June 9, 2026

Wastewater Solids Incineration Abroad—What can we learn from other countries?

MIDWEST BIOSOLIDS ASSOCIATION

Brown AND Caldwell

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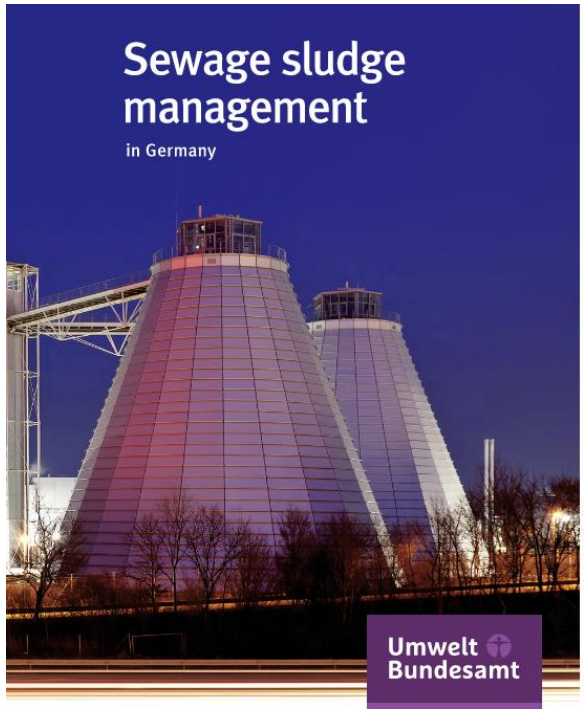
European Experience — How it happened…

German UBA Phosphorus Ordinance (2017)



https://www.umweltbundesamt.de/

Report recommends mono-incineration to limit pollution and recycle phosphorus

PFAS Destruction through Incineration at Wastewater Reclamation Facilities – Current Understanding and Research Efforts in North America

Lloyd Winchell

Active German Incineration Projects

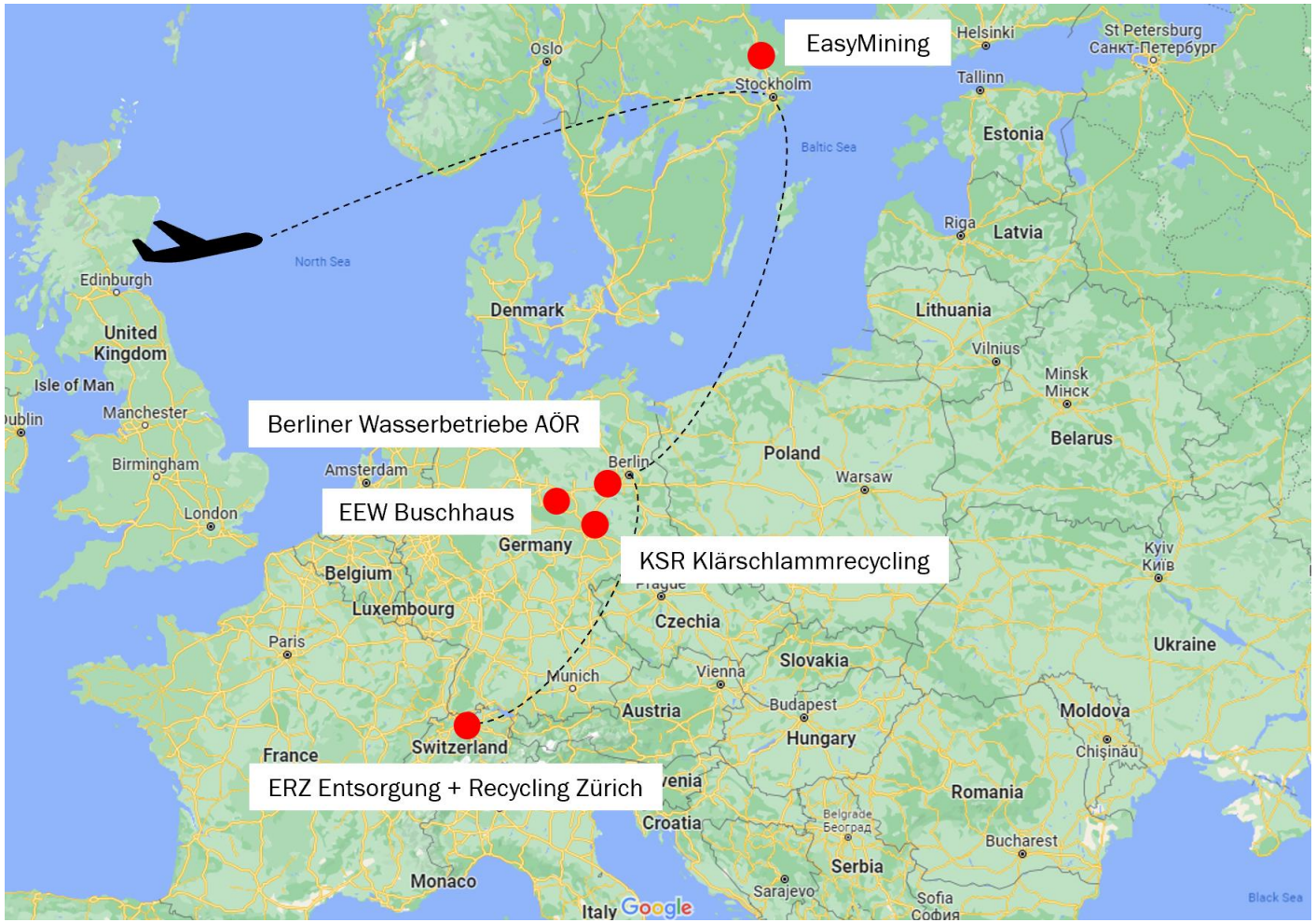
Table 4: New sludge incineration capacities under construction, planning or in discussion

Location	State	Capacity Mg/a	OS	Dry solids input %	Capacity DM Mg/a	Operator / utility
Berlin Wassmannsdorf	BE/BB				72.000	BWB
Beuna	ST	100.000			25.000	Wiese Service GmbH
Bitterfeld-Wolfen	ST				60.000	Gelsenwasser
Böblingen	BW				30.000	
Bonn regional	NRW				60.000	Bonn, Erftverb. STEB, WVER
Bremen	HB/NS	180.000		25	45.000	Kenow GmbH & Co. KG
Düren	NRW				70.000	Various incl. Cologne, see Bonn regional
Eisenhüttenstadt	BB				20.000	Cottbus, FF, EH
Frankfurt a.M.	HE					Tendered planning
Gießen	HE				20.000	Coop planned
Guestrow	MV				32.500	Remondis
Halle Lochau	ST	34.000			10.000	Built by sludge2energy
Hamburg	HH				+1 line	VERA (more capacity)
Hannover	NS				60.000	Enercity or EEW
Helmstedt	NS				32.000	EEW
Herne	NRW				30.000	Gelsenwasser
Hildesheim	NS				25.000	SE Hi
Karlsruhe City	BW					More capacity
Karlsruhe Landkreis	BW	18.000			4.500	Planning tendered
Kiel	SH				35.000	discussed
Koblenz**	RP	13.000			4.000	Under construction
Magdeburg	ST				18.800	Feasibility study
Mannheim	BW				37.500	MVV (2x Euphore rotary kilns)
Mainz Mombach	RP				37.500	Under construction
München	BY					Feasibility study
Neu-Ulm	BY					Add. new 3rd line
Offenbach	HE				20.000	MVV? (Euphore?)
Rostock	MV	84.000			25.000	KS Koop-MV
Saerbeck	NS	60.000			15.000	MAXXCON
Stapelfeld	SH				32.000	EEW
Stavenhagen	MV				32.500	EEW
Trier	RP	48.000			12.000	
Wuppertal	NRW					Feasibility study
Saxony	SA	Demand ca. XYZ t DS/a				Leipzig, Chemnitz, Dresden?
Schleswig-Holstein	SH	Demand ca. 70.000 t DS/a				Stapelfeld (EEW), Kiel, Lübeck, Hetlingen?
Thuringia	TH	Demand ca. 40.000 t DS/a				Erfurt, Jena?

Courtesy of Peter Brady

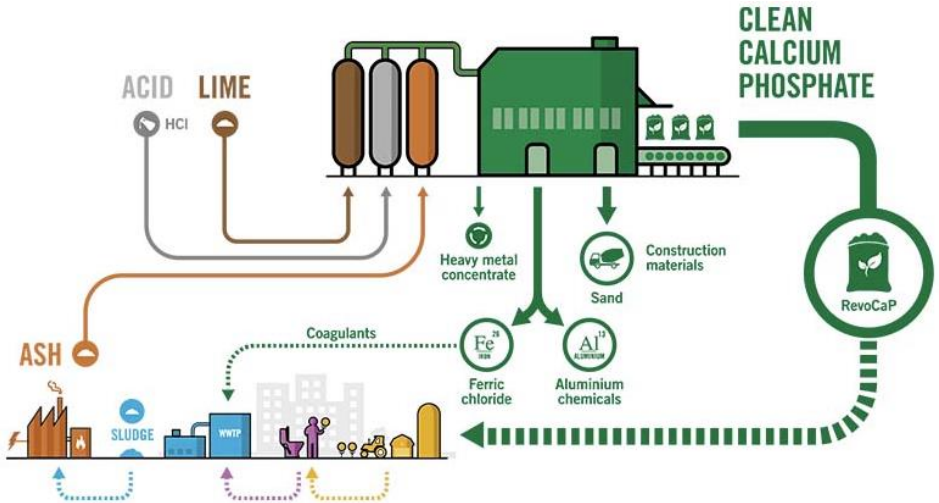
Where I went…

- Started in Sweden
- Ended in Switzerland
- Five site tours
- One conference
- 11 days



Where I went… Uppsala

- Uppsala Universitet off-shoot
  - *EasyMining is passionate about inventing new technology that uses intelligent chemical solutions to close nutrient cycles. Our objective is to create new circular material flows in an efficient commercial way.*
- Sweden limits chlorides disposed in landfills – MSW large contributor
  - Developed treatment process to wash ash and recover minerals for reuse
- Similar process being developed to recapture phosphorus – big German market potential
- https://www.easymining.se/

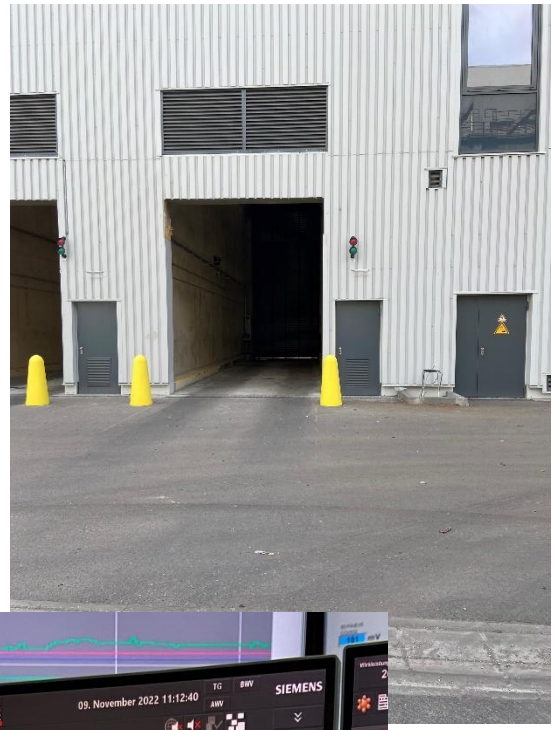


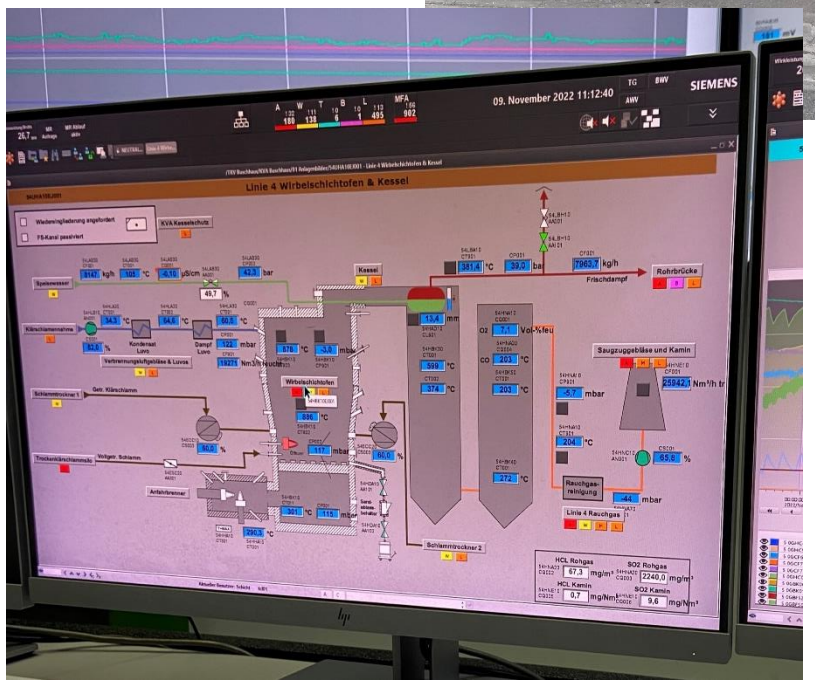
Where I went… Helmstedt

- EEW Energy from Waste Helmstedt GmbH TRV Buschhaus
  - Private industry
- Co-located with MSW incinerator
- Process 450 wet metric tons/day (digested)
- Single fluidized bed – Siemens
  - “Warm” windbox, 300°C
- https://www.eew-energyfromwaste.com/de/standorte/helmstedt-trv/

Where I went… Helmstedt

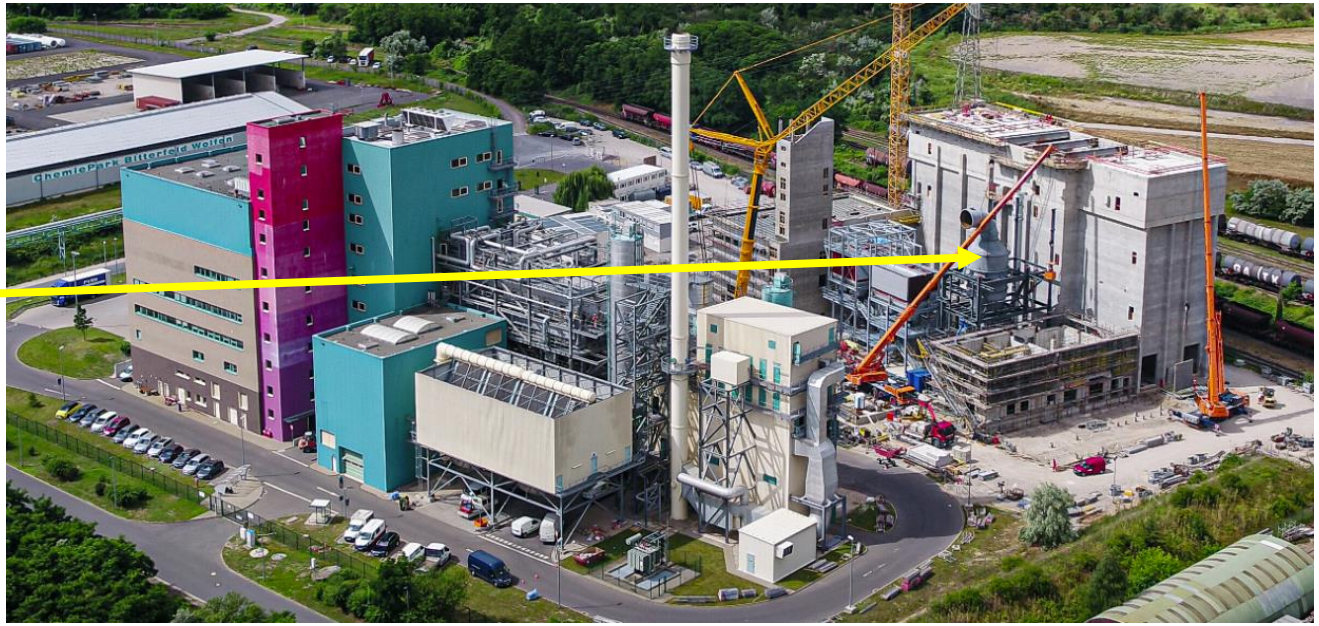
- Cake receiving – dual bay, clam bucket
- Drying – disc dryers (2), 42% TS
  - Dryer vapor, recycled to furnace for NOx control
- Boiler, dry ESP, condenser (Ca injection), baghouse, two-stage scrubber
- Designed with live pneumatic sand bed extraction system – doesn't work
- Commissioning facility – learning curve





Where I went… Bitterfeld

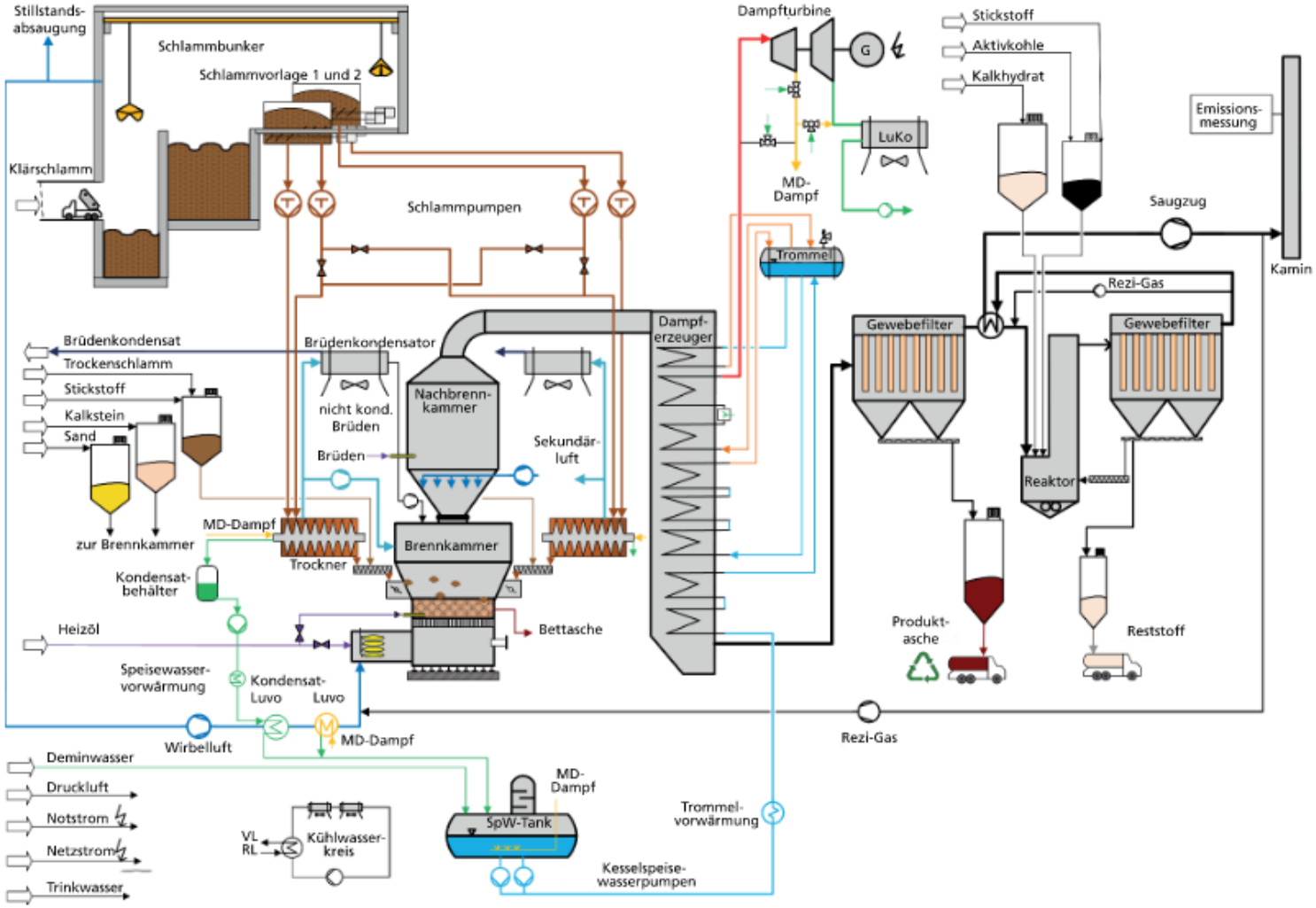
- Klärschlammrecycling (KSR) Bitterfeld-Wolfen GmbH
- Co-located with MSW incinerator
- Process 800 wet metric tons/day (digested)
- Single fluidized bed - Küttner Martin (Outotec)
    - “Warm” windbox



https://www.kuettner-martin.de/de/

Where I went… Bitterfeld

- Cake receiving – triple bay clam bucket
- Dryers – disc (65% TS)
- Boiler, two baghouses (Ca and carbon addition)
- Used 95% TS sludge as auxiliary fuel



Where I went… Berlin

- Klärwerk Ruhleben
  - Largest of 5 facilities
  - 223,000 m^3/day (60 mgd)
- POTW
- Three fluidized bed furnaces built during cold war (1985), components flown into Berlin from the West
- 300 wet metric tons/day
- https://www.bwb.de/en/index.php

Where I went… Berlin

- Cake receiving – single bay, piston pumps
- Furnaces
  - “Warm” windbox, 300°C
- Boiler, dry ESP (carbon and on roof), wet scrubber
- Heat paint

Where I went… Berlin

- Constructing new facility
  - Klärwerk Waßmannsdorf
  - Ruhleben continues to operate
  - Plan start 2014, commission in 2025
  - Three trains, 68,000 dry metric tons/year
  - Dryers ahead of furnaces
  - 80 trucks/day
  - 70,000 lb/hr steam

Where I went… Zurich

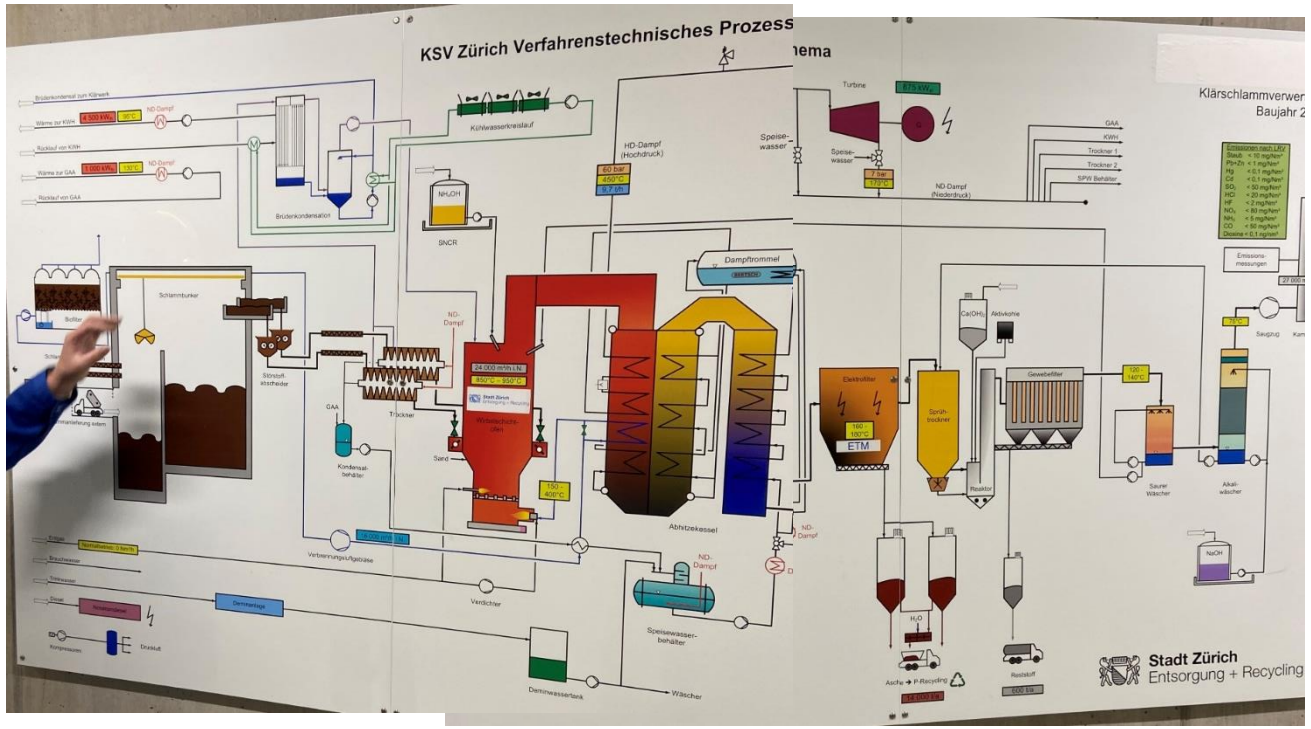
Stadt Zürich
Entsorgung + Recycling

- Werdhölzli, largest WWTP in Switzerland
- 500,000 m^3/d (110 mgd) peak
- Single fluidized bed train, built in 2015 - Küttner Martin (Outotec)
- https://www.stadt-zuerich.ch/ted/de/index/entsorgung_recycling/wissen/wasser/klaerwerk.html

Where I went… Zurich

Stadt Zürich
Entsorgung + Recycling

- Cake receiving – dual bay, clam bucket
- Drying – disc dryers (2), 40-45% TS
- Furnace – warm windbox (200°C)
  - Active sand removal
- Boiler, dry ESP, condenser, Ca/C reactor, baghouse, two-stage scrubber



Noteworthy European Observations

- Centralizing
- Co-locating with MSW incineration for process synergies
- Steep process learning curve and maintenance intensive, just like NA
- Standard approach includes:
  - Energy recovery
  - Cake receiving
  - Minimize water usage and discharge
    - Especially at co-located facilities
- Sand other than olivine used
- Google Translate works, kind of

Japan Experience — How it came to be…

water ENVIRONMENT RESEARCH

Water Environment Federation the water quality people

REVIEW | Open Access

Per- and polyfluoroalkyl substances thermal destruction at water resource recovery facilities: A state of the science review

Lloyd J. Winchell, John J. Ross, Martha J. M. Wells, Xavier Fonoll, John W. Norton Jr, Katherine Y. Bell

First published: 15 November 2020 | https://doi.org/10.1002/wer.1483 | Citations: 140

RESEARCH ARTICLE | Open Access

Fate of perfluoroalkyl and polyfluoroalkyl substances (PFAS) through two full-scale wastewater sludge incinerators

Lloyd J. Winchell, Martha J. M. Wells, John J. Ross, Farokh Kakar, Ali Teymouri, Dana J. Gonzalez, Ky Dangtran, Scott M. Bessler, Shane Carlson, Xavier Fonoll Almansa, John W. Norton Jr, Katherine Y. Bell

First published: 05 March 2024 | https://doi.org/10.1002/wer.11009 | Citations: 3

CONTRACT

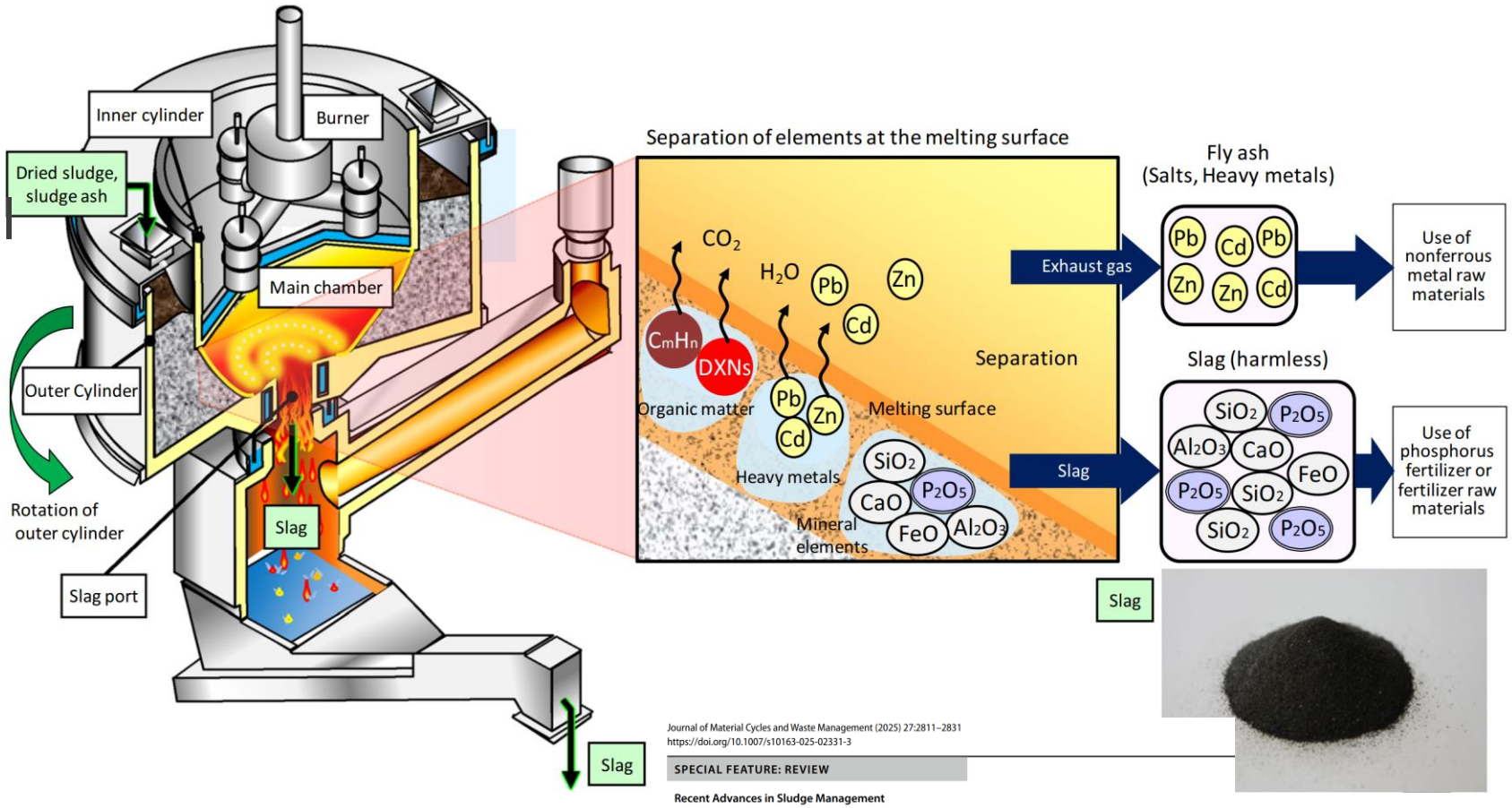
PFAS Study

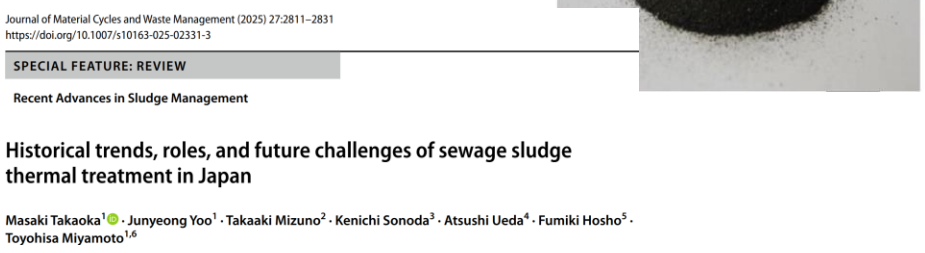
Brown AND Caldwell

Kubota

Kubota Surface Melting Furnace (KSMF)

- First commissioned in 1979
- Treats variety of material
  - Sludge
  - Ash
  - MSW
- 45 furnaces applied
- Currently have two operating on sludge





Journal of Material Cycles and Waste Management (2025) 27:2811–2831
https://doi.org/10.1007/s10163-025-02331-3

SPECIAL FEATURE: REVIEW

Recent Advances in Sludge Management

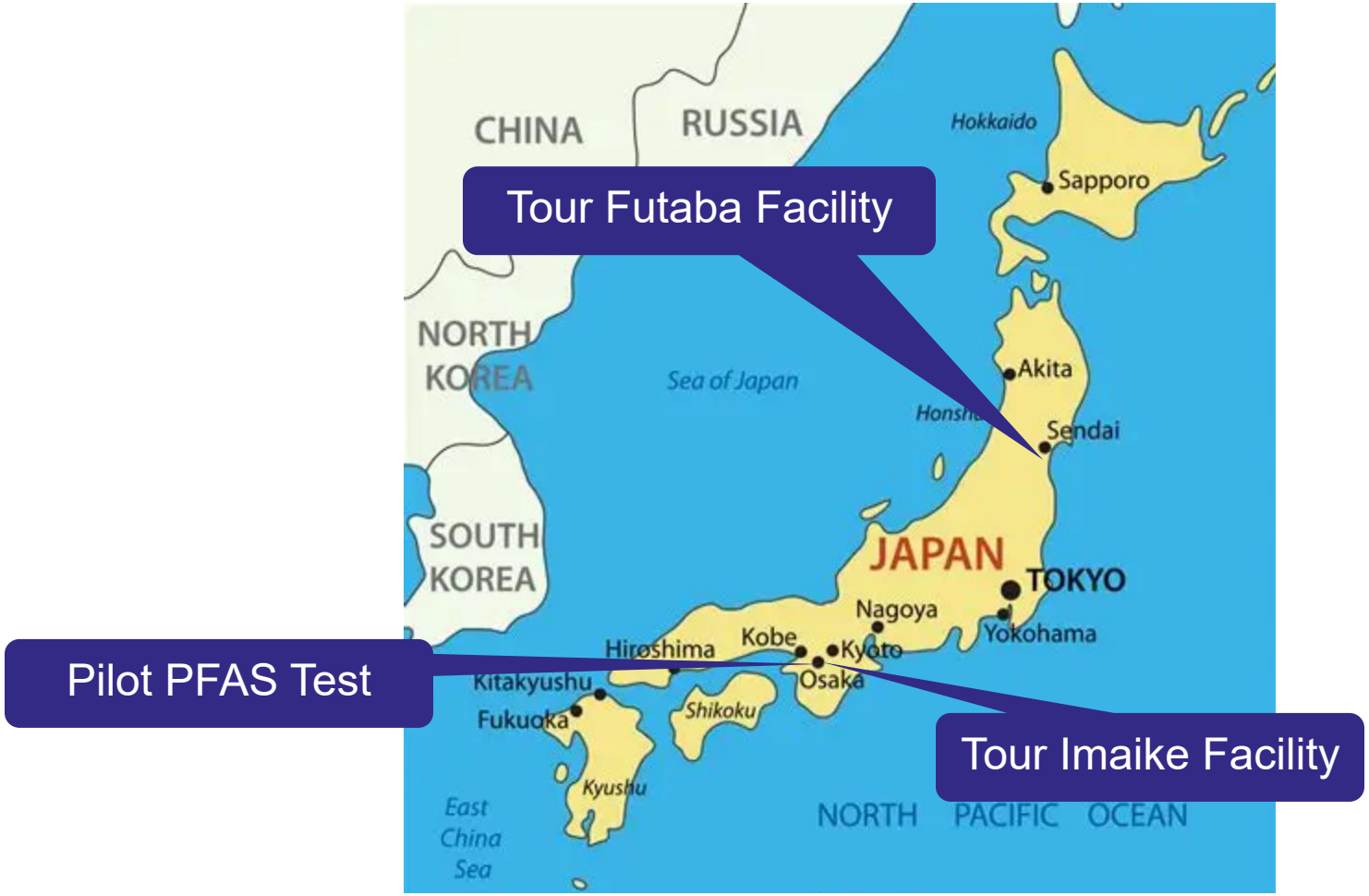
Historical trends, roles, and future challenges of sewage sludge thermal treatment in Japan

Masaki Takaoka[1] · Junyeong Yoo[1] · Takaaki Mizuno[2] · Kenichi Sonoda[3] · Atsushi Ueda[4] · Fumiki Hosho[5] · Toyohisa Miyamoto[1,6]

https://www.kubota.com/kubotastories/melting-furnace/index.html

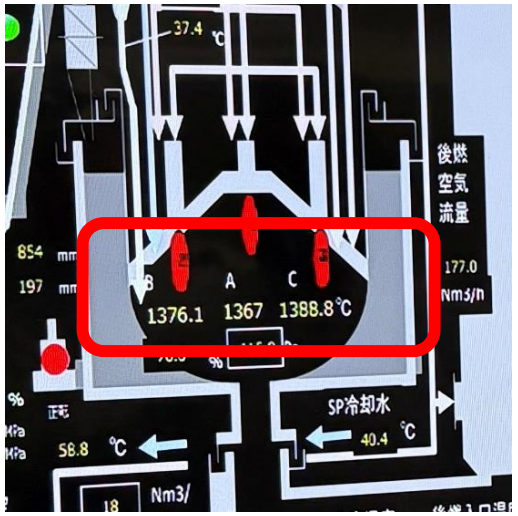
Visit Agenda

- Sample pilot KSMF
- Leverage trip for tours



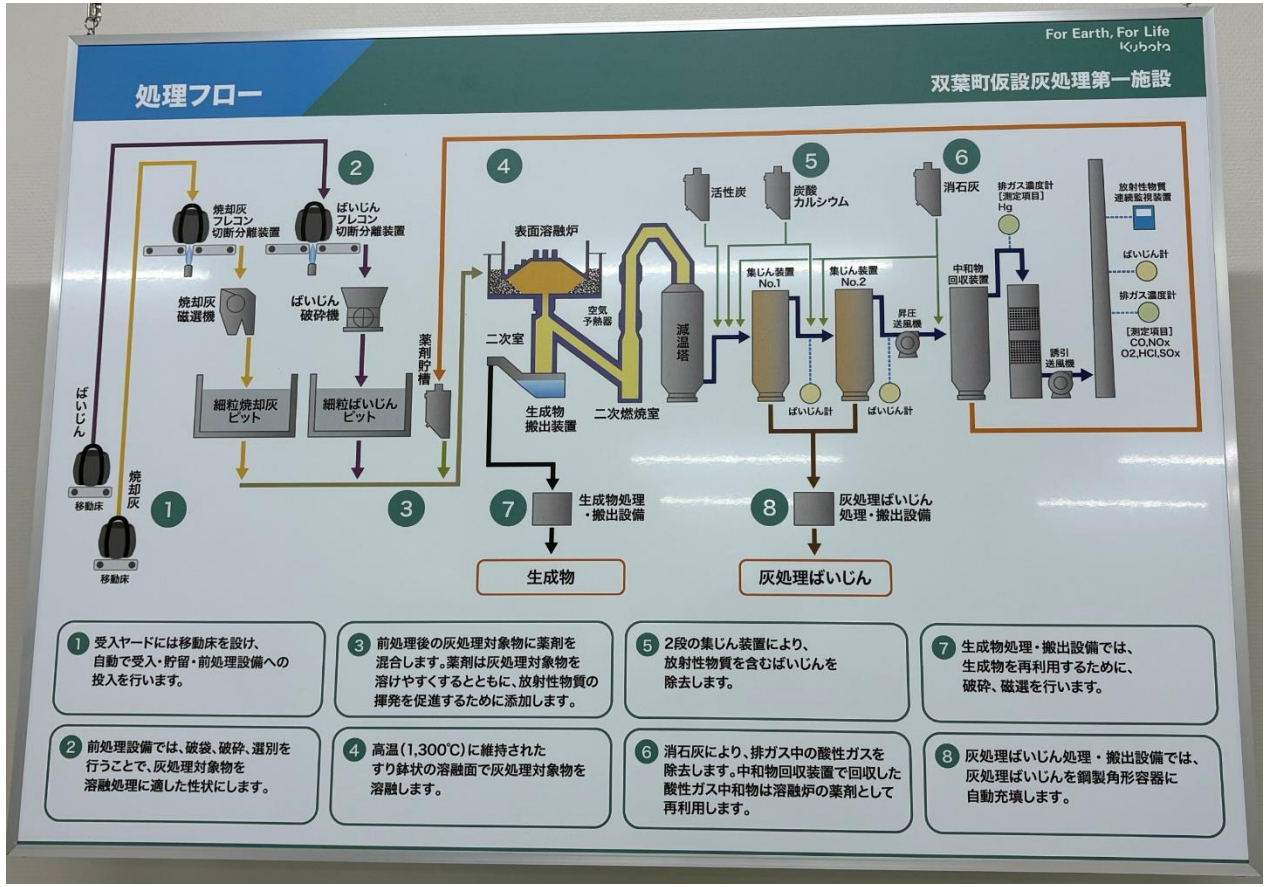
KSMF Pilot Test

- August 25–28, 2025
- Spiked crushed glass feedstock
- Three runs plus blank
- Collected samples from everywhere in system



Site Tours – Futaba

- Largest KSMF installation
  - 150 t/d
- Treating incineration ash from Fukushima nuclear disaster
  - Debris and soil in surrounding area incinerated
- KMSF drives off radioactive cesium-137 and concentrate/capture downstream

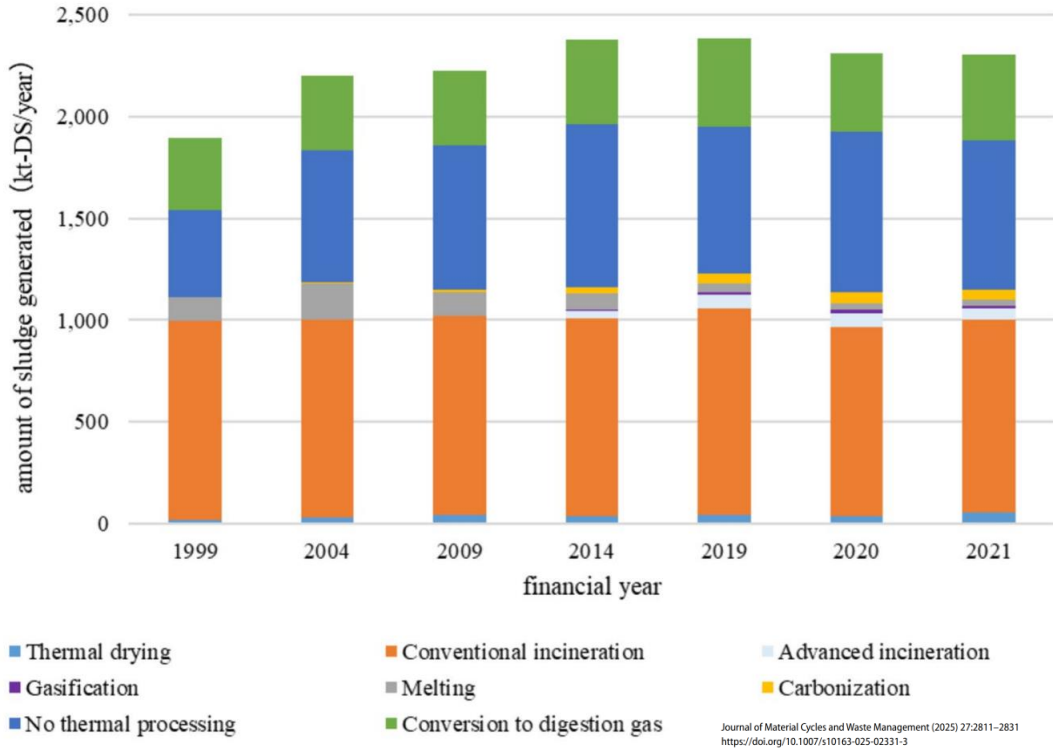


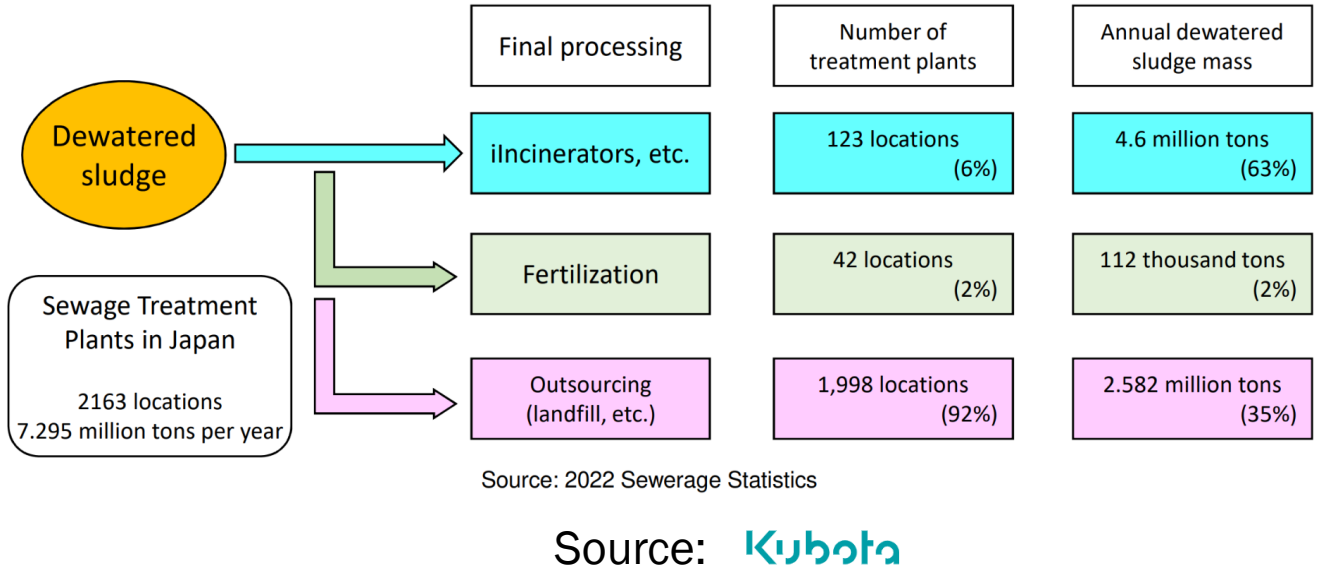
Site Tours – Futaba

- Built in just over a year
- Train consists mostly of Kubota technology
- Will operate till 2033
- Tangent – Kubota has H_2 fuel station on site

Japan Sludge Handling Diversification

- Heavily dependent on thermal treatment





Source: 2022 Sewerage Statistics

Source: Kubota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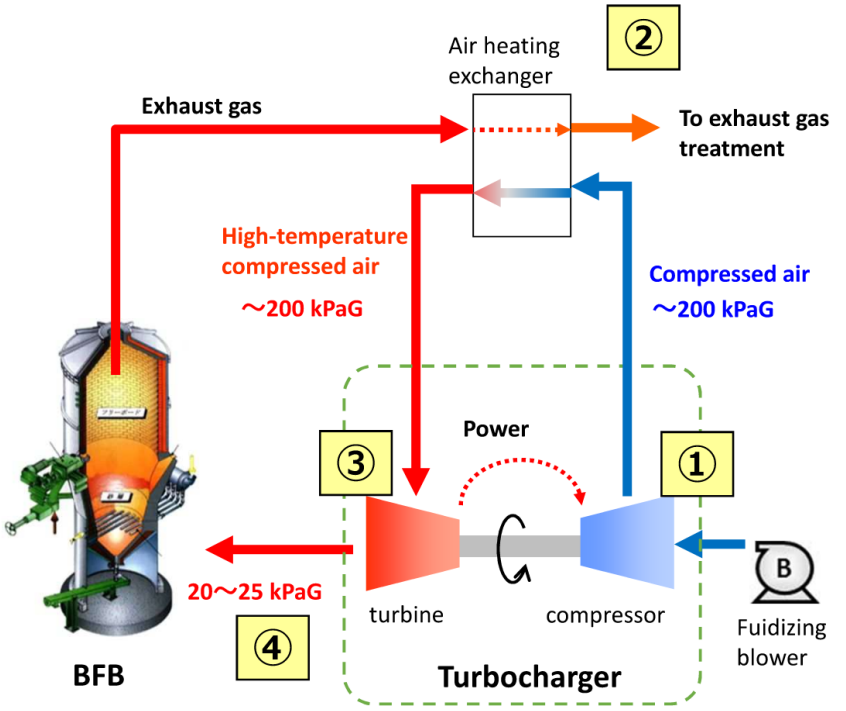
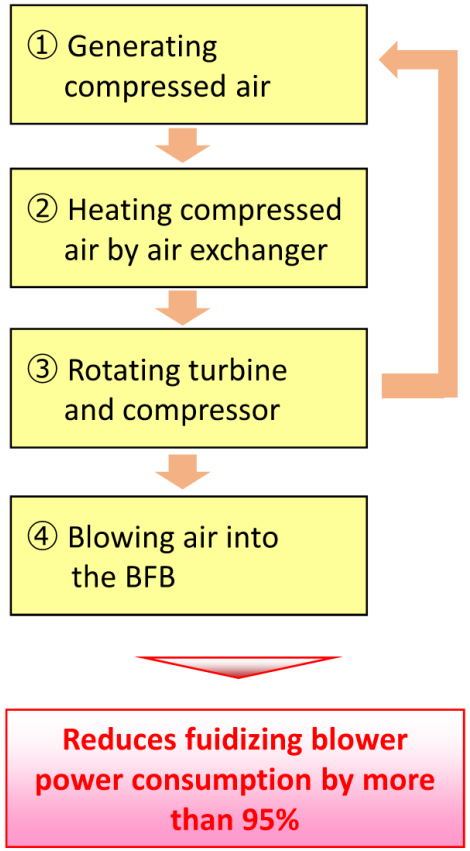
Site Tours - Imaike

- Fluidized bed
  - Piped tuyeres – typical in Japan
- Energy main driver in Japan
  - Couple fluid bed with turbocharger
- Avoids pressurized flue gas
- Capacity up to 300 wt/d
- Imaike 90 wt/d



※ Turbocharger
A device that connects a compressor and a turbine with a shaft, used to improve engine output and thermal efficiency.



Source: Kubota

Site Tours - Imaike

- Third train being added
- Most of train is Kubota equipment
- Construction complete at end of 2026




Source: Kubota

Japan Takeaways

- Advanced incineration technologies employed
- Technologies not yet in US market
- Gifts
  - No food
  - Like baseball, golf, beer
- Business cards – forgot mine ☹

QUESTIONS?

it's about connecting

Brown AND Caldwell essential ingredients®