



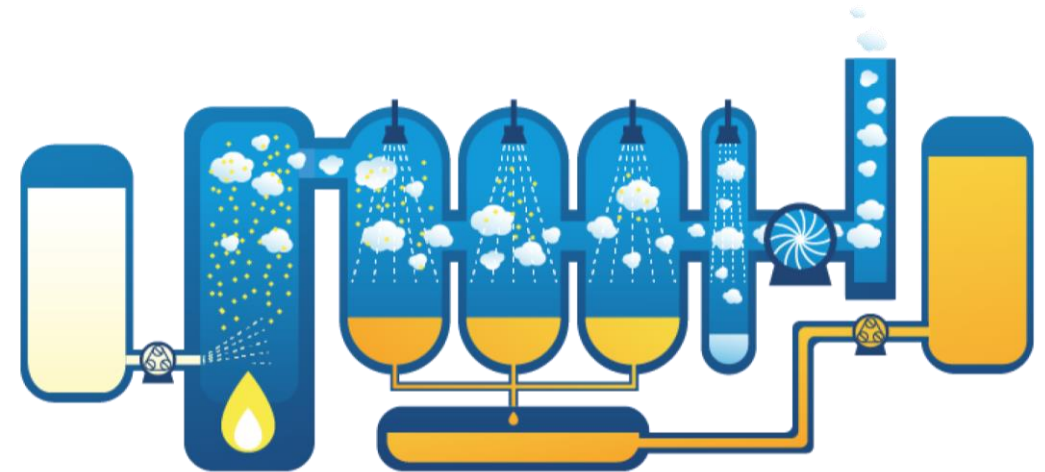
MAXIBROME: A unique process for bromine regeneration

Prometia Annual Seminar – Florent Sassi

Lisbon, November 30th, 2023



- 1. SECHE Environnement / Trédi Saint-Vulbas Focus**
- 2. Static Kiln – a specific tool in a global market**
- 3. Maxibrome – capacity increase through technological innovation**
- 4. Conclusion**





SECHE Environnement / Trédi Saint-Vulbas Focus

Presentation of the company and its range of businesses

A **leading player** in the circular economy and waste recovery, **Séché Environnement** focuses on the **ecological transition** in all its solutions.

Circular economy - Biodiversity - Climate change

To industries and municipalities
in **France** and **abroad**.



[Séché Environnement - Partenaire de votre transition écologique \(groupe-seche.com\)](https://groupe-seche.com)



CIRCULAR ECONOMY AND DECARBONATION

- **RECYCLING AND MATERIAL RECOVERY**
- **CREATION AND MANAGEMENT OF LOCAL ENERGY LOOPS**

Séché Environnement offers tailor-made solutions for the recovery of hazardous and non-hazardous waste (1/3 of the activity) – historically, the Group's primary business.



01

HAZARD MANAGEMENT

- **DECONTAMINATION**
- **WASTE TREATMENT**

Séché also offers solutions for the treatment of all types of industrial waste (2/3 of the activity), particularly hazardous waste, a field in which its expertise is widely recognized.



02

SERVICES

- **SERVICES FOR THE ENVIRONMENT**
- **SERVICES TO KEY INDUSTRIAL ACCOUNTS**
 - Solarca Group
- **LOGISTICS SERVICES**

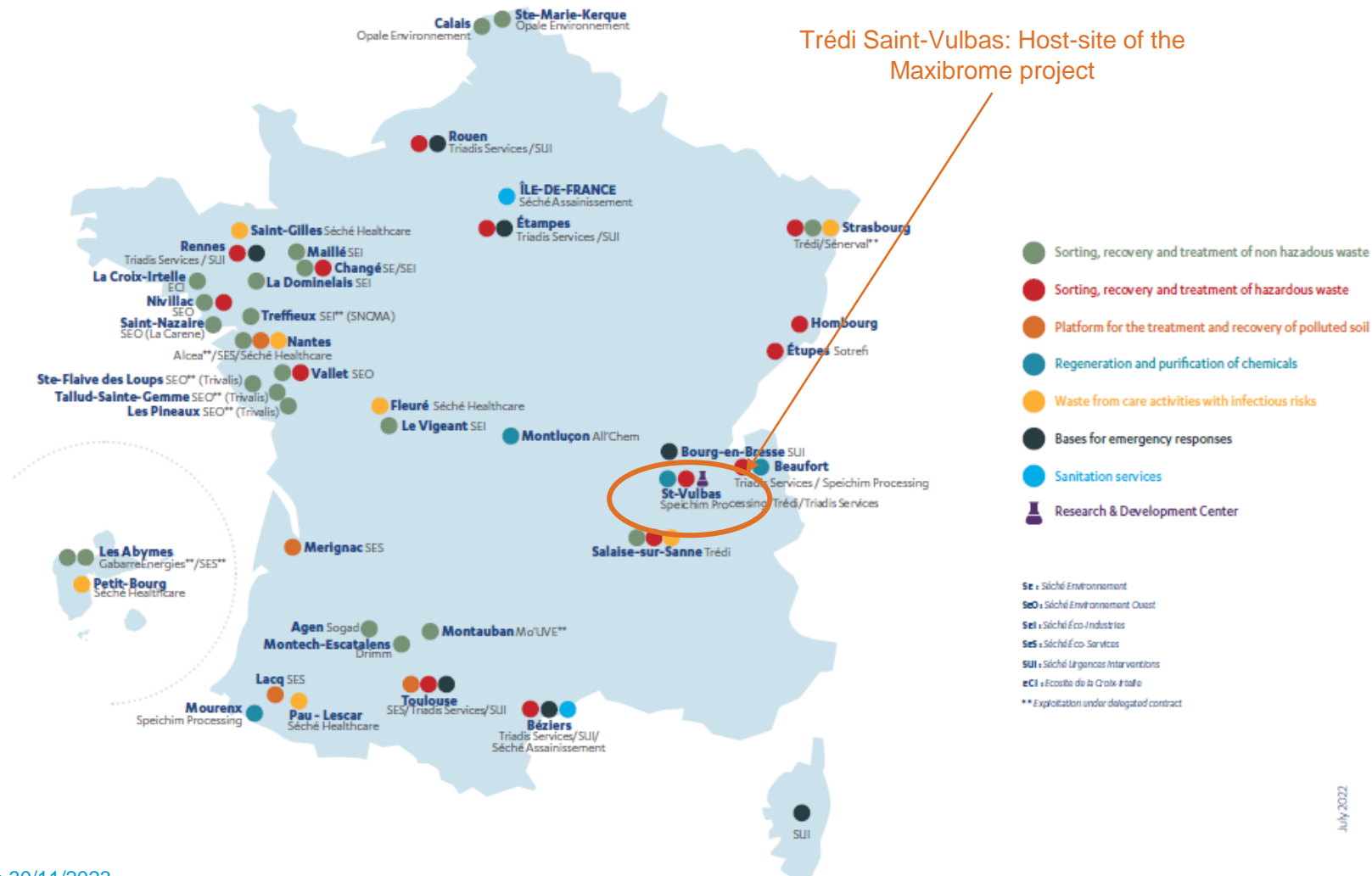
In terms of services, Séché has developed unique expertise in the field of decontamination and intervention in environmental emergencies as well as in chemical cleaning.



03



SÉCHÉ ENVIRONNEMENT, PARTNER IN YOUR ECOLOGICAL TRANSITION INDUSTRIAL FACILITIES



July 2022

Primary activities

Thermal treatment of hazardous waste

- Solid, liquid, pasty, gaseous
- Organohalogen waste,
- Reactive, toxic, odorous & corrosive organic waste
- PCBs waste
- Halogenated & special gases
- Rotary kiln with a capacity of 35 000 t/year
- Static kiln with a capacity of 23 000 t/year
- Special industrial gases treatment workshop

PCBs =
Polychlorinated
biphenyl

Transformers activities

- Decontamination, recovery & rehabilitation of PCBs transformers
- Preventive maintenance of dielectric fluids
- PCBs waste on-site depollution project

Specific activities

- Bromine brine regeneration
- Greenhouse gas regeneration

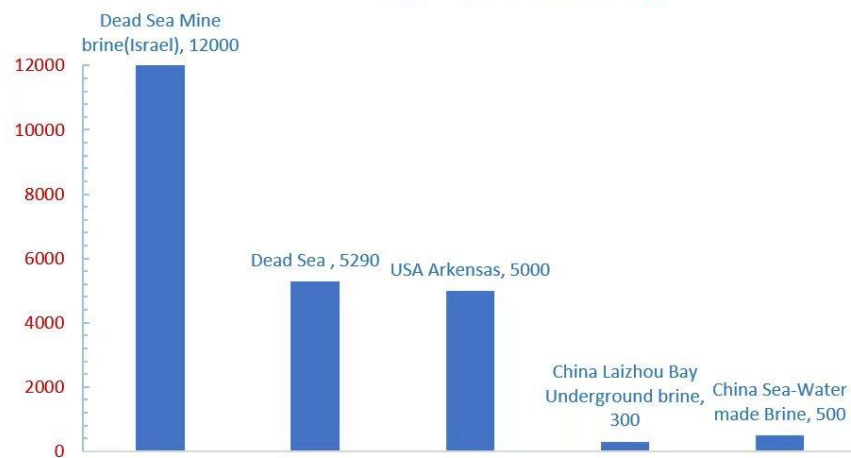




Static Kiln – a specific tool in a global market

Bromide regeneration in Trédi Saint-Vulbas

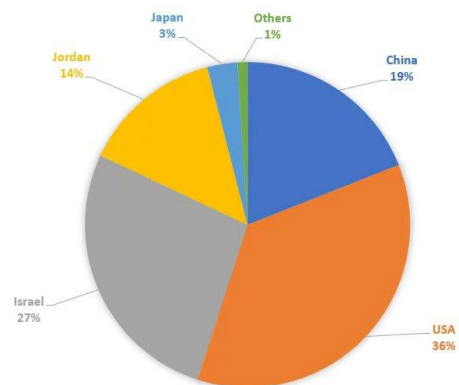
Bromine Content(ppm) in different region



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GLOBAL BROMINE RESOURCES DISTRIBUTION



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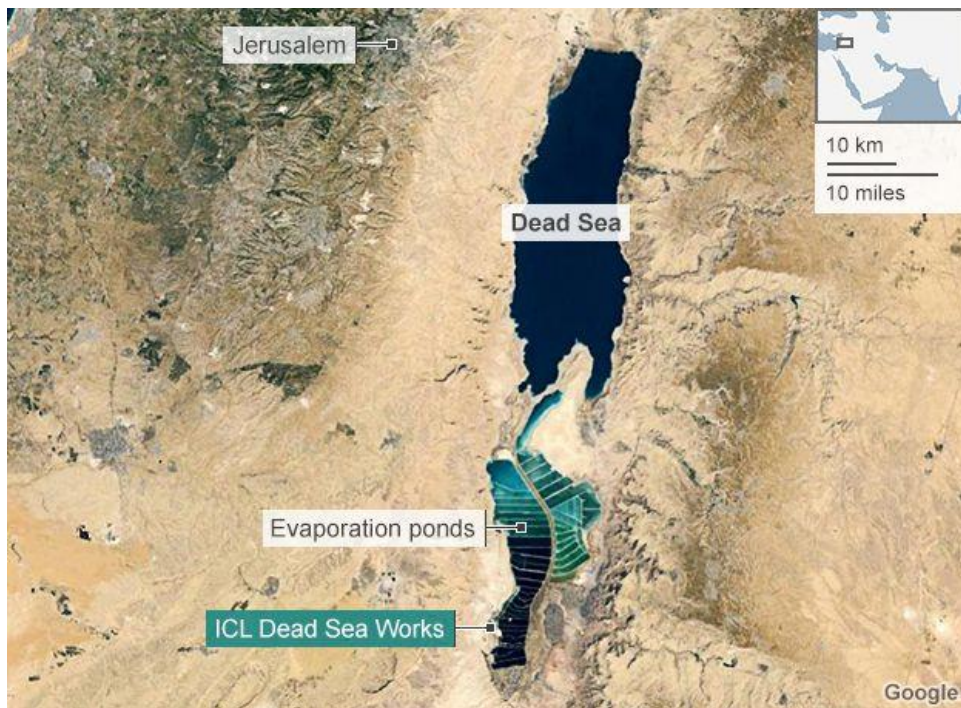


Main producers worldwide :

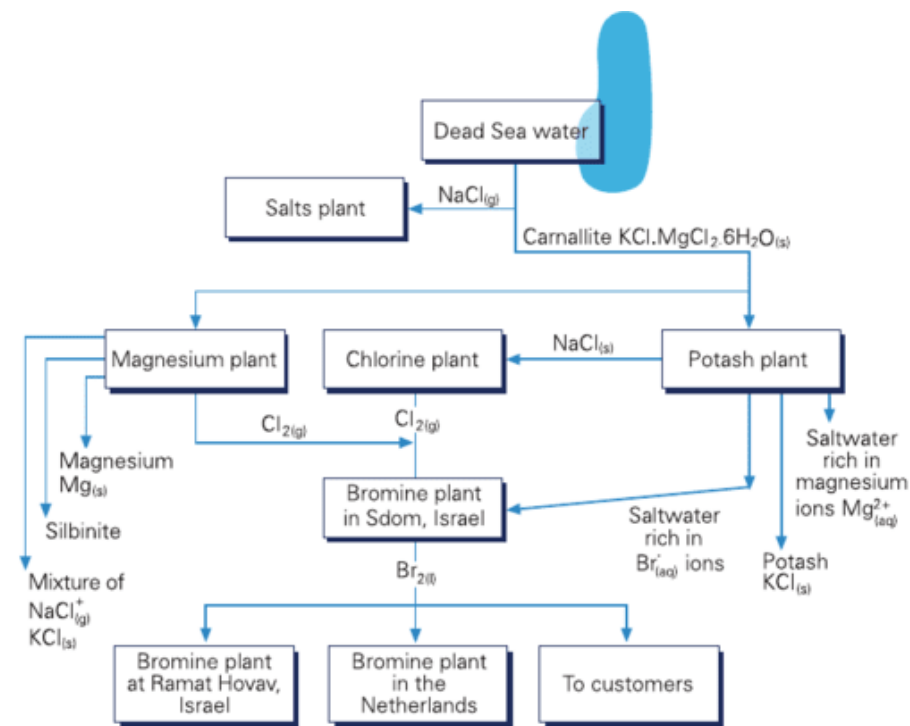
1. Israël Chemicals Ltd (ICL) → process the water from the Dead Sea. 280 kT/yr capacity
2. Albemarle Corporation (U.S) → 148 kT/yr capacity in Arkansas / 60 kT/yr capacity in Jordan (joint venture with Arab Potash Company → Jordan Bromine operating in the Dead Sea)
3. Lanxess (Germany) through Chemtura Corporation → 130 kT/yr capacity in Arkansas
4. Gulf Resources (China) → 46 kT/yr capacity from underground brines extraction
5. Tosoh Corporation (Japan) → 24 kT/yr capacity from sea water

→ Around 90% of the effective World production (~ 600 kT/yr) is shared between the Dead Sea (Israel and Jordan sides) and the U.S (Arkansas, Michigan)

→ Seche Environnement produces a Br equivalent of 4400 T/year → 1/3 of France's needs



Source: *Who's afraid of bromine?* - BBC News



Source: *Brombook* - Weizmann Institute of Science

■ “Virgin bromine” = extracted from natural resources

- Dead Sea → oxidation from Br by Cl₂ in aqueous phase + stripping Br₂ (Kubierschky process)
- Need of highly favorable conditions (Surface / Temperature of evaporation ponds + High Br concentration in brines)
- Mediterranean Sea → 40 mg/L Br and sporadic sources of Bromine (potash mines closed in France in 1998, ...)
→ Br consumption in Europe but no long-term natural source to ensure local supply

■ Bromine wide range of application

→ Largest single use in fire safety (~ 20% of Flame Retardants are bromine-derived)

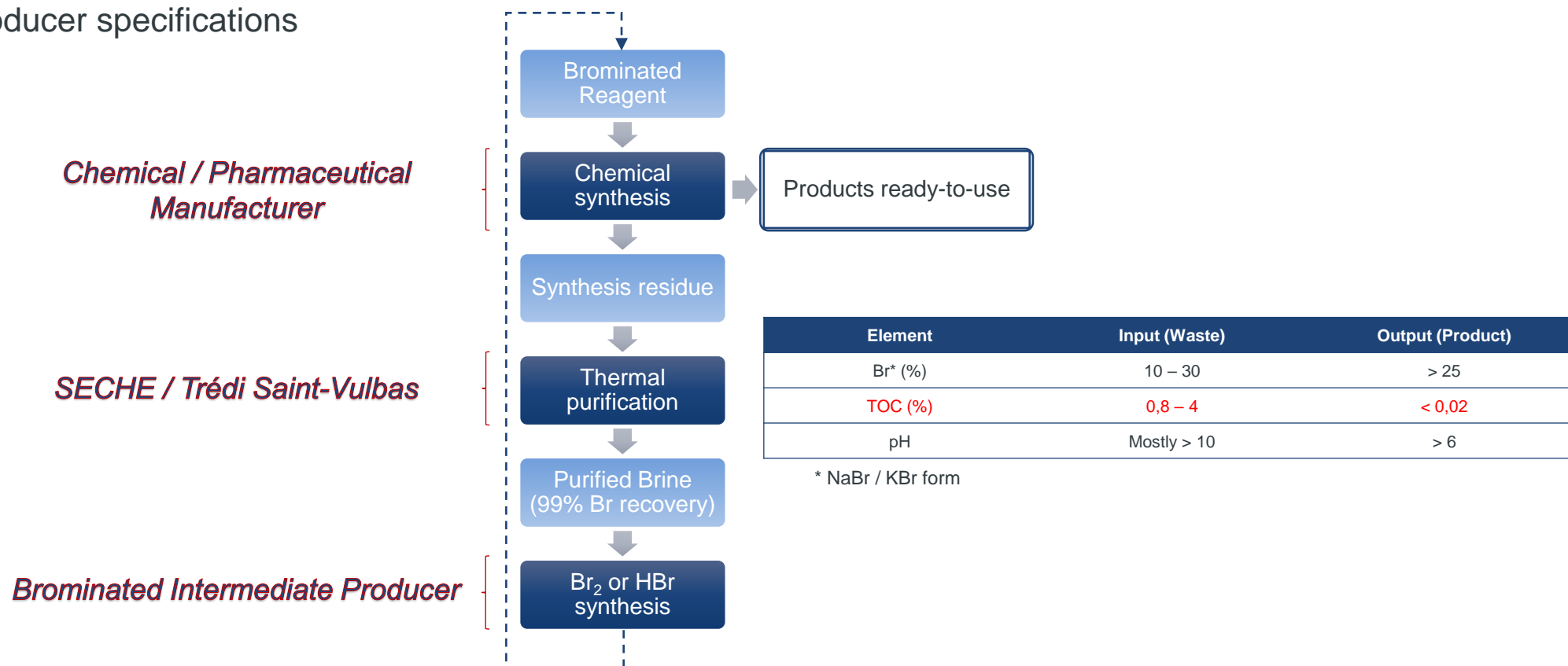
→ Br₂ and HBr are used as synthesis intermediates mainly in chemical and pharmaceutical industry

By Derivative	<ul style="list-style-type: none">• Clear brine fluids• Hydrogen bromide• Organobromines
By Application	<ul style="list-style-type: none">• Flame Retardants• Biocides• Organic Intermediates• PTA synthesis• Plasma Etching• Oil and Gas Drilling
By End User	<ul style="list-style-type: none">• Pharmaceuticals• Cosmetics• Textile• Pesticides• Automotive• Others

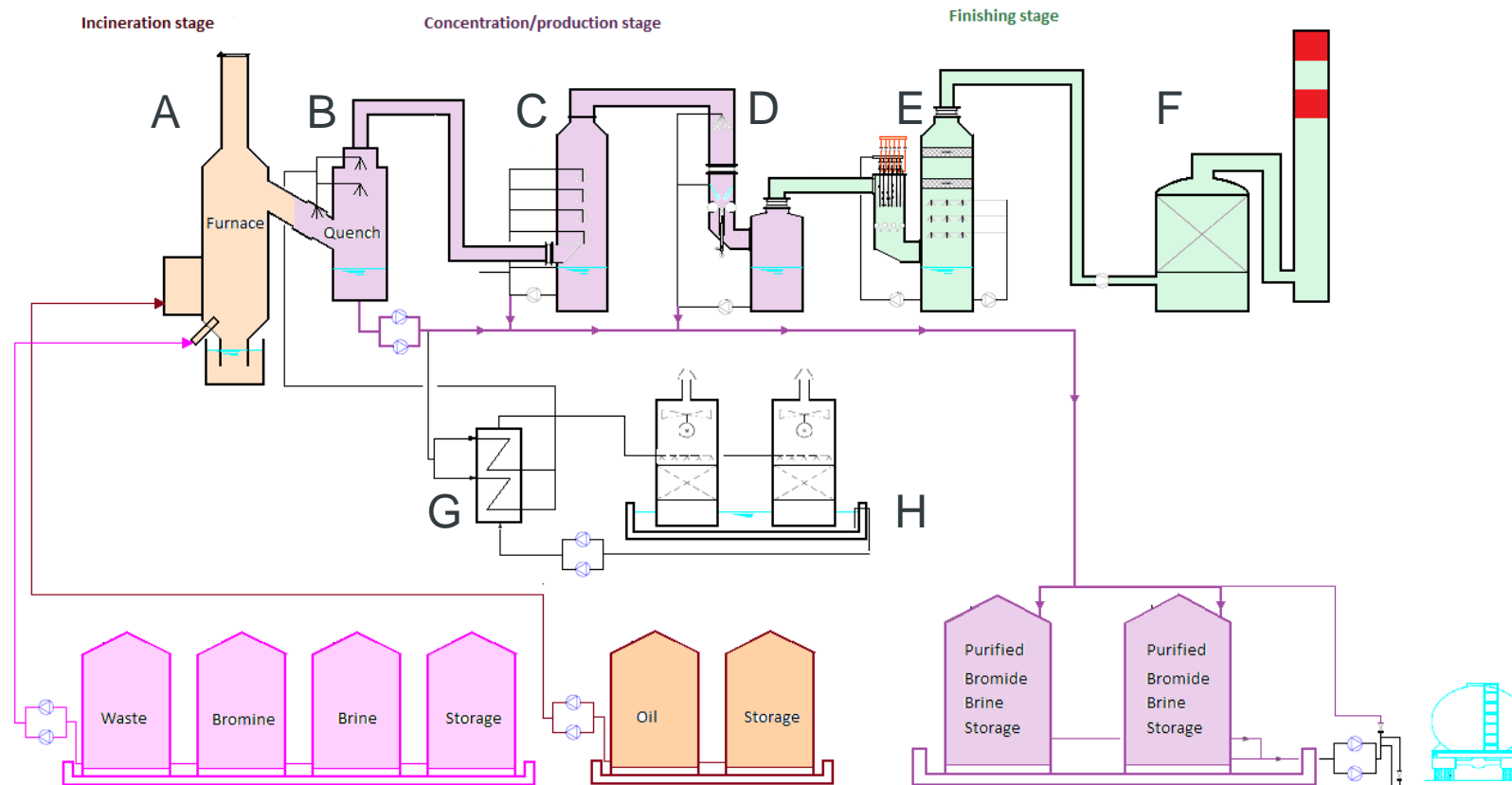
Source: Researchnester – Bromine Market

Br lifecycle through Regeneration cycle

- Organic synthesis of bromine derivative → waste co-generation during the washing step
- Material recovery in Trédi Saint-Vulbas: from "waste" to "product" status → the purified brine meets brominated intermediate producer specifications



Process



- A. Static kiln : Operating temperature from 850 °C to 1200 °
- B. Quenching : Combustion gas cooled from 850/1200°C to 60/ 80 °C
- C. Crossed pulverisation
- D. Dynamic venturi
- E. High pressure ejectors
- F. Charcoal tower
- G. Heat exchanger
- H. Air Cooling Tower

Maxibrome – capacity increase through technological innovation

O₂ enriched combustion

Aim of the Maxibrome Project

Commercial Request

- Br Market growth (~ +4%/year 2022-2027)
- SECHE's Client needs to increase destocking rate
- European Br producers needed



Technical limitation

- Limited space
- Need to be ready quickly
- HCV (fuel) tense market

Maxibrome Project

- Improve combustion conditions → HCV / LCV ratio
- Enhance brine capacity treatment at constant fumes flowrate
- Meet environmental standards (NO_x emissions, ...)

HCV = High Calorific Value (waste)
LCV = Low Calorific Value (waste)



Why O₂ enriched combustion ?

Regular vs. Oxy-Fuel Combustion

Combustion

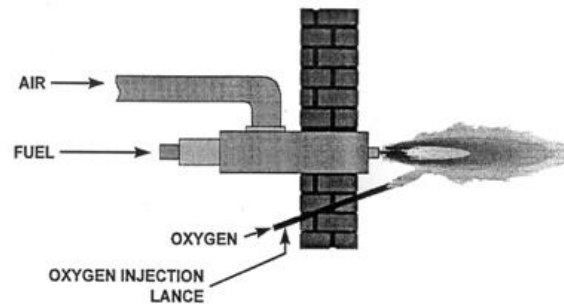


- Air = 78% N₂ + 21% O₂
- NO_x emission risk ↑
- Energy consumption to heat useless volume of air

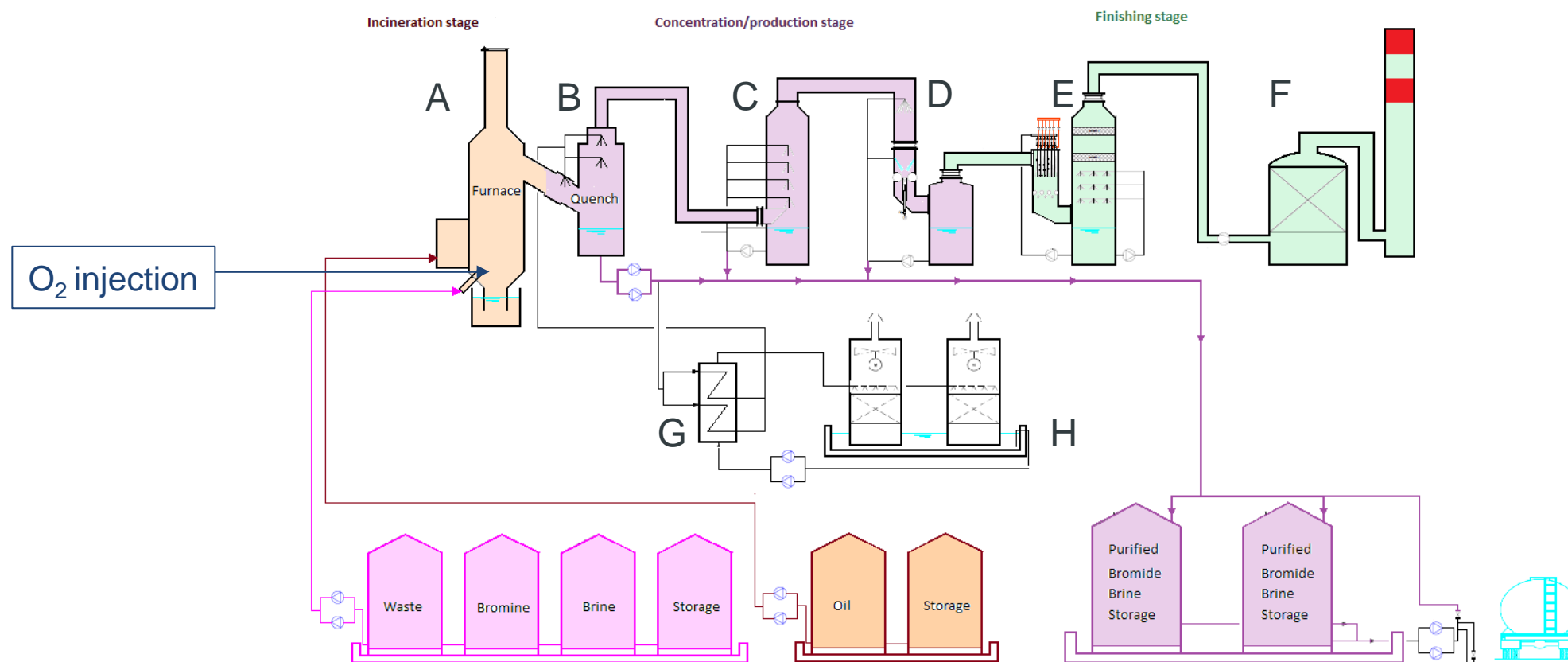
Oxy-Fuel Combustion



- O₂ source added into the combustion zone = capacity increase 1,6 T/h → 2,5 T/h



O₂ injection into the combustion zone



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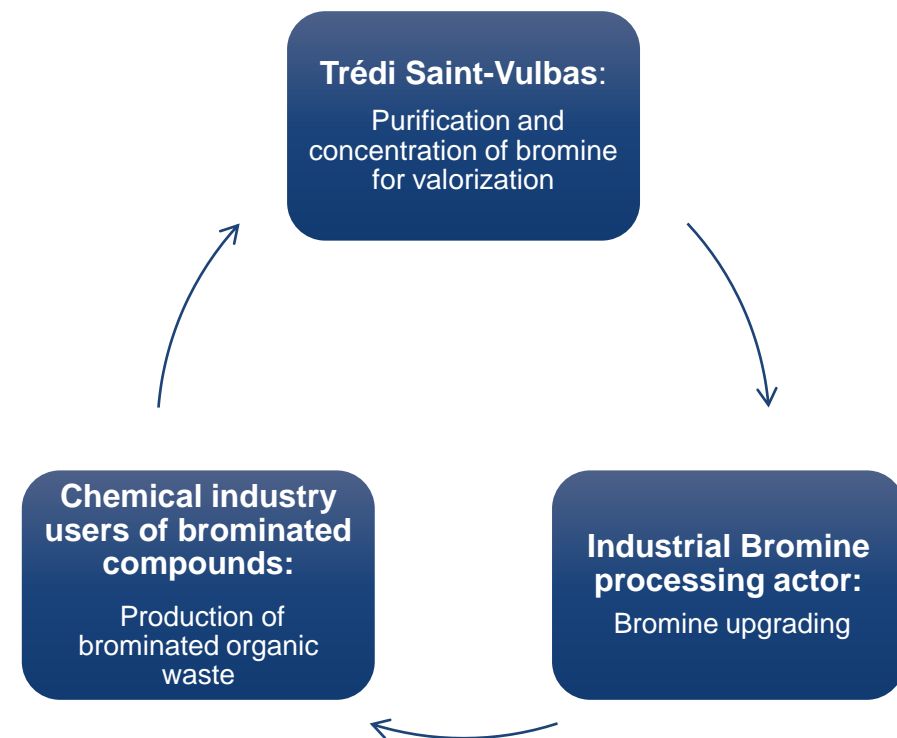
Maxibrome Scoreboard

Parameter	Initial Process	Maxibrome
Tons of LCV (waste brine) treated / h	1,6	2,5
Tons of HCV treated / h	0,2	0,2
HCV / LCV ratio	12,5%	8%
Tons of waste treated / year	15 000	23 000
Pure O ₂ (Nm ³ /h)	0	200
Equivalent T(Br) produced	2800	4400
Tons of CO ₂ eq / T(Br) produced	2,2	1,5

- Decrease of the HCV / LCV Ratio
- 55% increase for polluted brines treatment capacity
- Fumes flowrate not impacted → decrease of the T(CO₂ eq) / T(Br_{produced}) ratio

A specific process in Europe

- From “waste” to “product” status
- 99% of Br content recycled
- Thermal process know-how applied to material valorization and capacity increase
- SECHE actor of Europe’s circular economy
 - Cost Reduction
 - Environmental Footprint Reduction





Thank you for your attention

Any Question ?

