

Purestream Services



A'ARA

Advanced Vapor Recompression
Thermal Evaporation

FLASH
BRINE  CONCENTRATOR

**Brine
Encapsulation
Services**



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Purestream Reliability



- Purestream is a wholly-owned subsidiary of Swire Group – an international private and public group of companies with combined annual gross revenue over \$50 billion and a substantial market cap.
- Companies Include John Swire and Sons; Cathay Pacific Air; Swire Properties; China Navigation Co.; Swire Coca Cola USA, Finlay Tea, and an aircraft engine manufacturing facility.

Issues Facing Power Plants

- Remaining lives/longevity are uncertain
- Rate increases are not assured
- NGOs are in opposition
- Increasingly stringent regulations
- Changing permit requirements
 - CCR
 - ELG



The Perfect Wastewater Solution

- Addresses current and future limits
- Applicable to multiple types of wastewater
- Low capital cost
- Minimum impact on operations
- Low cost per gallon treated
- Responsive to changing duty cycle
 - Low turndown
 - Quick startup
 - Variable capacity
- No harmful byproducts



Purestream Listens

AVARA

Advanced Vapor Recompression
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**Brine
Encapsulation
Services**

- Mobile, modular designs based on simple principles of boiling water or physical separation
- Handle all pollutants in one unit operation
- Add or subtract capacity as needed
- Build-own-operate-maintain (BOOM) service
 - Fixed price per gallon
 - Includes operators, spare/replacement parts
 - Modules added or taken away as needed
- Provide brine sequestration services



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How BOOM Service Model Works

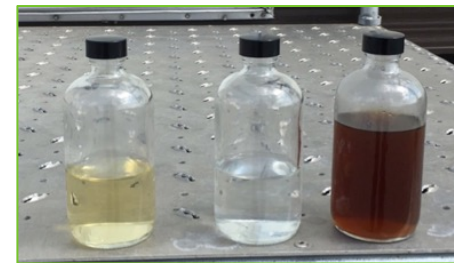
**Build
Own
Operate
Maintain**

- We build and amortize primary treatment equipment.
- We employ specialized, skilled experienced labor for O&M at clients' sites.
- We offer contracts with flexibility to meet clients' changing requirements.
- We can redeploy treatment equipment when clients' needs change.



Purestream's ZLD Technologies

- AVARA brine concentrator to distill and reuse wastewater
- FLASH brine concentrator to reduce volume by evaporation
- Other
 - Brine encapsulation
 - Conventional phys-chem
 - Tanks, pumps and ancillaries

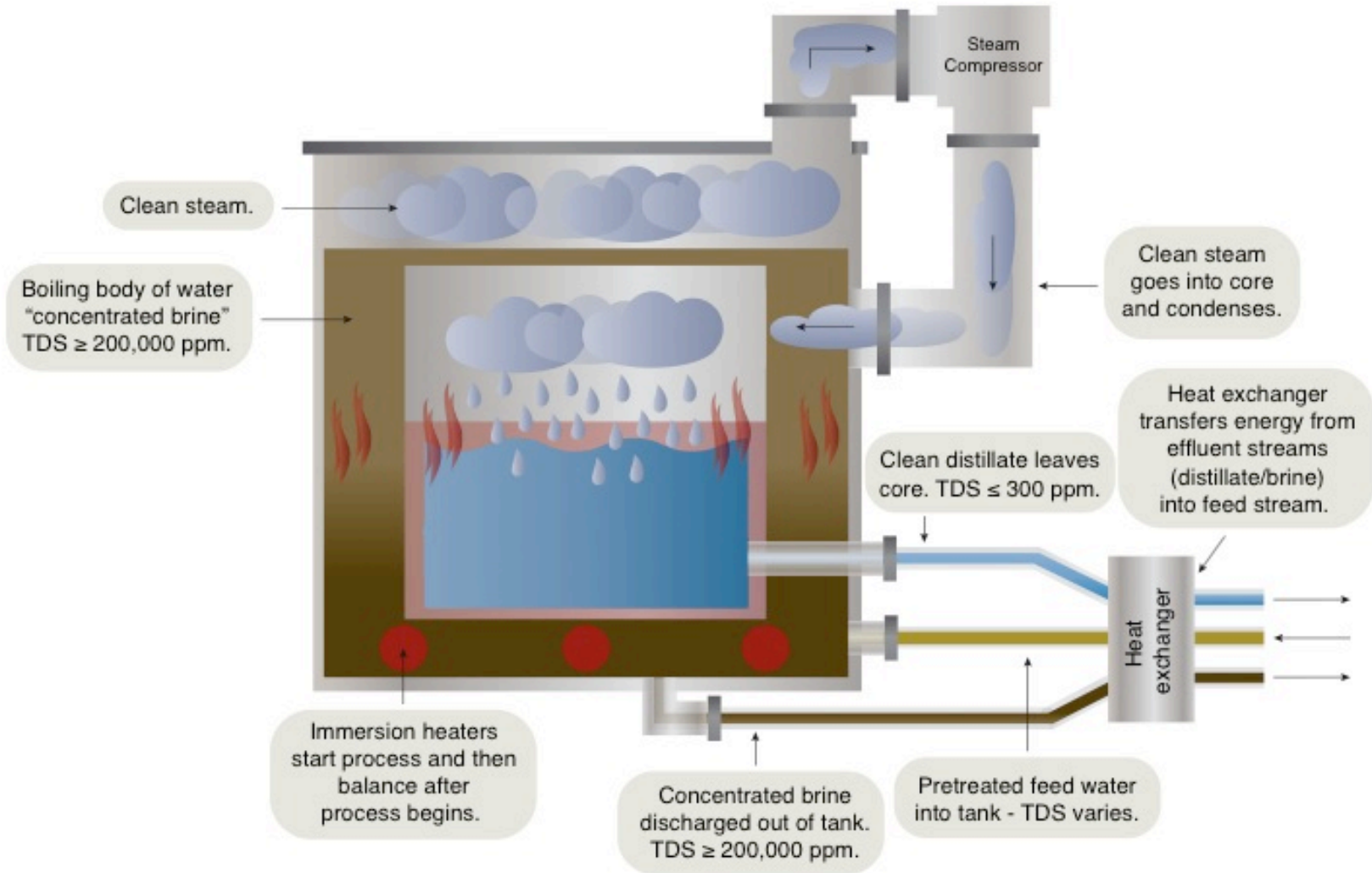


Brine Concentration and Encapsulation Technology

- Pond Volume Management
- FGD or Cooling Tower Blowdown
- Leachate
- Metal Cleaning Wastewater (Air Heaters or Boilers)



Mechanical Vapor Recompression





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Performance

- Up to 94% of FGD blowdown recovered as clean distillate for reuse
- Typical cost range of \$0.05 to \$0.07 per gallon of FGD blowdown
- Metals and other potential pollutants concentrate into brine
- Brine is encapsulated for an additional \$0.38 to \$0.43 per gallon of brine which equates to \$0.030 to \$0.034 per gallon of FGD blowdown



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Thermal Evaporation

FGD Treatment Results

EPA ELG Discharge Limits Achieved

| | As (µg/L) | Hg (ng/L) | Se (µg/L) | NO ₃ ⁻ /NO ₂ ⁻ (mg/L as N) |
|-----------------|-----------|-----------|-----------|---|
| Daily Maximum | 11 | 788 | 23 | 17 |
| Monthly average | 8 | 365 | 12 | 4.4 |

| ELG Items: | Feed: | Distillate: | Brine: |
|-----------------|-----------|-------------|------------|
| As (µg/L) | < 5.5 | < .1 | 14.34 |
| Hg (ng/L) | 7,600.00 | 109.00 | 120,028.00 |
| Se (µg/L) | 232.64 | < .1 | 3,228.66 |
| Nitrates (µg/L) | 11.46 | 0.03 | 224.55 |
| TSS (mg/L) | 226.00 | < 10 | 15,636.36 |
| TDS (mg/L) | 14,246.67 | < 20 | 200,120.00 |
| *Boron (mg/L) | 195.76 | 4.88 | 2,479.03 |

Results based on samples obtained by Southern Research on AVARA pilot unit operating.



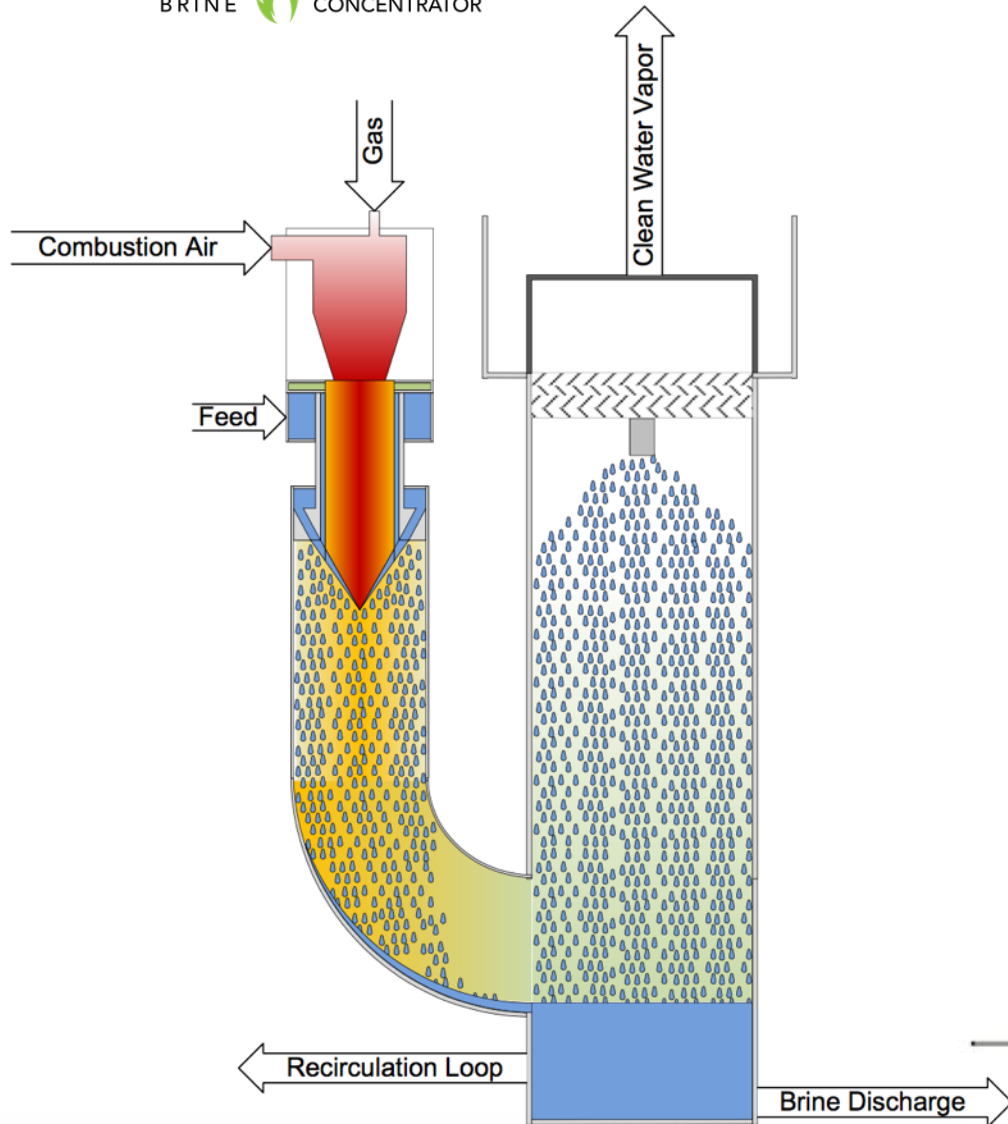
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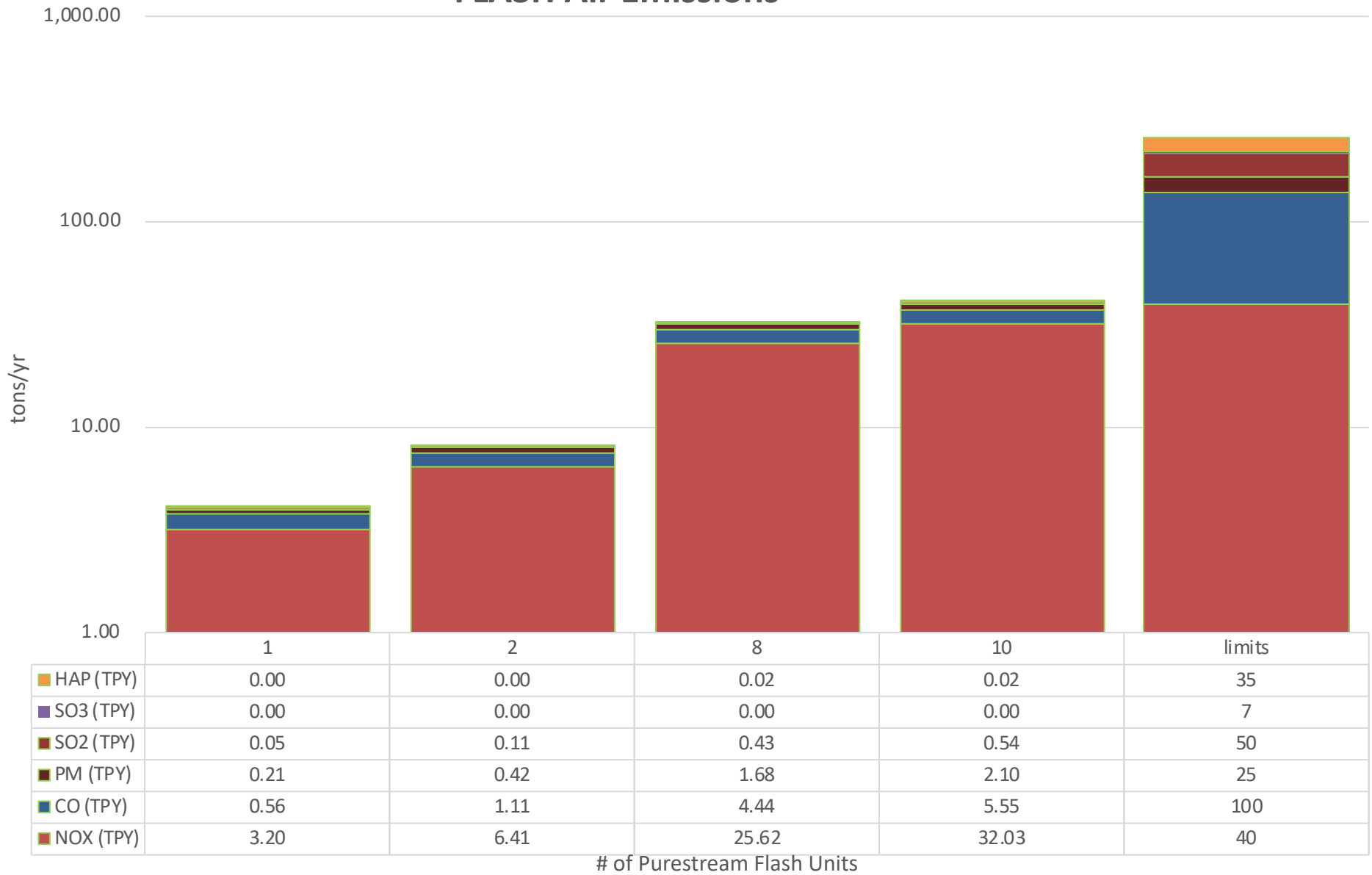
Brine Concentrator High TDS Wastewater



What's Inside



FLASH Air Emissions

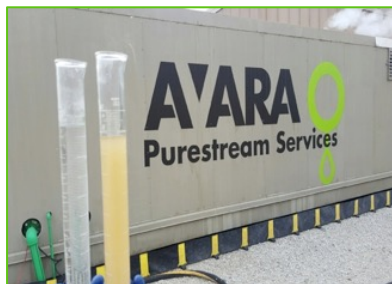


Performance

- Up to 94 % of FGD blowdown released as clean water vapor
- Typical cost range of \$0.06 to \$0.08 per gallon of FGD blowdown
- Metals and other potential pollutants concentrate into brine
- Brine is encapsulated for an additional \$0.38 to \$0.43 per gallon of brine which equates to \$0.030 to \$0.034 per gallon of FGD blowdown



Brine Solidification/Encapsulation to Immobilize Pollutants



- What to do with 1% to 10% of leftover liquid after wastewater volume reduction?
- Stabilizing brine from power plant wastewater with pozzolanic solids (fly ash, cement, lime)
- Benefits of brine encapsulation vs. full crystallization: lower cost, reduction in leaching, better stabilization, no need for additional water





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Beneficial Uses of Brine



Custom Solutions for Unique Situations:

- **Multiple mix designs and deposition methods to meet unique situational needs**
 - Material availability (fly ash, Portland cement)
 - Beneficial use options
 - Economic optimization
- **Environmental safety**
 - All mix designs meet TCLP standards
 - Can be designed to pass paint filter test for landfills





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Beneficial Uses of Brine



Target Mix Results

TCLP & Compressive Strength Results

40% Brine - 51% Flyash - 9% Cement

| Item: | Results (mg/L): | Limits (mg/L): |
|----------|-----------------|----------------|
| Arsenic | 0.33 | 5.00 |
| Barium | 0.23 | 100.00 |
| Cadmium | ND | 1.00 |
| Chromium | 0.01 | 5.00 |
| Lead | ND | 5.00 |
| Mercury | ND | 0.20 |
| Selenium | ND | 1.00 |
| Silver | 0.03 | 5.00 |

14-day Compressive Strength 227psi

28-day Compressive Strength 262psi

Beneficial Uses of Brine

Flowable Fill

- Self leveling
- Easily excavated
- 7-Day Strength: 140 PSI



Underwater Deposition

- Minimal washout
- Increase pond impermeability
- 7-Day Strength: 4410 PSI



Grout

- 40% brine, 60% cementitious material
- 14-Day Strength: 227 PSI





Thank You

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