

REMONDIS®

WORKING FOR THE FUTURE

Clean technology for P-recycling to phosphoric acid: REMONDIS TetraPhos®



> REMONDIS Aqua GmbH & Co. KG

ESPP (European Sustainable Phosphorus Platform)

Phosphorus stewardship in the chemicals industry and new industrial applications

Thursday 1st December 2016, Brussels

Responsibility of waste & wastewater management company

- *Conserve natural resources*
- *Ensure environmentally sound waste disposal*
- *Meet requirements for discharge of waste water into water bodies*

- *Prepare for reuse*
- *Recycling*
- *Energy recovery*
- *Disposal*

Demand of producing industry in secondary raw material

Producing industry will use secondary raw material in case you can offer

- *Constant quality*
- *Ensured availability*
- *Various applications*
- *Saleable costs*
- *Added value*

Phosphoric acid

Key basic product for the phosphorus industry



Fertilizers



Pet food



Phosphoric acid
(H₃PO₄)

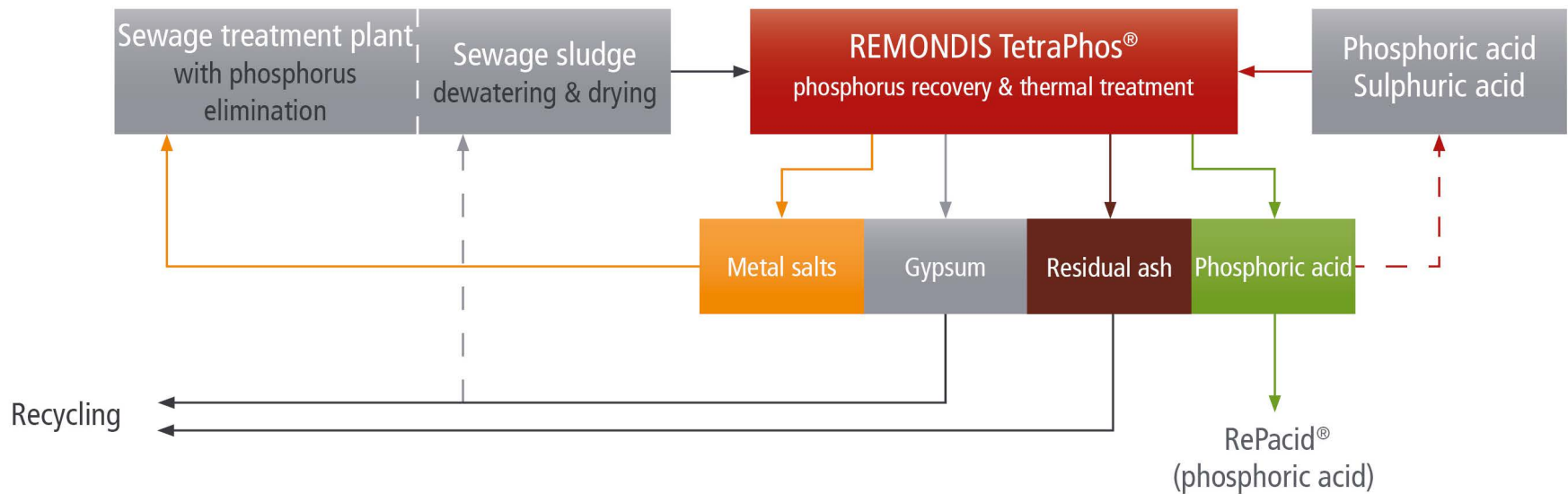
Food additives



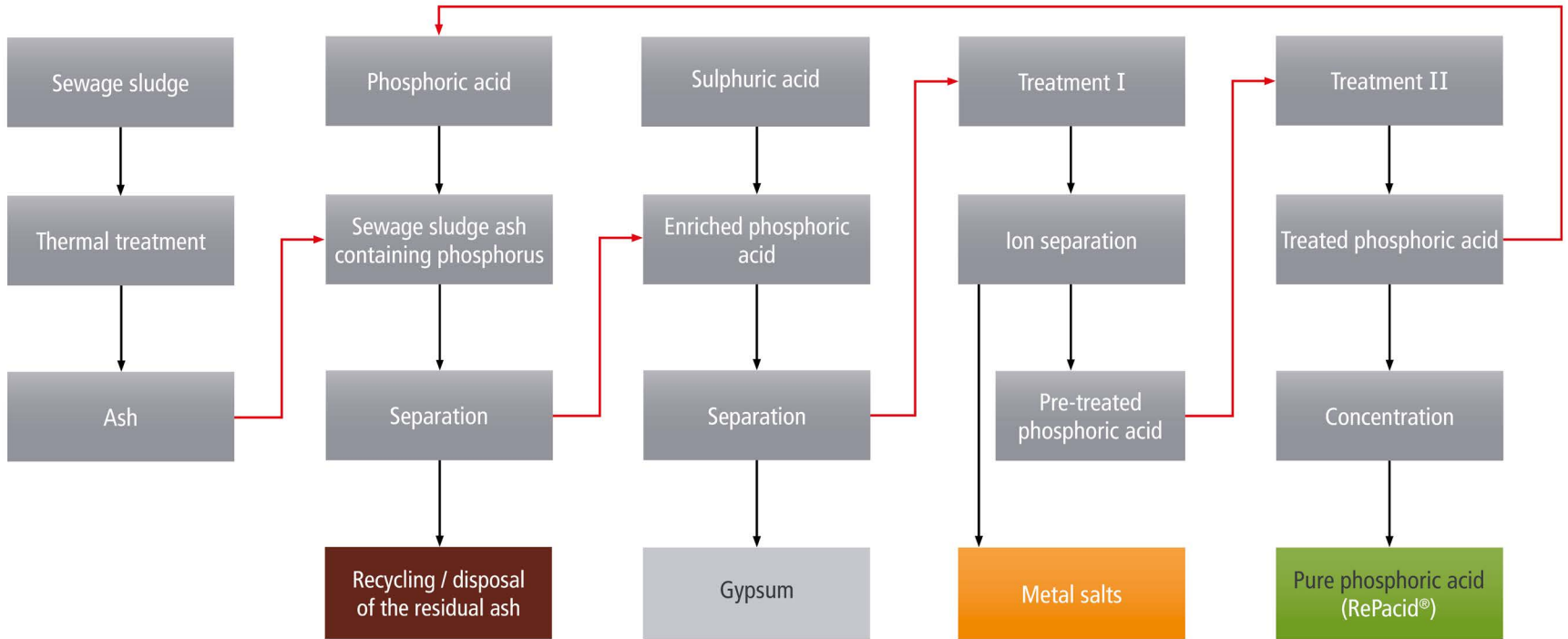
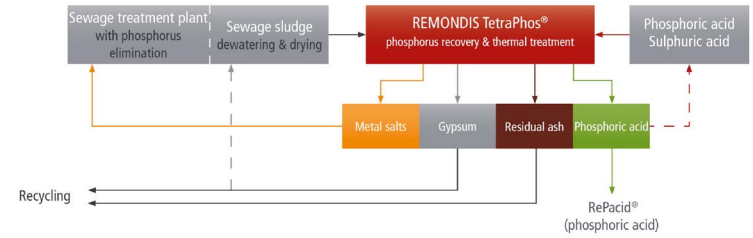
Corrosion inhibitors
Surface finishing



REMONDIS TetraPhos® Recovery and Recycling



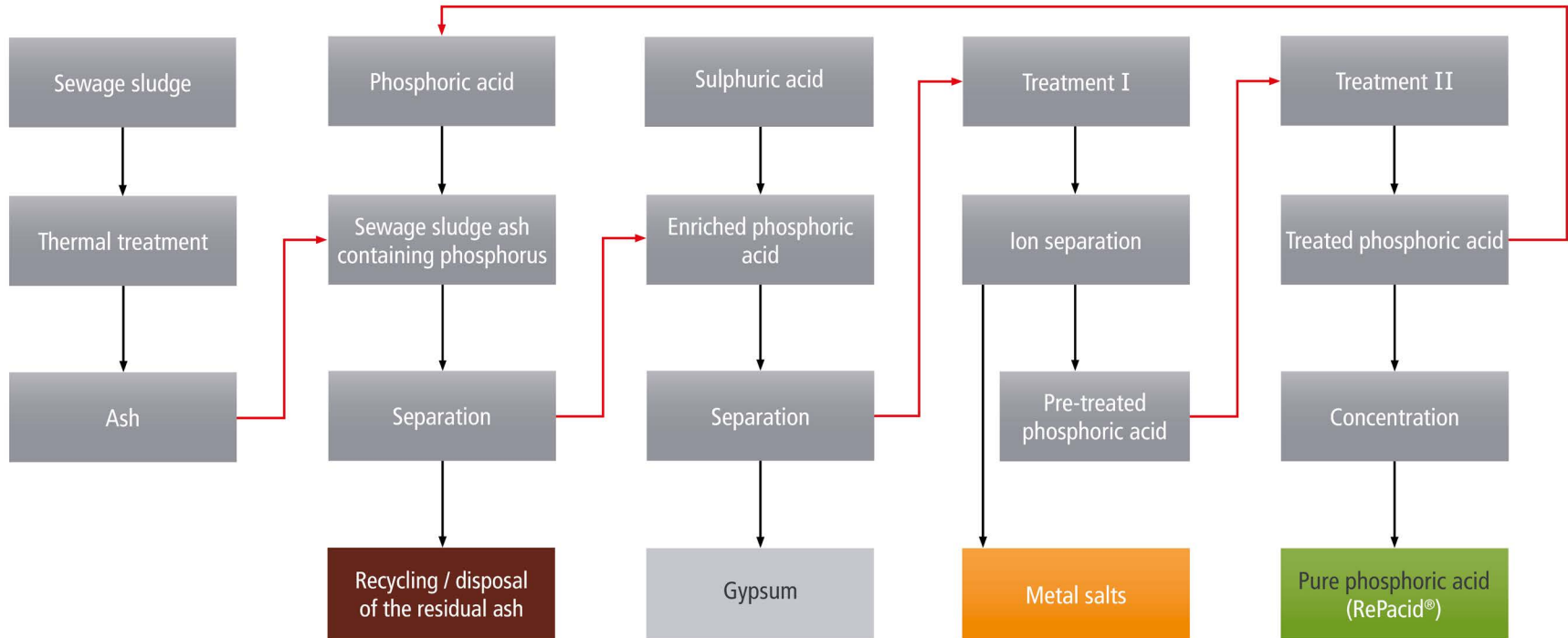
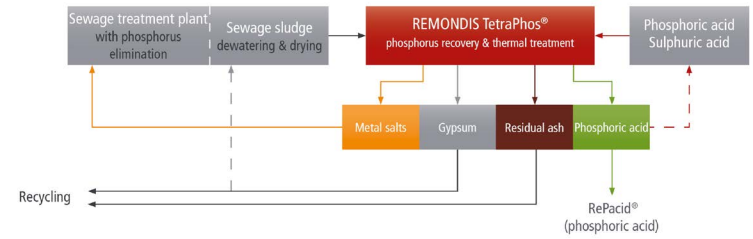
REMONDIS TetraPhos® Energy recovery



Comparison of phosphate resources

Analyse der Trockensubstanz	Rock	MBM-Ash	KS-Asche	
			Asche 1	Hamburg
% P2O5	31,2	41,0	23,0	24,0
% CaO	52,9	45,1	14,5	17,2
% SiO2	2,0	2,9	27,2	27,9
% Al2O3	0,2	0,2	21,5	7,1
% Fe2O3	0,2	0,3	3,1	22,9
% ZnO	<0,1	<0,1	0,5	0,3
% MgO	0,4	1,6	2,9	2,4
% Na2O	0,4	3,8	0,8	0,8
% K2O	<0,1	1,8	1,9	1,3
mg/kg Blei	16	28	93	100
mg/kg Cadmium	26	1	3	2
mg/kg Kupfer	23	64	1.200	1.800
mg/kg Nickel	59	4	42	41
mg/kg Chrom gesamt	<0,1	11	48	110
mg/kg Uran	102	<0,1	5	4
U-238 Bq/g	1,38	<0,1	<0,1	<0,1

REMONDIS TetraPhos® Phosphate recovery

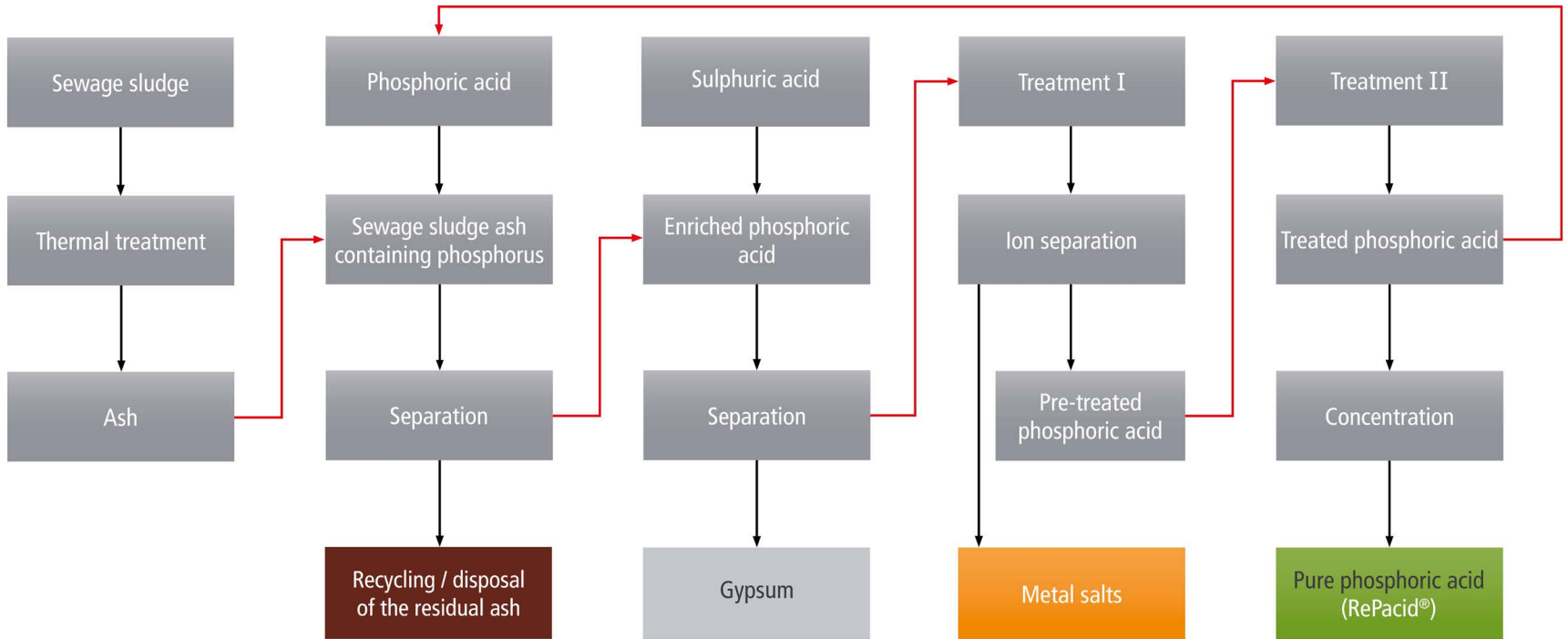
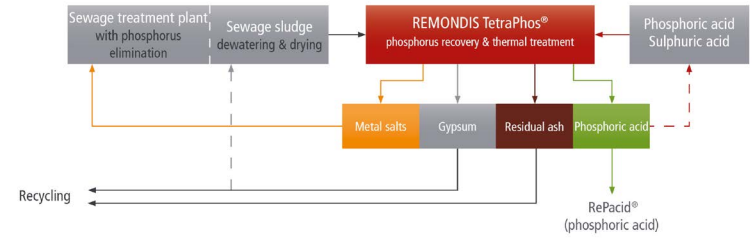


Results of pilot plant operation

Raw acid quality

		unit	MGA	raw acid (after Step 2)
concentrations				
Phosphoric acid	H ₃ PO ₄	%	75	75
Sulfuric acid	H ₂ SO ₄	%	1,9 – 5,5	0,5 - 1
aluminium	Al	%	0,2 – 0,4	1 – 2
iron	Fe	%	0,1 – 0,3	0,5 – 1
calcium	Ca	%	0,01–0,1	0,5 – 1,5
magnesium	Mg	%	0,2 – 0,25	0,4 – 0,5
Heavy metals				
arsenic	As	ppm	< 1	1 - 2
cadmium	Cd	ppm	9	< 1
chromium	Cr	ppm	95	1 -10
copper	Cu	ppm	26	1 -10
nickel	Ni	ppm	22	10 – 15
lead	Pb	ppm	< 3	< 3
zinc	Zn	ppm	290	300 – 500
manganese	Mn	ppm	30	300 – 500
uranium	U	ppm	192	< 10

REMONDIS TetraPhos® Phosphate & more recycling loops



Results of pilot plant operation

acid quality

		unit	MGA	raw acid (after Step 2)	purified acid
concentrations					
Phosphoric acid	H ₃ PO ₄	%	75	75	75
Sulfuric acid	H ₂ SO ₄	%	1,9 – 5,5	0,5 - 1	0,5 - 1
aluminium	Al	%	0,2 – 0,4	1 – 2	0,1 - 1
iron	Fe	%	0,1 – 0,3	0,5 – 1	0,1 - 1
calcium	Ca	%	0,01–0,1	0,5 – 1,5	< 0,05
magnesium	Mg	%	0,2 – 0,25	0,4 – 0,5	< 0,05
Heavy metals					
arsenic	As	ppm	< 1	1 - 2	< 1
cadmium	Cd	ppm	9	< 1	< 1
chromium	Cr	ppm	95	1 -10	1 - 5
copper	Cu	ppm	26	1 -10	< 3,5
nickel	Ni	ppm	22	10 – 15	< 3
lead	Pb	ppm	< 3	< 3	< 3
zinc	Zn	ppm	290	300 – 500	< 3
manganese	Mn	ppm	30	300 – 500	< 3
uranium	U	ppm	192	< 10	< 10

GreenTec Awards

Winner 2016 // Recycling & Resources

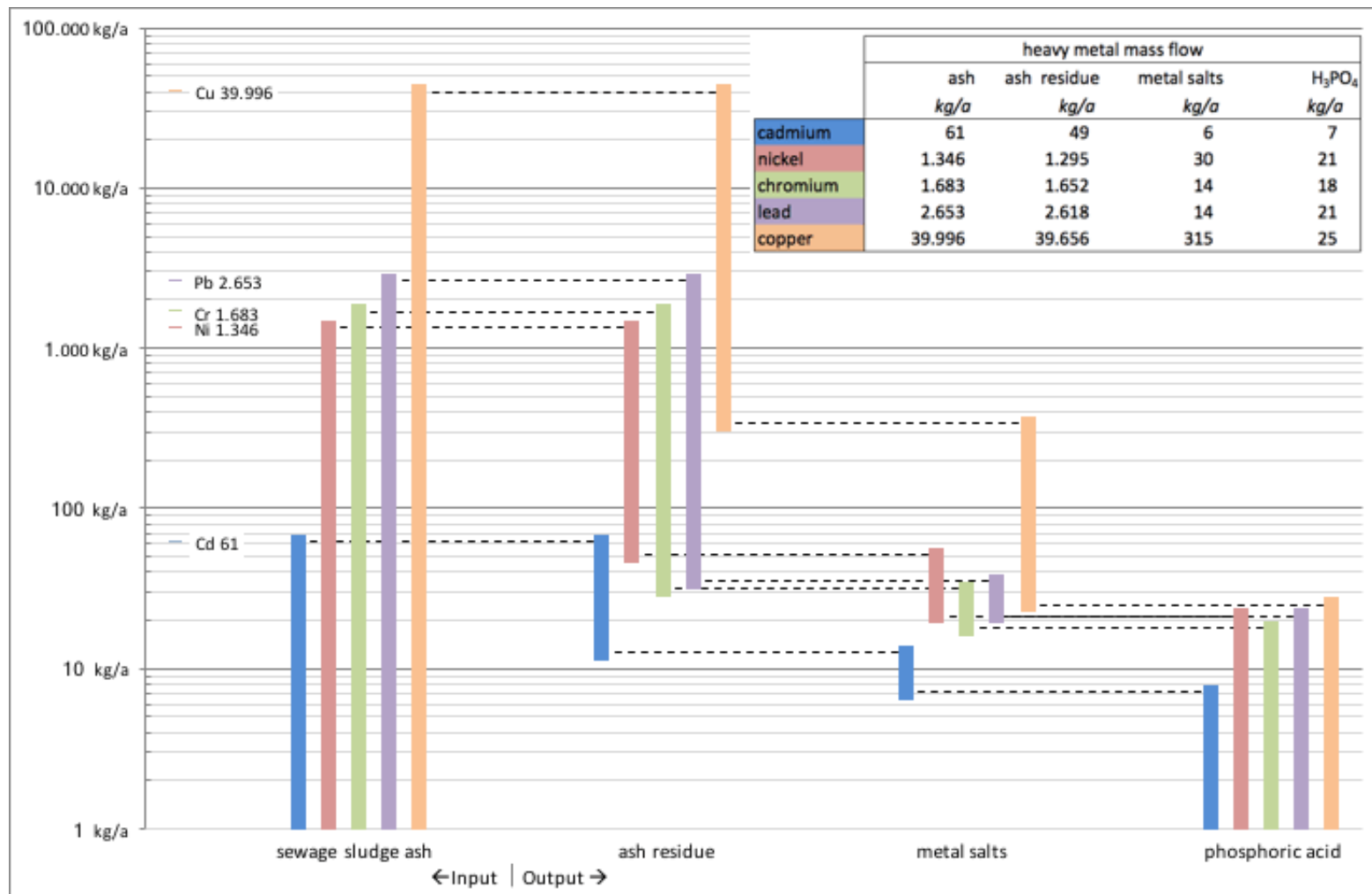


REMONDIS[®]

WORKING FOR THE FUTURE

Results of pilot plant operation

Mass balance heavy metals



REMONDIS TetraPhos® Mass balance phosphate

