The Ash2Salt process

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EasyMining Sweden AB, part of Ragn-Sells Goup

RAGN-SELLS COMPANY FACTS

8 696 MSEK
Sales

2 477
Employees

Sweden, Norway, Denmark, Estonia
Markets

100
Sites

6.3 MILLION TONNES
Material treated

EASYMINING

Innovation company focused on closing nutrient cycles – with own R&D, engineering and marketing

50+
Employees

2007
Year of foundation

Uppsala, Gothenburg, Helsingborg and Berlin
Sites

Part of Ragn-Sells Group since 2014

WE ARE IN THE ROLL-OUT PHASE FOR ALL OUR TECHNOLOGIES

7
N
Nitrogen

AQUA2®N

- removing and recovering nitrogen from liquid waste streams

Process demonstrated in operational environment
Capacity: 4 m3/h process water (landfill or WWTP)

15
P
Phosphorus

ASH2®PHOS

- extracting phosphorus and other resources from incinerated sewage sludge

Schkopau: Joint-Venture with Gelsenwasser AG
2027 intended start operation, capacity: 30,000 t ssa/year

Helsingborg: Cooperation Ragn-Sells Treatment & Detox
2027/8 intended start operation, capacity: 30,000 t ssa/year

19
K
Potassium

ASH2®SALT

- recovering pure salts from fly ash

Inaugurated in April 2023
Capacity: 130,000 t fly ash/a

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THE ASH2SALT PROCESS

FLY ASH – A HAZARDOUS WASTE RESIDUE

Cleaning flue gases during municipal waste incineration leaves behind fly ash.

Fly ash from waste incineration contains high concentrations of chlorides as well as high levels of heavy metals.

This makes fly ash difficult and expensive to handle. It is note even suitable for landfills for hazardous waste.

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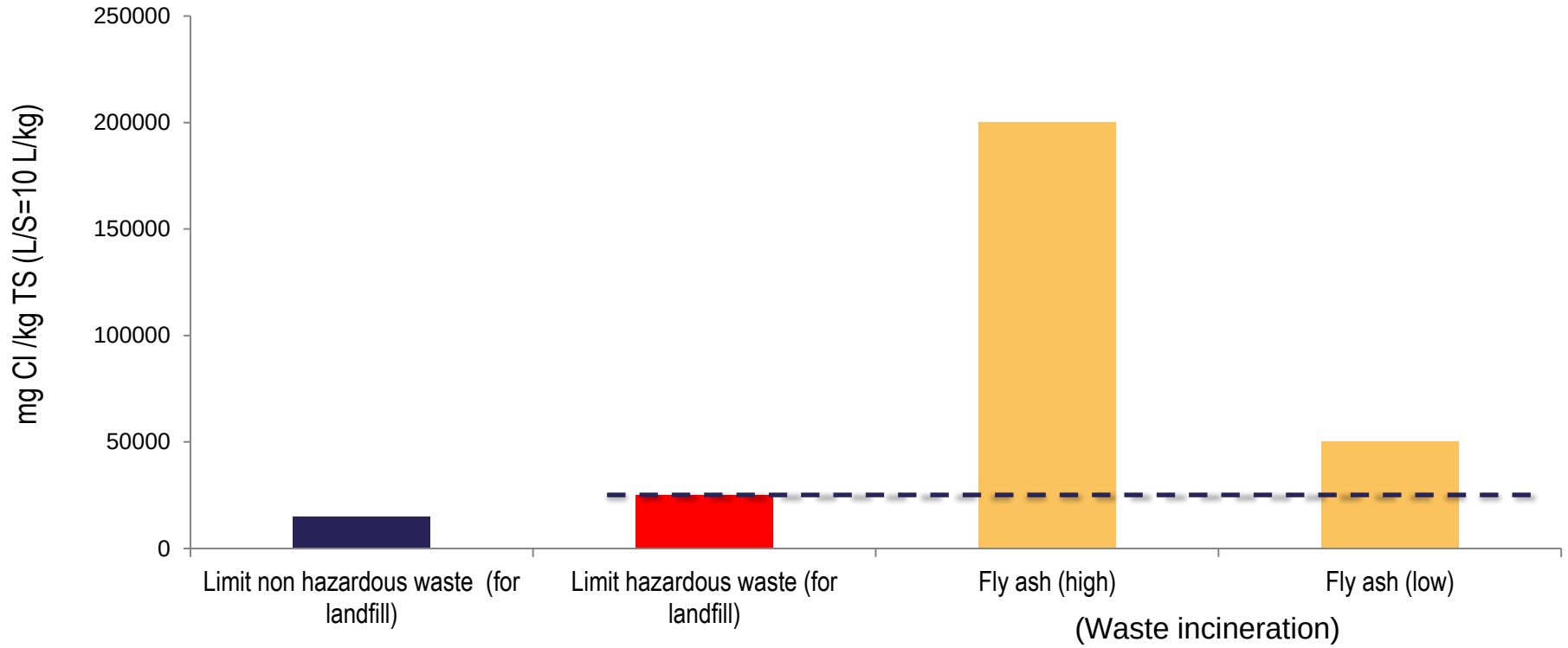
CRITERIA FOR DISPOSAL OF WASTES IN SWEDEN

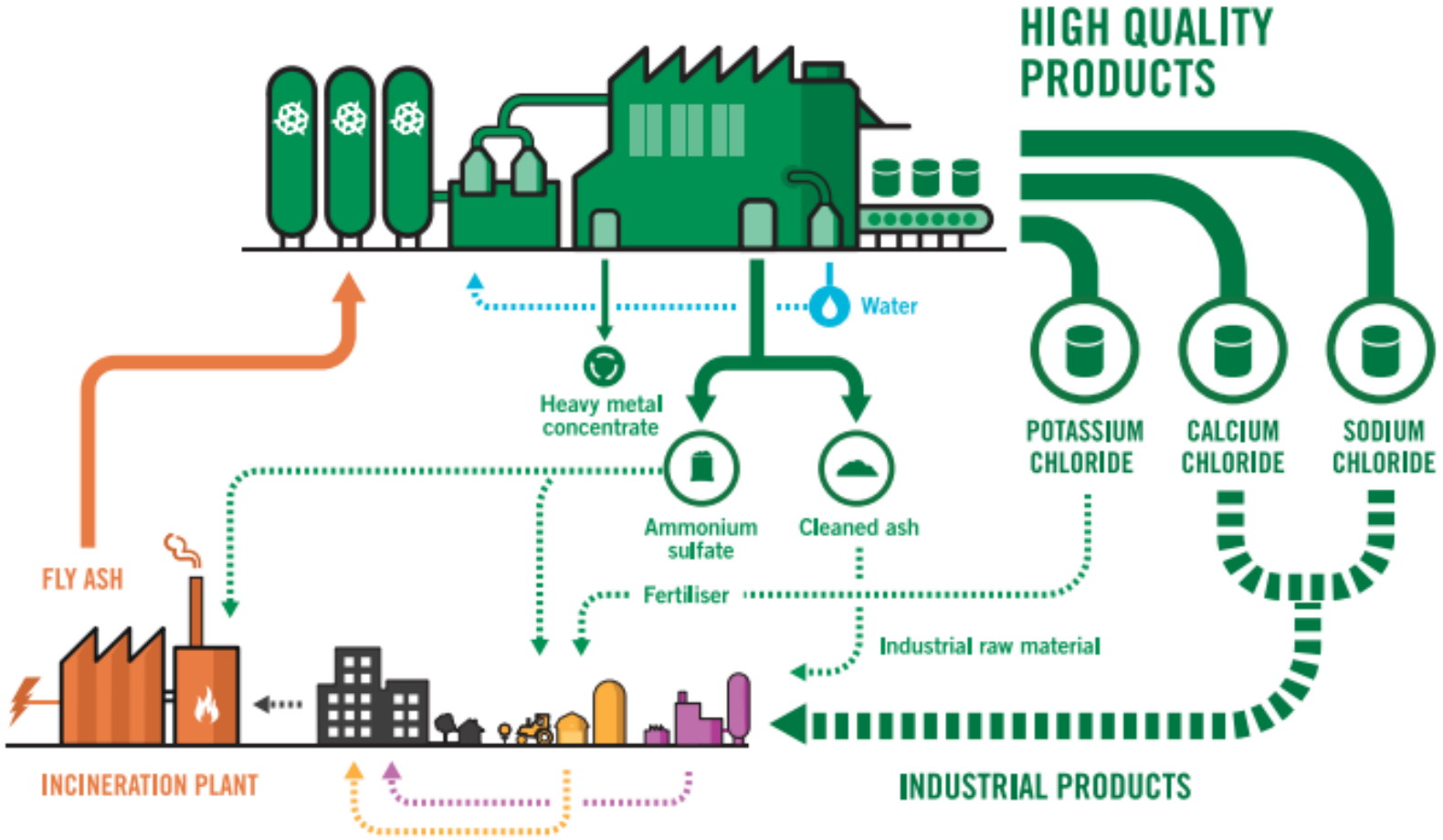
L/S 10	Inert avfall L/S=10 l/kg Bränsle mg/kg TS	Icke farligt avfall L/S=10 l/kg mg/kg TS	Farligt avfall L/S=10 l/kg mg/kg TS	över FA L/S=10 mg/kg TS
Analys	**Analys**			
Arsenik	0,5	2,0	25,0	
Barium	20,0	100,0	300,0	
Kadmium	0,0	1,0	5,0	
Krom total	0,5	10,0	70,0	
Koppar	2,0	50,0	100,0	
Kvicksilver	0,0	0,2	2,0	
Molybden	0,5	10,0	30,0	
Nickel	0,4	10,0	40,0	
Bly	0,5	10,0	50,0	
Antimon	0,1	0,7	5,0	
Selen	0,1	0,5	7,0	
Zink	4,0	50,0	200,0	
DOC	500,0	800,0	1 000,0	
Klorid	800,0	15 000,0	25 000,0	
Flourid	10,0	150,0	500,0	
Sulfat	1 000,0	20 000,0	50 000,0	
TS för lösta ämnen	4 000,0	60 000,0	100 000,0	

FLY ASH FROM WASTE INCINERATION HAVE A HIGH CONTENT OF SOLUBLE CHLORIDE SALTS

- Up to 40% by weight



THE ASH2SALT PROCESS



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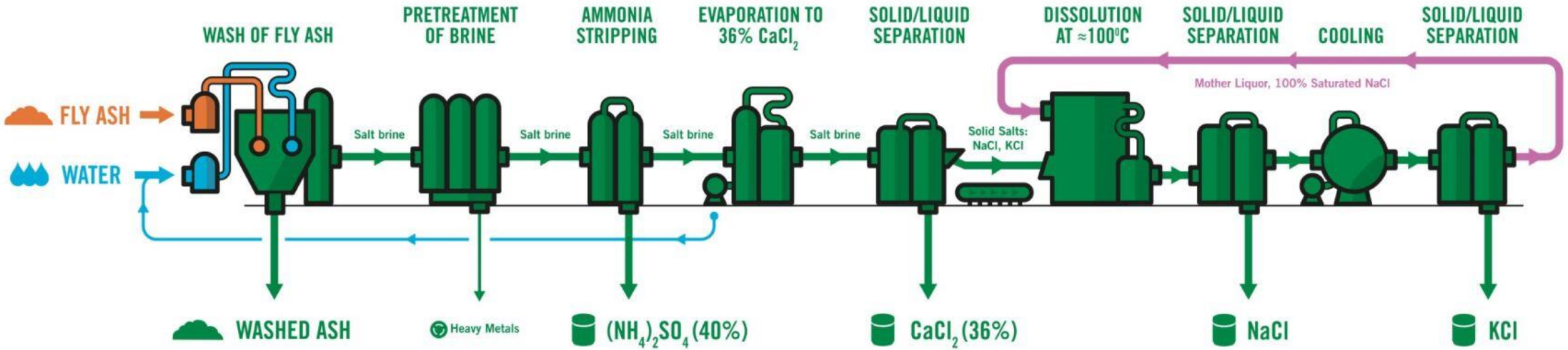
THE ASH2SALT PROCESS



- Robust process - can handle variations in ash content
- Facilitates cleaning of contaminated aqueous streams, e.g., landfill leachate
- Zero liquid discharge
- Separation of the individual salts with high purity

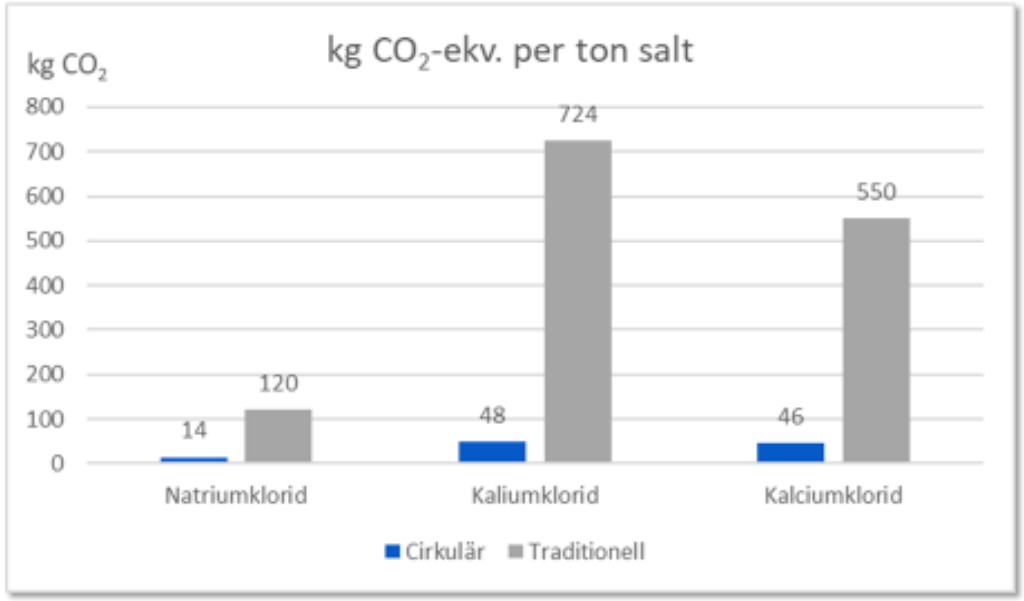
ASH2SALT - PRODUCTS FROM THE PROCESS

- **Potassium chloride** – Fertilizer, 3 500 ton (dry)
- **Calcium chloride** – Dust control and deicing, 32 000 ton (36%)
- **Sodium chloride** – Industrial processes, 7 000 ton (dry)
- **Ammonium sulfate** – Air pollution control/fertilizer, 750 ton (40%)

Recovered potassium chloride from fly ash

SALT WITH A VERY LOW CLIMATE IMPACT

LCA – Comparison Circular salts vs. Traditional production of salts



Circular salts can reduce

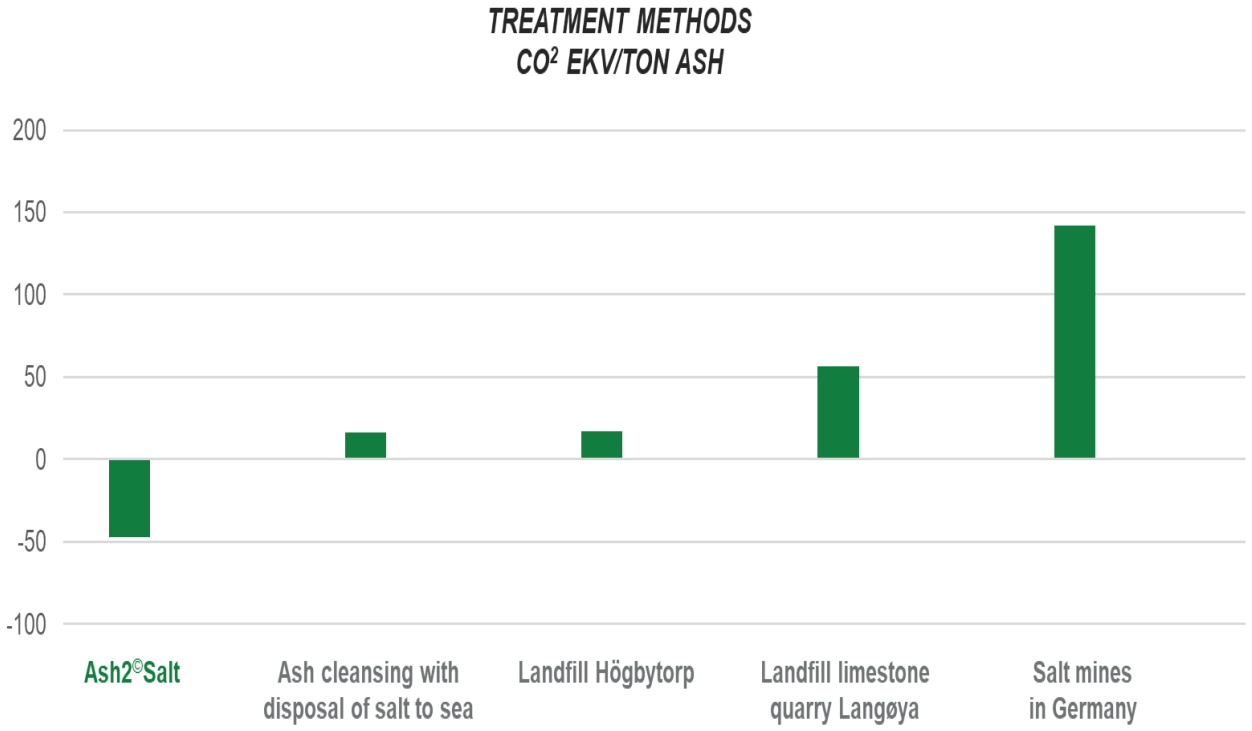
90% of the CO_2-emissions.

LCA analys – GC Rieber Salt, 2021

GC RIEBER

ASH2SALT – DETOXIFICATION AND ENERGY EFFICIENCY

Al	ppm	<10
Fe	ppm	5,4
Co	ppm	<5
Ni	ppm	<5
Cu	ppm	<5
As	ppm	<5
Se	ppm	<5
Mo	ppm	<5
Cd	ppm	<5
Sb	ppm	<5
Ba	ppm	<5
Ti	ppm	<5
Pb	ppm	<5
V	ppm	<5
TOC	%	<5
Particle size	mm	0,25-0,4



Recovered potassium chloride of 99,1% purity!

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LEACHING WATER (LS 10) FROM THE ASH2SALT RESIDUE (AVERAGE FOR SEVERAL OF ASHES, mg/Kg DRY MATTER)

pH	10,8
EC	371
Ca	8800
K	160
Na	497
Cl	4633
SO4	13333
DOC	22
F	1,1
Sb	0,02
As	0,02
Ba	2,4
Pb	0,04
Cd	0,002
Co	0,001
Cu	0,08
Cr	1,8
Hg	
Mo	0,9
Ni	0,01
V	0,31
Zn	0,03

Cl	15000	25000
SO_4	20000	50000
Sb	0,7	5
As	2	25
Ba	100	300
Pb	10	50
Cd	1	5
Co		
Cu	50	100
Cr	10	70
Hg	0,2	2
Mo	10	30
Ni	10	40
V		
Zn	50	200
DOC	800	1000

The leaching levels fulfill non- hazardous landfill

KEY FACTS: Upplands-Bro Ash2®Salt plant

FOOTPRINT:	Plant 1600 m², site 11,500 m²
CAPACITY:	150,000 tonnes/annually
INAUGURATED:	April 2023
MAIN CONTRACTOR:	Hitachi Zosen Inova


SALARIUM
from ash to salt


Ash2Salt®
Ragn-Sells Högbytorp, Upplands-Bro, Sweden
2020-07


RAGN SELLS

ADVANTAGES OF ASH2®SALT

Ash2Salt extracts pure potassium, calcium and sodium chloride salts from fly ash at the same time as it delivers significant environmental gains. Climate impact is greatly reduced and recycling encouraged.

- Recovers valuable commercial salts and replaces virgin mined salt with recycled products.
- Removes heavy metals from circulation.
- Fly ash residue suitable for ordinary landfill deposition or even reuse.
- Huge reduction in climate footprint compared with traditional production of salts.
- Reliable large-scale operation with zero liquid discharge.
- Treated process water can be reused within the process.
- Option for treating impure water from, for example, the site.

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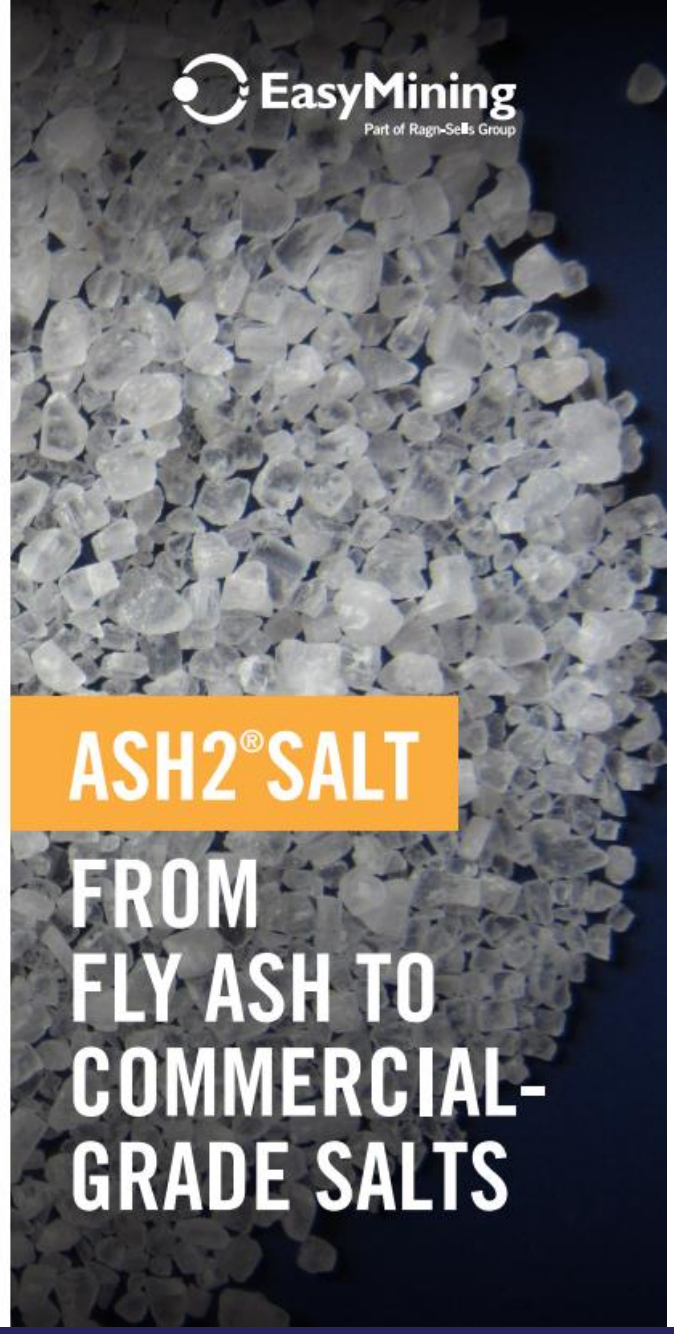
www.easymining.com

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