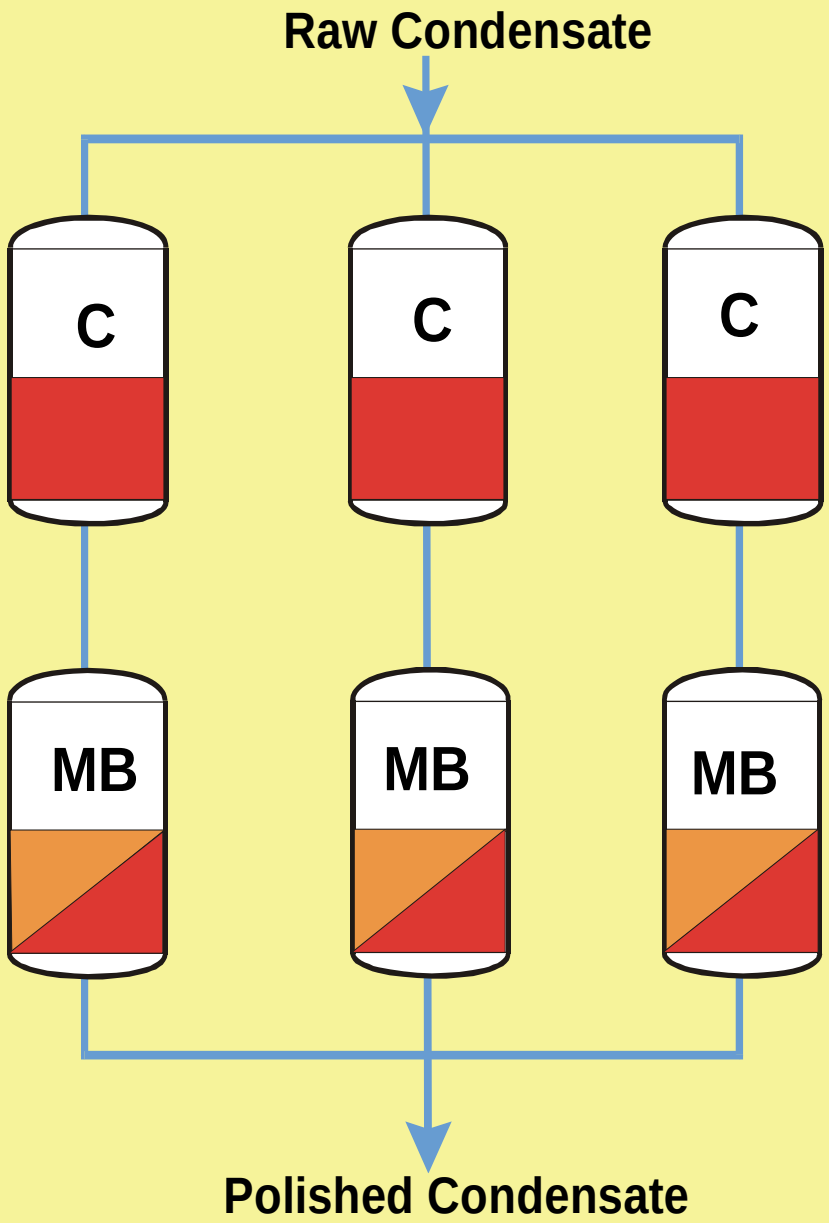
Traditional CPP



C - MB

Advantage

Continuous full flow operation

Reliable

High purity condensate

Good kinetic properties

– acidic conditions

Disadvantage

Difficult automation

Leachables from cation resin

- reheater corrosion

- SCC in LP turbine

New generation

Target

Keep all the advantages

Reduce the disadvantages

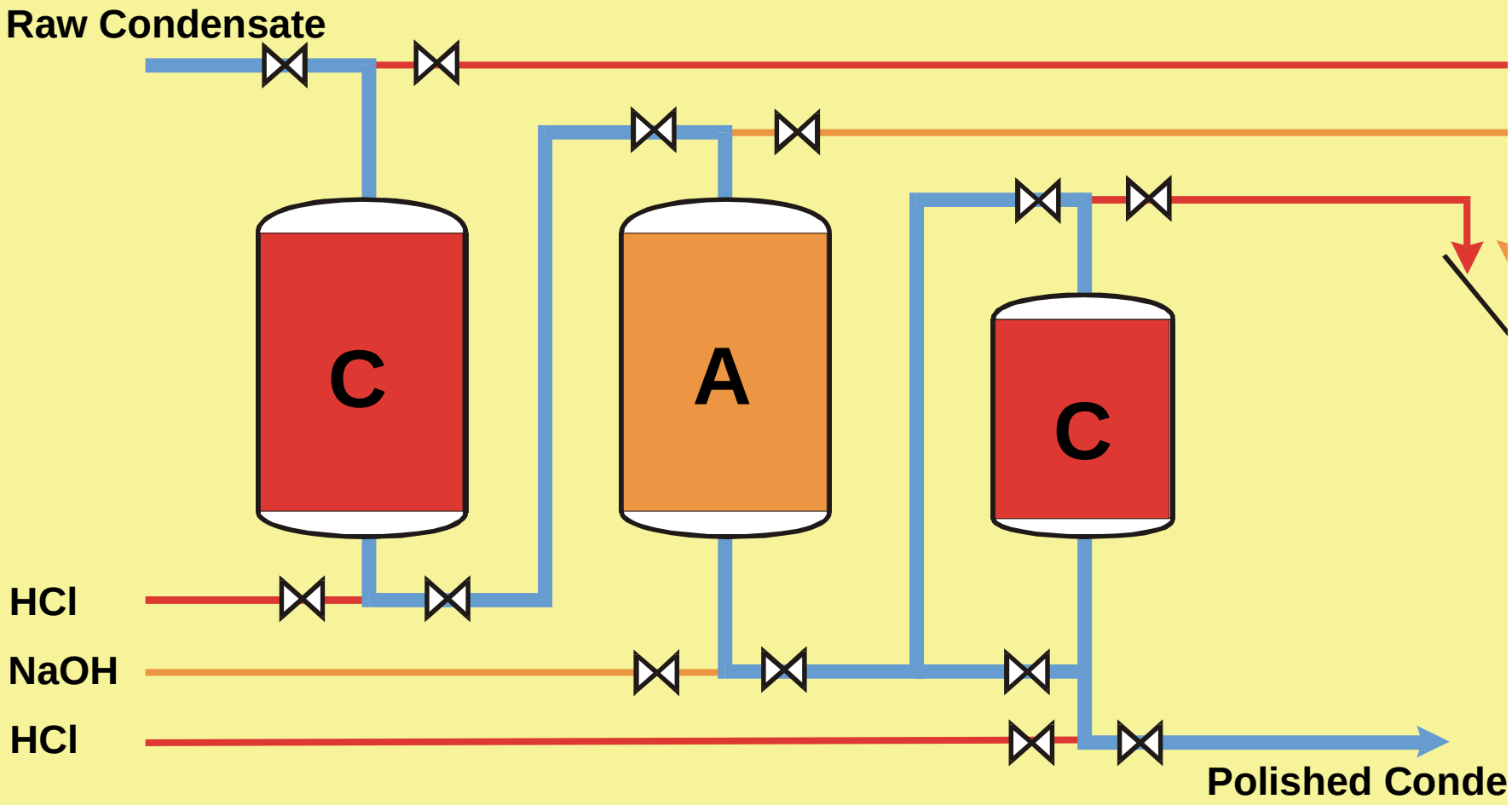
Means

New concept - C – A – (C)

Resin choice

Operational efforts

Counter current regenerated CPP



Calculation of the leachables release

Assumption – C_{trail} by-passed > 90 % of the time
-50 % of C leachables retained by A

C – MB -42 % enter the cycle
C – A – (C) -36 % enter the cycle

Calculated reduction at least 15 %

Experience – C_{trail} by-passed > 99 % of the time

Realised reduction at least 21 %

Resin choice

OSA test – All the resins were OK

Kinetic of anion resin (MTC) – No difference

Leachables of cation resin –

Producer	Product	Unit SKV	Unit NJV
1	Sample A	7	-
2	Sample C	16	-
1	Supplied A	25	-
1	Sample B	-	23
2	Sample D	-	8
2	Supplied D	-	15

Operational efforts

Initial leachables – Pre-treatment

Stand-by rinse – Daily rinse with 2 BV

Brine cleaning – After 5 years operation

Operational experience

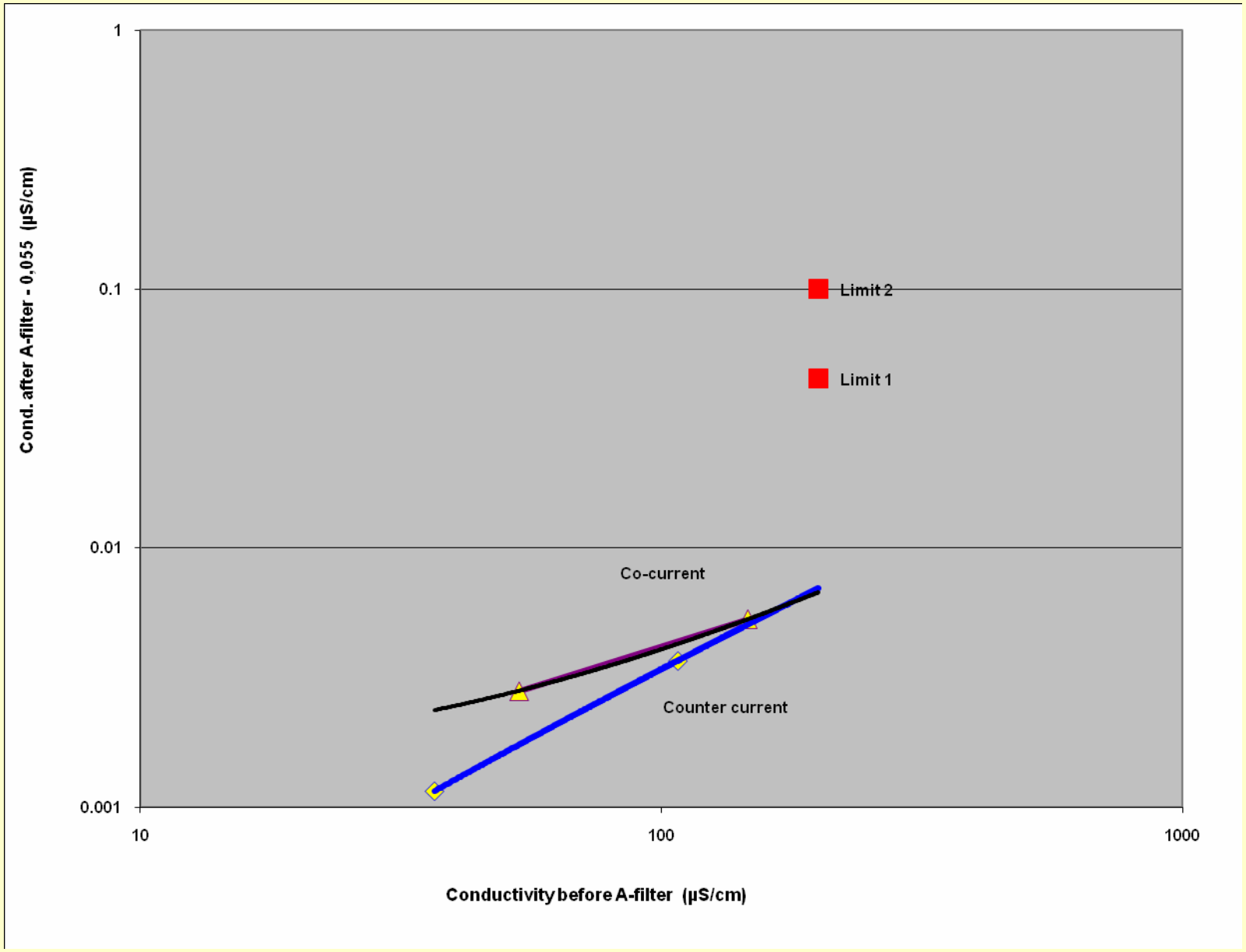
Performance test

- Capacity C_{lead} resin – 1 & 1.1 eq/L
- Kinetic of A resin
- Ionic leakage - < 0.3 µg/L typically
- Organic carbon leakage- <10 µg/L typically

Survey of 10 years operation

- Ionic leakage from C_{lead}
- Ionic leakage from A - < 0.3 µg/L typically

Kinetic test of CPP

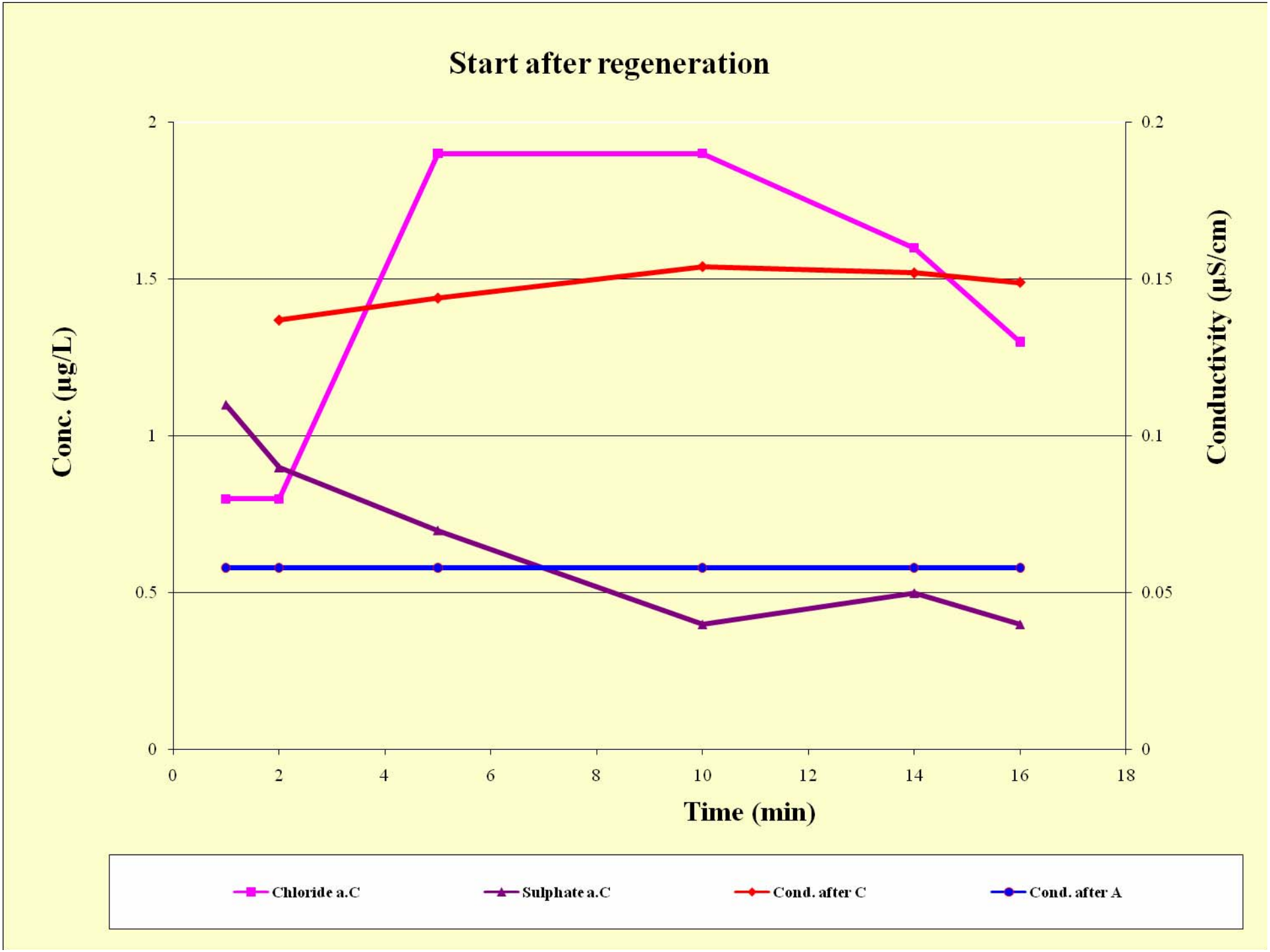


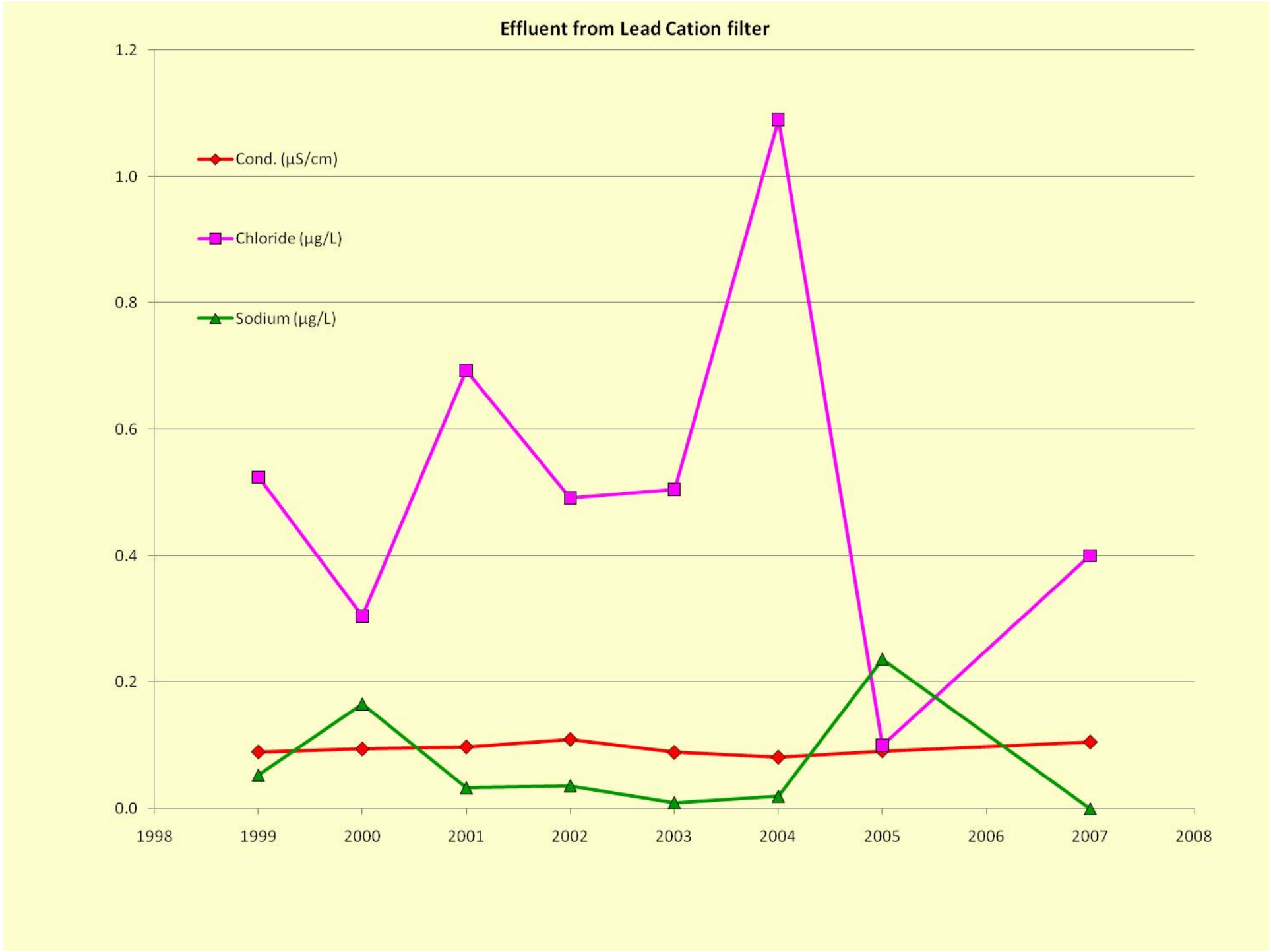
Average leakage in the first year of operation

	Sample after No.	Co-flow regenerated			Reverse-flow
		Lead Cation	Anion	Trail Cation	Anion
		50	50	3	
Conductivity	**µS cm^{-1}**	**0.126**	**0.057**	**0.058**	**0.126**
Fluoride	**µg L^{-1}**	**0.4**	**0.1**	**0.1**	
Acetate	**µg L^{-1}**	**0.6**	**0.5**	**0.3**	**0.5**
Format	**µg L^{-1}**	**0.3**	**0.2**	**0.3**	**0.5**
Chloride	**µg L^{-1}**	**0.6**	**0.3**	**0.7**	**< 0.1**
Sulfate	**µg L^{-1}**	**0.3**	**0.2**	**0.7**	**< 0.1**
Sodium	**µg L^{-1}**	**0.2**	**0.1**	**0.1**	**0.3***
Ammonium	**µg L^{-1}**	**3.8**	**3.3**	**0.5**	
Magnesium	**µg L^{-1}**	**0.1**	**0.0**	**0.0**	
Calcium	**µg L^{-1}**	**0.2**	**0.1**	**0.6**	

Organics in condensate

Time (min)	**Volume** (m^3)	**TOC** (µg L^{-1})			
		Raw Cond.	**After lead C**	**After A**	**After trail C**
2	8	**57**	**51**	**31**	**62**
11	55		**54**	**47**	**27**
14	76	**58**	**50**	**53**	**27**
16	86	**28**	**38**	**53**	
23,000	36,000		**< 10**	**70**	
32,000	66,000		**< 10**	**< 10**	
67,000	138,000	**11**	**11**	**10**	**10**


Start after regeneration
Conc. (µg/L)
Conductivity (µS/cm)
Time (min)
0
0.5
1
1.5
2
0.05
0.1
0.15
0.2
0
2
4
6
8
10
12
14
16
18
Chloride a.C
Sulphate a.C
Cond. after C
Cond. after A


Effluent from Lead Cation filter
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Cond. (µS/cm)
Chloride (µg/L)
Sodium (µg/L)
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008


Effluent from Anion filter
Cond. (µS/cm)
Chloride (µg/L)
Sodium (µg/L)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008

C – A – (C) versus C - MB

- C – A – (C) is simpler to regenerate
- C – A – (C) is simpler to automatize
- C – A – (C) gives lower ionic leakage
- C – A – (C) release less organic leachables
- No difference in kinetic properties
- C – A – (C) has slightly higher capital costs
- C – A – (C) has slightly lower operating costs

Conclusion

C – A – (C) - superior concept

- High quality CPP
- Robust and reliable
- Simple automatisation
- Low manpower requirement
- Justified investment