GOLDER

September 18, 2019 – WPCA TVA Seminar

Paste Technology for Operations and Closure

Agenda

- Paste Introduction
  - What is it?
- Drivers for deposition
  - Project examples
- Scale and Handling
- Co-disposal
- Conclusions

What is “Paste”?

- Simply dewatered material (generally ash, tailings or other mineral wastes) that is an engineered mixture of solids and water
- Possesses a yield stress
- Produces a measurable slump and has a maximum slump of ~10 inches
- Has a homogenous appearance i.e. no segregating of coarse to fine particles

What is “Paste”?

- Is normally free standing when deposited
- Has low or no critical flow velocity
- Uses pumps or gravity to move through a pipeline
- Exhibits plug flow characteristics
- Exhibits little to no water bleed during transport or placement

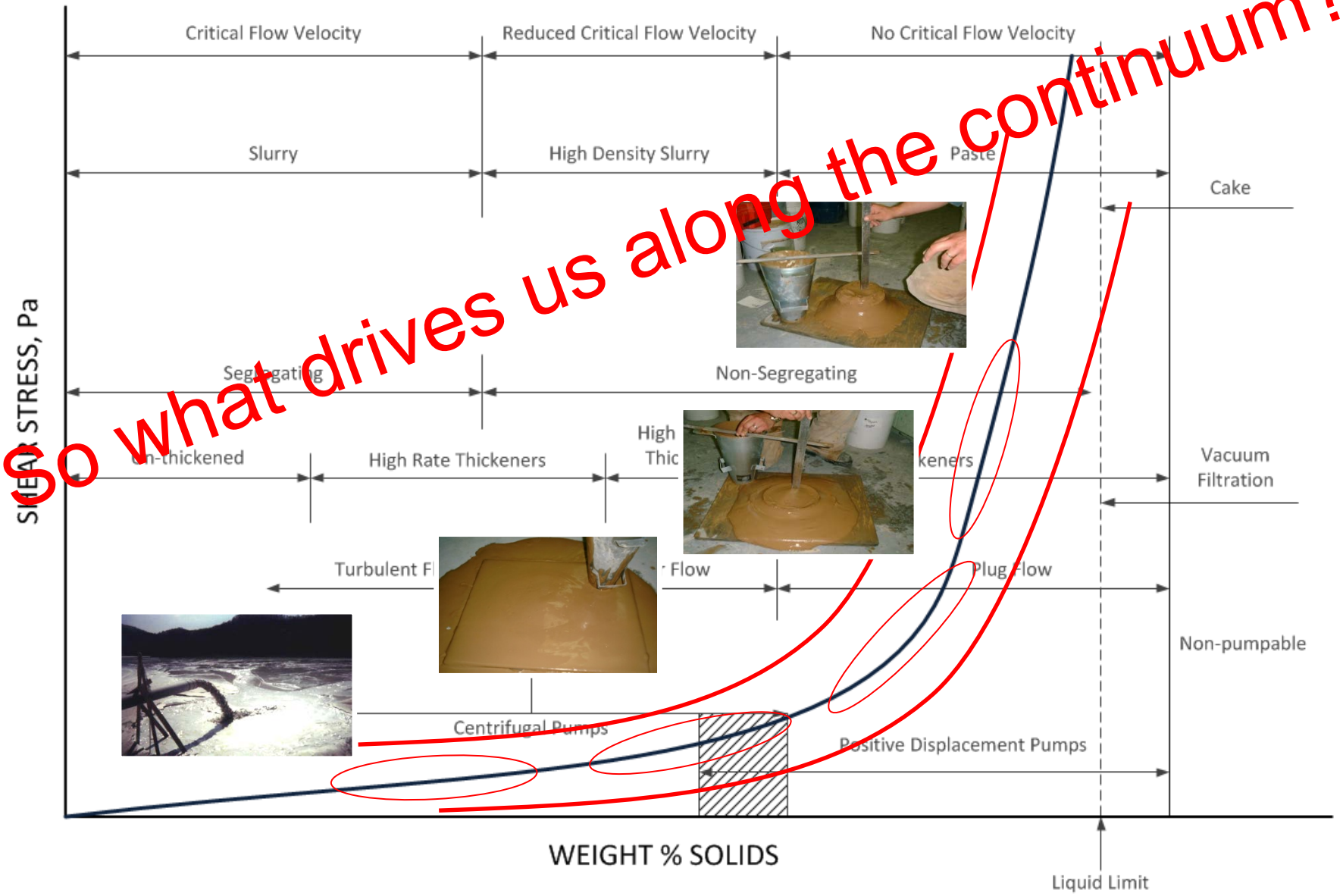
Paste



Different materials – same output

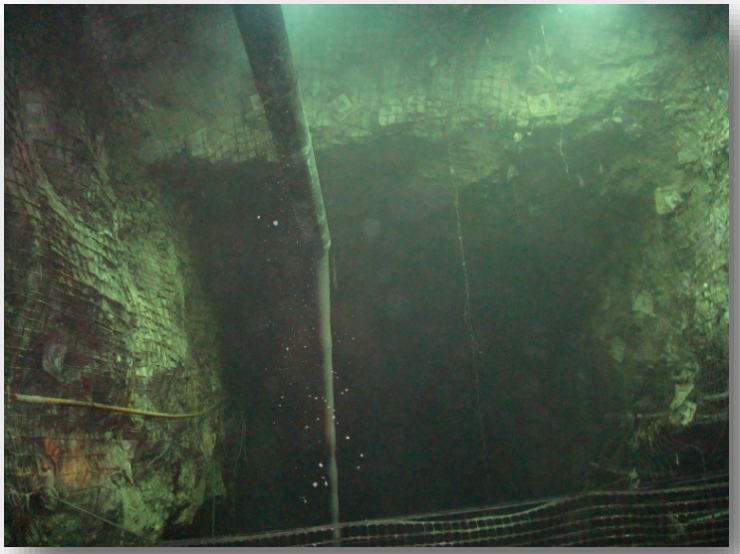


Dewatering Continuum

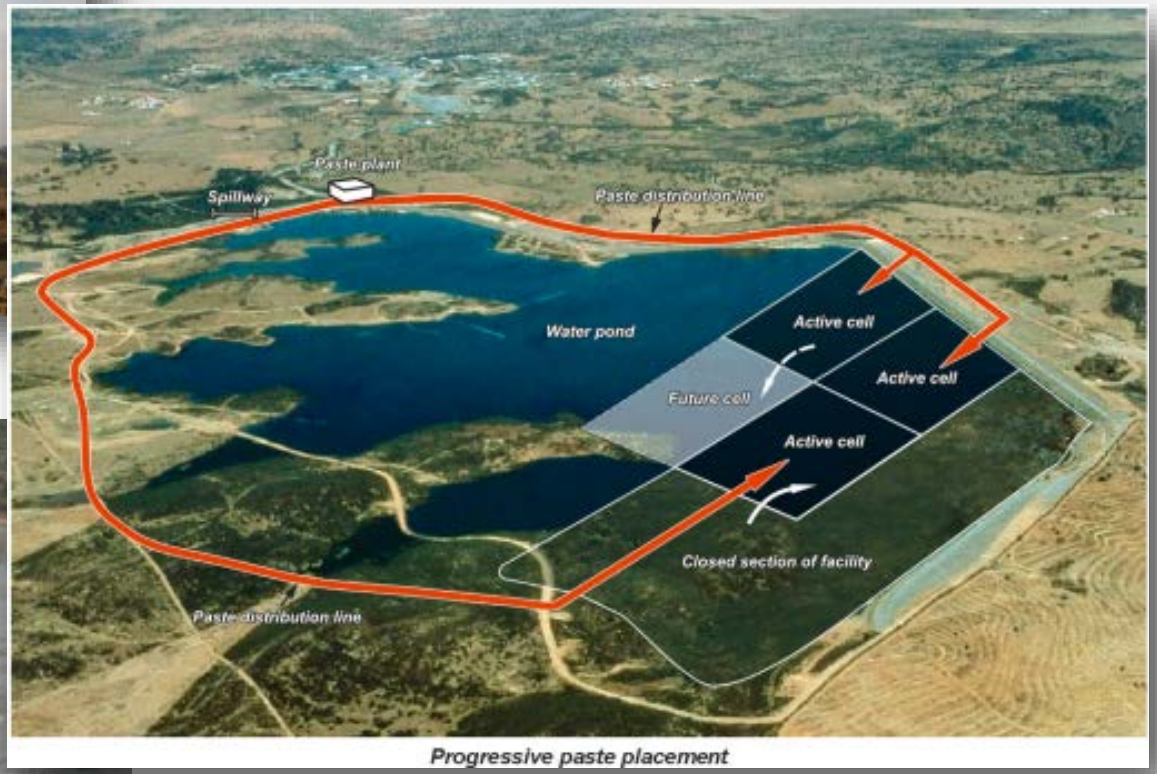


Continuum Drivers

Geotechnical Instability



Progressive Closure – Sluiced to Paste



Progressive paste placement

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Dam failure mitigation

Life of Site Extension

Water Recovery In Northern Climate

Water Recycling and Volume Maximization without double handling

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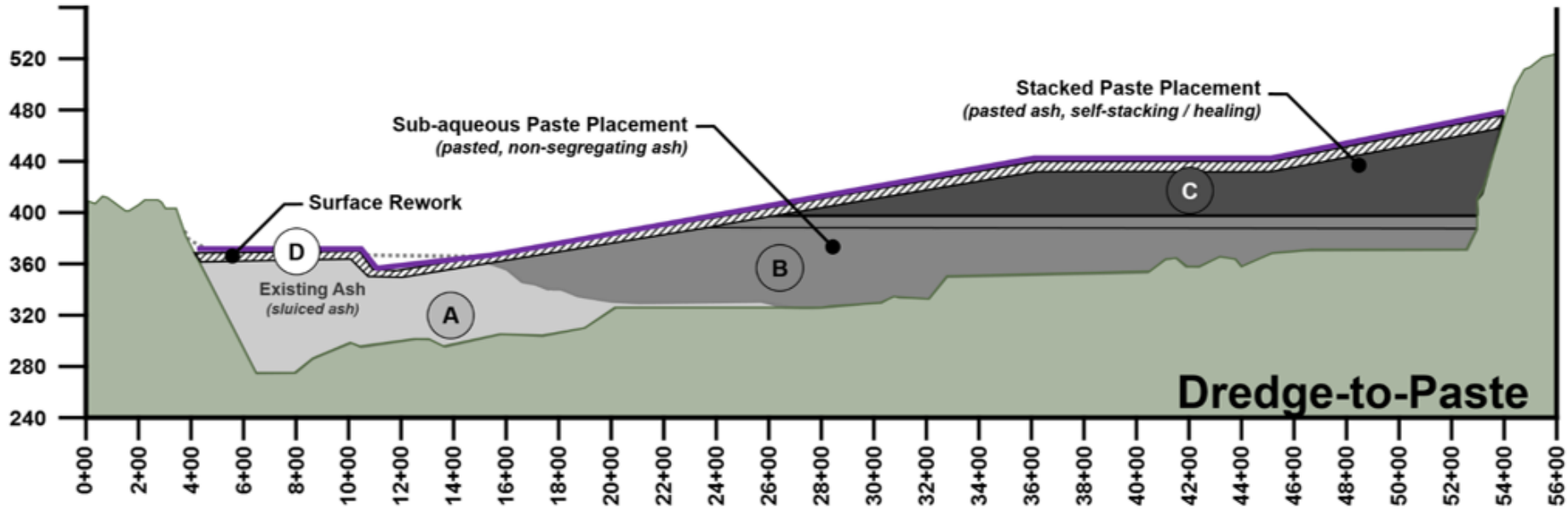
Smaller Dikes / Containment

Filter Cake – Stackable and Compactable

Sub-aqueous to sub-aerial transition

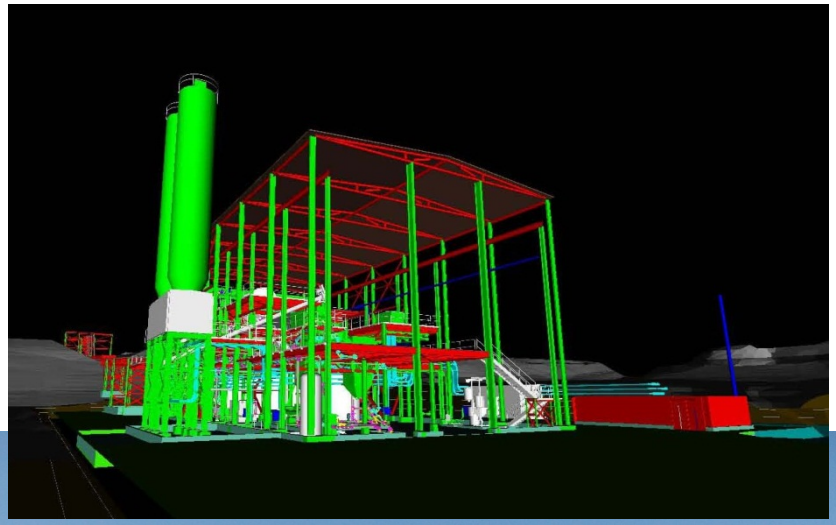
CCR Paste Deposition Example



Scale and Handling

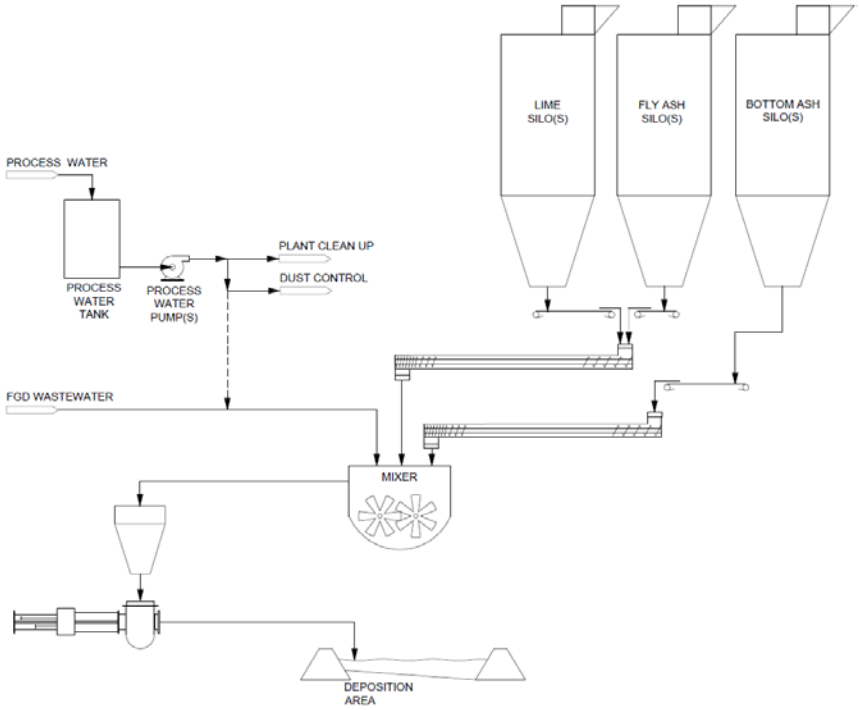
Scale

- Golder has designed and built 34 dewatering plants around the world
- Size of plants can vary from 50-1000 tph (solids)
- Varies from Day Only operations to 24/7/365

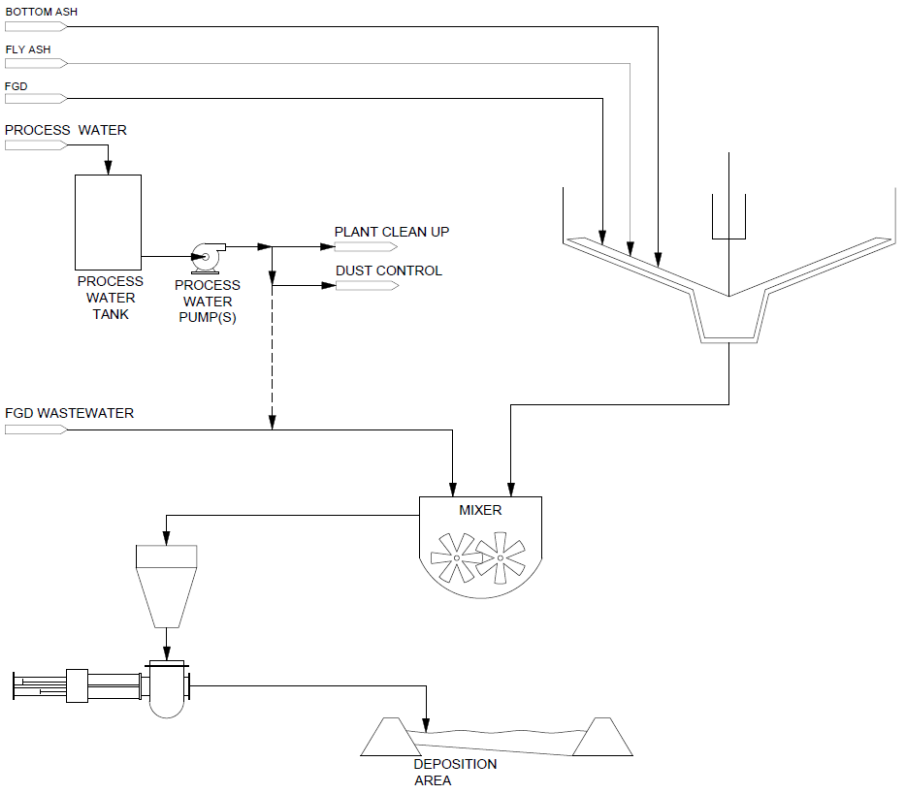


Wet or Dry Feed Material Handling

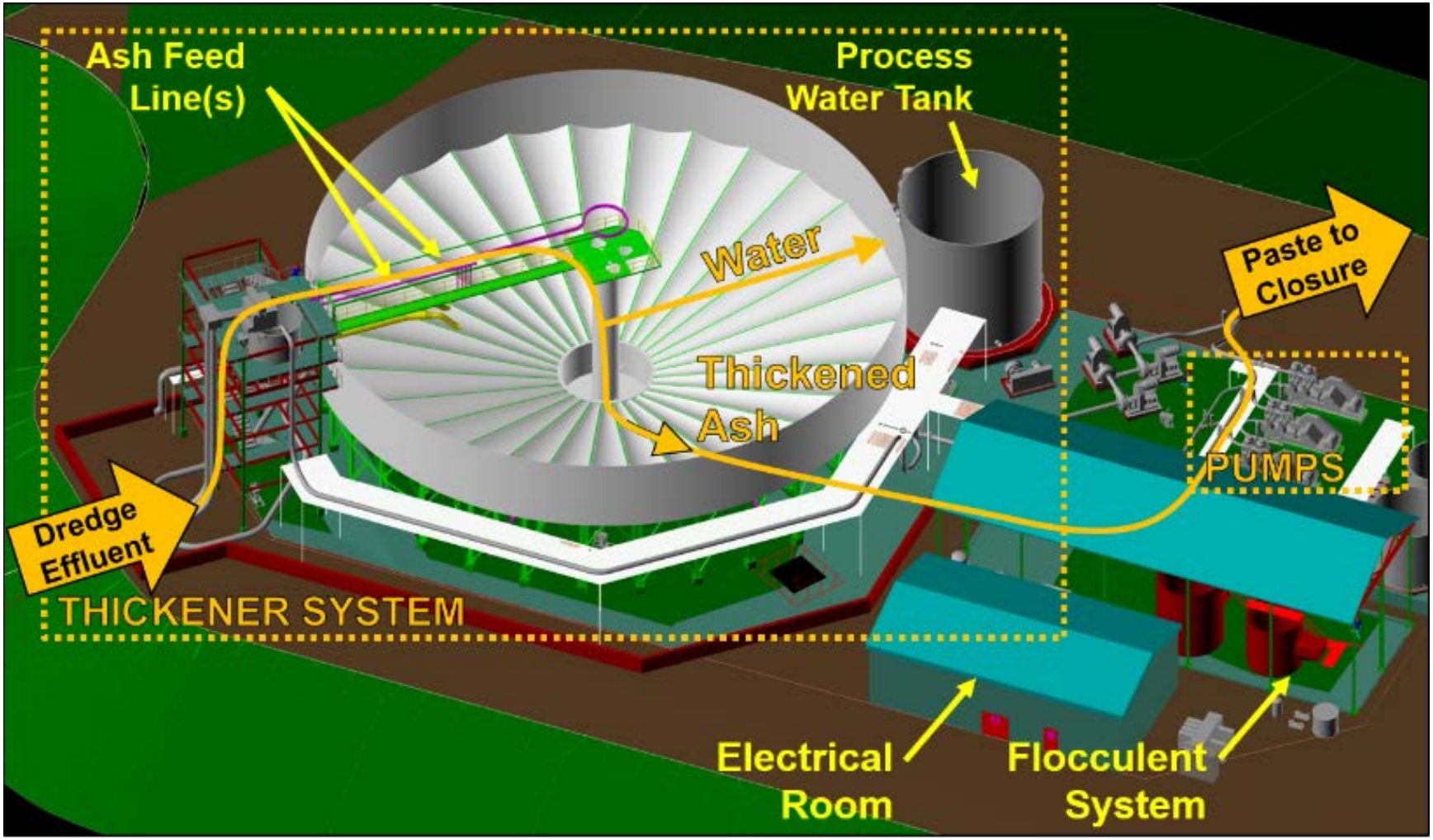
Dry Feed Materials



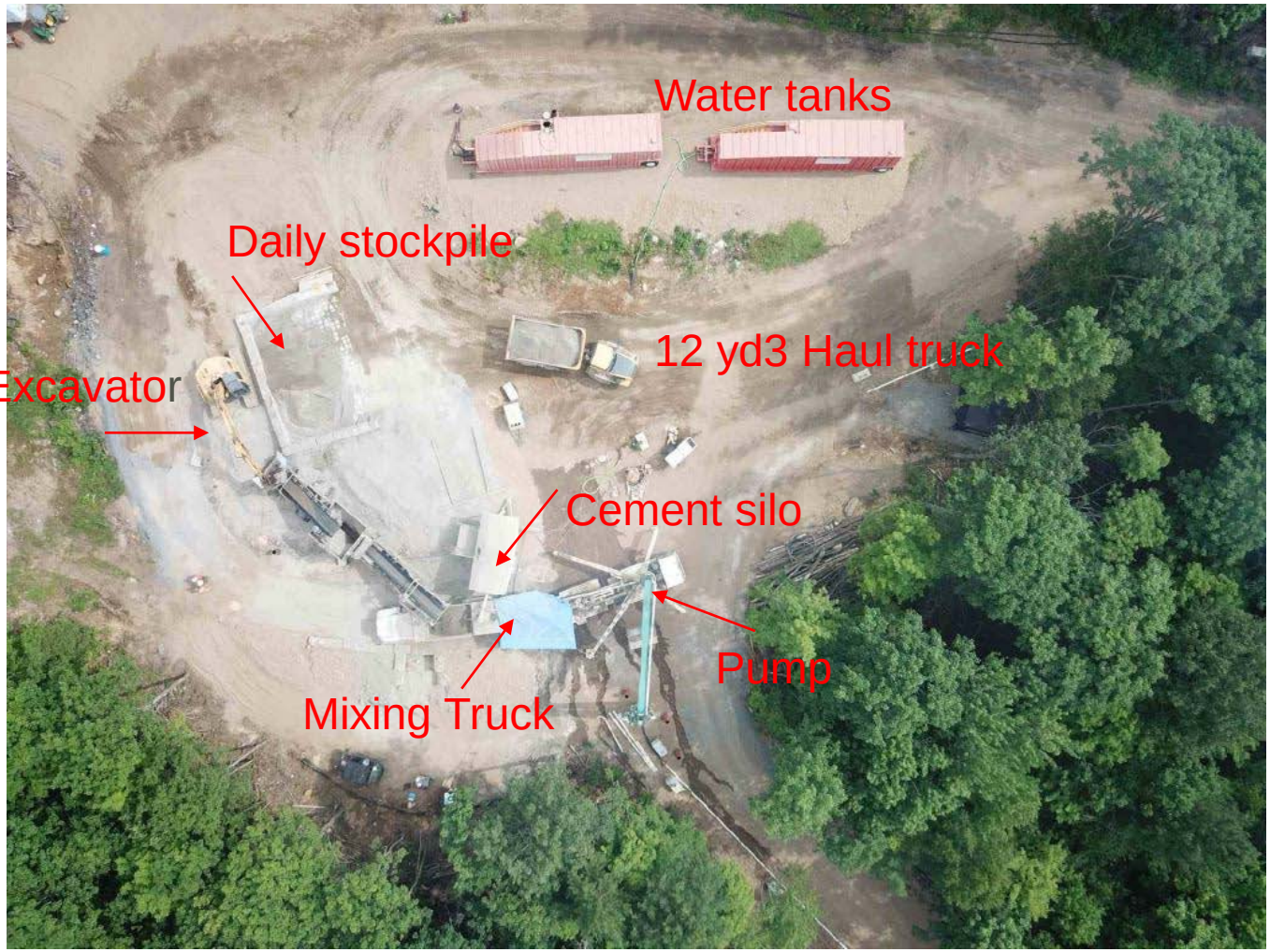
Wet Feed Materials



Plant General Arrangement

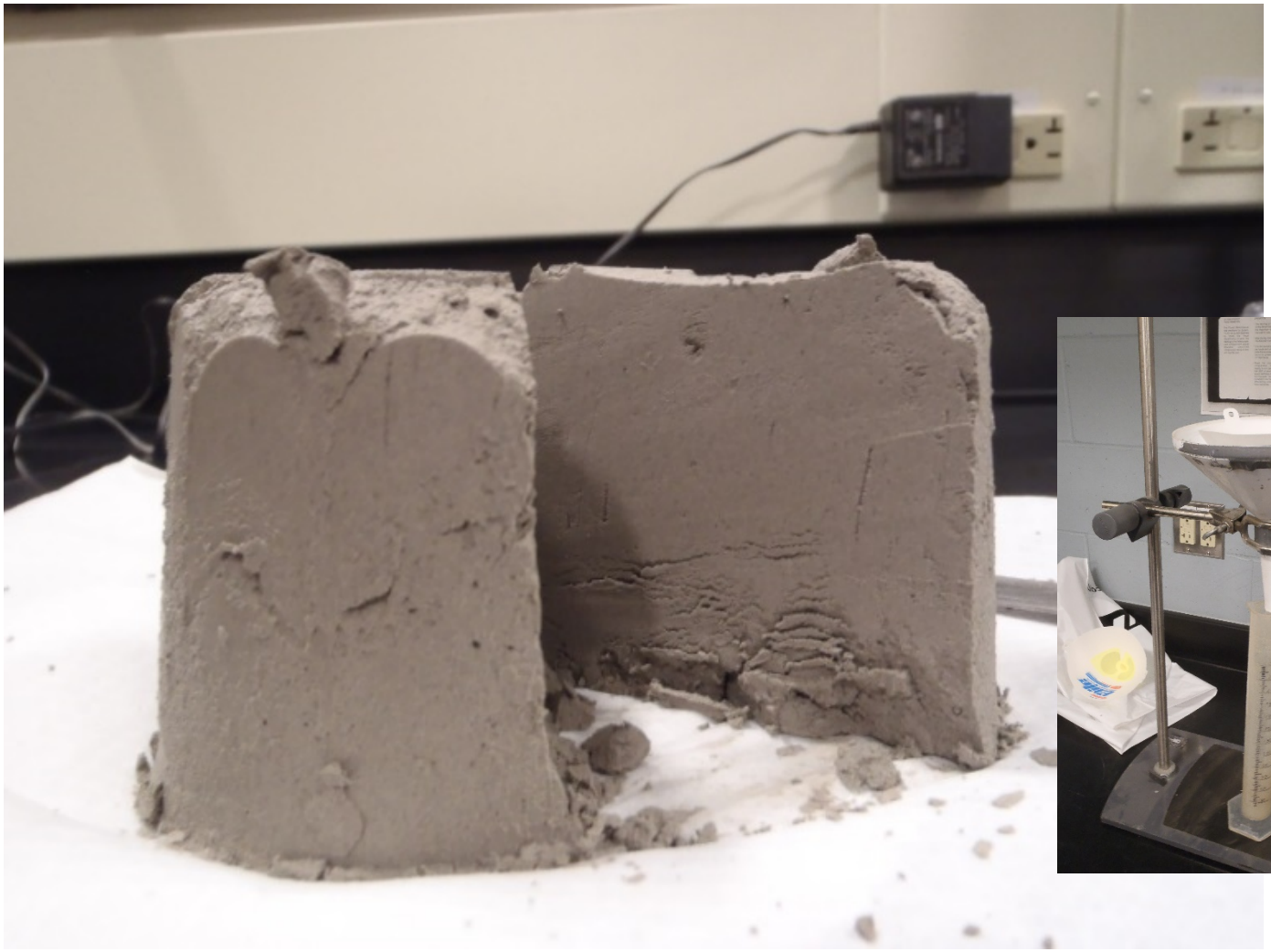


General Arrangement of Mobile Plant

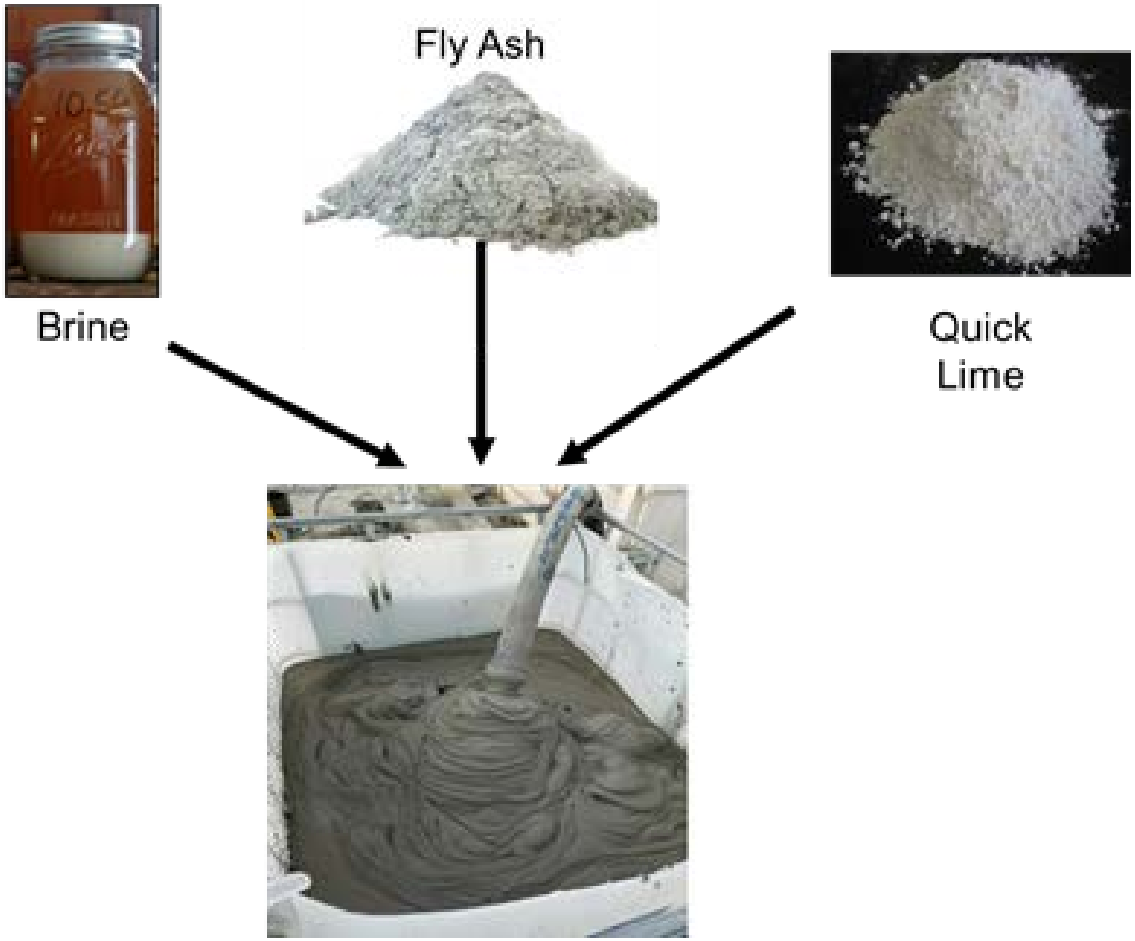


Co-disposal / Encapsulation

Paint Filter



Encapsulation In A Nutshell



Co-disposal + Paint Filter

Sample	Slump (inches)	Time Zero (ml)	0.5 hour (ml)	1 hour (ml)	2 hour (ml)	24 hour (ml)
Blend 1 (Fly Ash)	7	0	0	0	0	0
	10	0	0	0	0	0
Blend 2 (Fly Ash / Bottom Ash)	7	0	0	0	0	0
	10	1.2	0.8	0.8	0.3	0
Blend 3 (Ash Sludge / Lime Sludge)	7	0.03	0.02	0.04	0.01	0
	10	0.06	0.08	0.10	0.13	0.07
Blend 4 (Ash Sludge / Fly Ash)	7	0	0	0	0	0
	10	0	0	0	0	0
Blend 5 (Fly Ash / Lime Sludge)	7	0.3	0	0	0	0
	10	0.5	0.1	0	0.08	0
Blend 6 (Fly Ash / Gypsum / Bottom Ash)	7	0	0	0	0	0
	10	0.13	0.11	0.07	0.09	0
Blend 8 (Fly Ash / Bottom Ash / Ash Sludge)	8	0.14	0.13	0.10	0.09	0
	10	0.19	0.12	0.20	0.05	0
Blend 9 (Fly Ash / Bottom Ash / Ash Sludge / Retardant)	7	0	0	0	0	0
	10	0.09	0.01	0	0	0

Summary

Summary of Paste Advantages

- Increased water reuse/recycling
- Smaller surface footprints (stackable)
- Reduces likelihood of seepage/leachate from waste facilities (10^{-6} cm/s or better)
- Smaller containment dikes (not dams)
- Reduces risk of failure of dikes
- Reduces dusting on surface
- Faster reclamation (progressive)
- Co-disposal opportunities (coarse and fines)
- Forces holistic discussions between engineering, environmental, regulatory

Summary of Paste Advantages

- Some sites have advantages for Wet vs Dry Handling
- Ability to scale up / down to match handling operations
- Production and safety advantages at some sites
- Can be operated 24/7 – safe working at night
- Paste operations less impacted by weather than trucking / conventional methods
- Can significantly reduce post deposition handling needs – significantly reduces need for access / personnel on ash
- Can reduce water treatment costs/schedules

Key Takeaways

- Dewater only as much and if you have to – its governed by the deposition goals
- Consideration of all waste materials
- Investigation and evaluation of options for any waste material has to include:
  - Processing
  - Transport
  - Deposition

THANK YOU