



DUNDEE SUSTAINABLE TECHNOLOGIES

CLEVR
PROCESS™

GLASSLOCK
PROCESS™

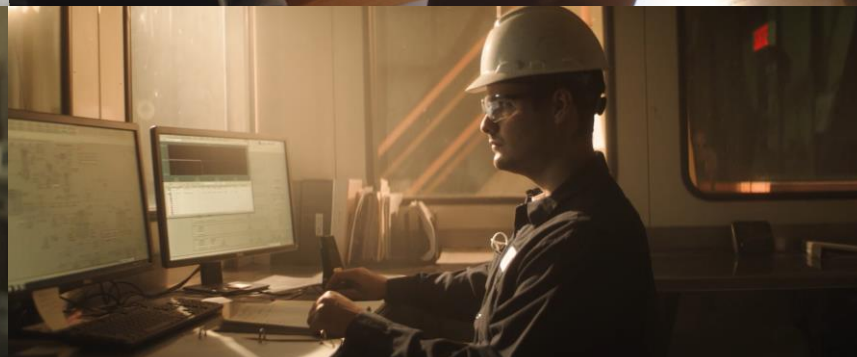
Innovative Metallurgical Processes for the Mining Industry

Company Overview

Dundee Sustainable Technologies (DST) is engaged in the commercialization of environment-friendly technologies for the treatment of materials in the mining industry.

- » **Invested >\$50 million** developing its processes
- » Technologies **successfully demonstrated**
- » **43 patents** in 16 countries







Industry Challenges

Environmental

- » Cyanide
 - Jurisdictions have banned or restricted cyanide
- » Arsenic
 - Industry is turning to deposits with greater concentration of arsenic
 - Few facilities currently treat high arsenic material
 - Industry requires a permanent arsenic disposal process

Metallurgical

- » Metal recovery from refractory ores
- » Base metals, tellurium or organic carbon in gold ores



DST Solutions

CLEVRPROCESS™

- » Cyanide-free gold extraction
- » No liquid effluents
- » Refractory ores

GLASSLOCKPROCESS™

- » Arsenic stabilization
- » Allows access to complex ores
- » Permanent disposal solution

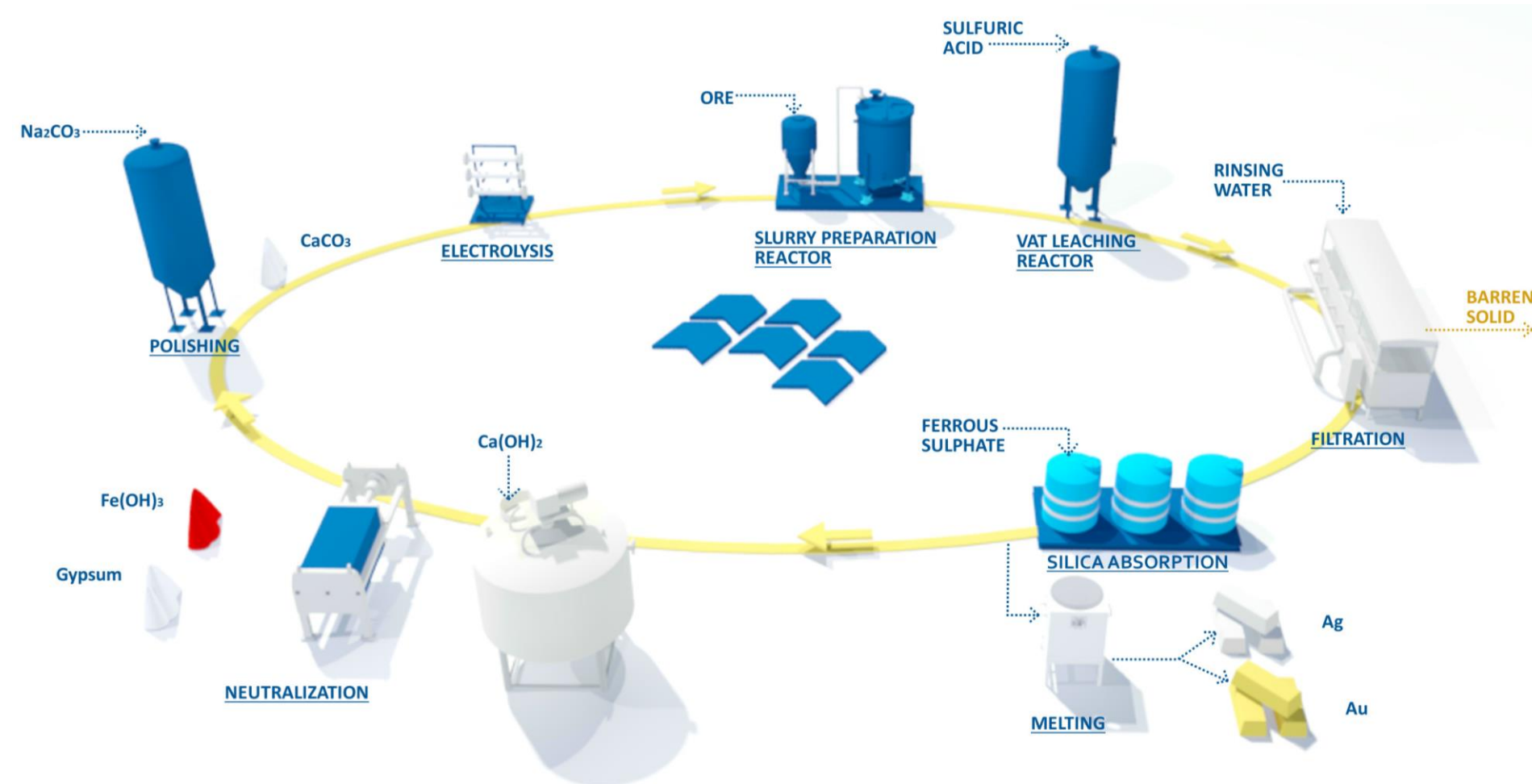


CLEVRPROCESSTM
Cyanide-free Gold Extraction

Industrial Plant
Thetford Mines, Qc



CLEVR Process – Closed Loop Circuit



ISO 14034:2016
Environmental Technology
Verification (ETV)



eWaste – Local Processing

Leveraging DST's Thetford Mines Plant

» Electronic waste represent a new product stream for the application of CLEVR



enim

CLEVRPROCESS™



CLEVR Process – Commercial Drivers

- » Increased **Gold Recovery**
- » Chemistry, **Cyanide-free** gold extraction
- » Efficiency, **2-hour** Reaction time

Process Costs

- » 150 tpd up to **15,000 tpd** ROM Plant Designs
- » Competitive OPEX
- » Competitive CAPEX, **Reduced Plant Footprint**



GLASSLOCK
PROCESS[™]
Arsenic Stabilization

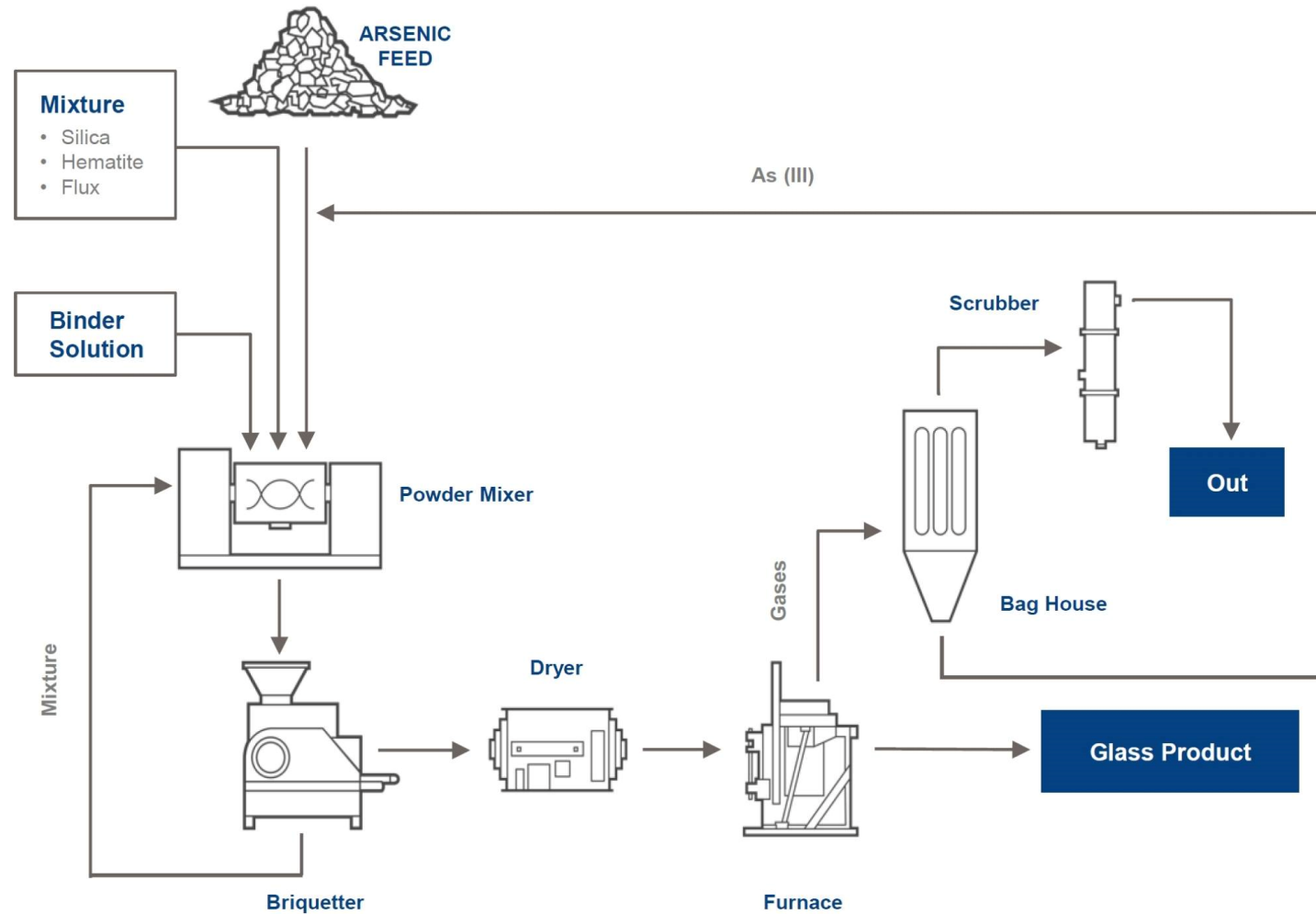
Industrial Plant
Namibia, Africa

GlassLock Process – Arsenic Stabilization

- » Stabilization by vitrification
- » Intermediate compound that can sustain vitrification temperature
- » Produces glass with over >15% As
- » EPA 1311, 1315,... & EN 12457-1 Compliant
- » Widely available reagents / equipment



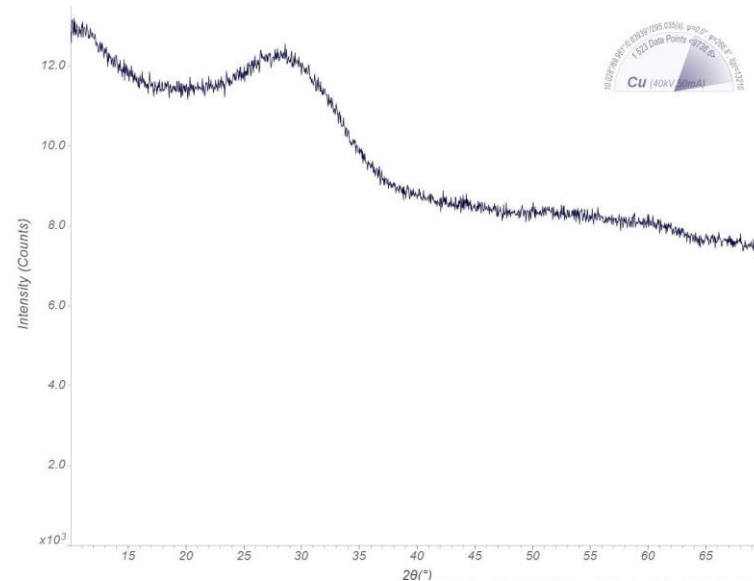
GlassLock Process – Circuit



Arsenic Glass Product

- » Glass density: 2.7
- » Amorphous/single phase silica matrix
- » Contaminants such as Sb, Cd, Bi, Te and Pb present in the dusts would also be encapsulated within the glass product.

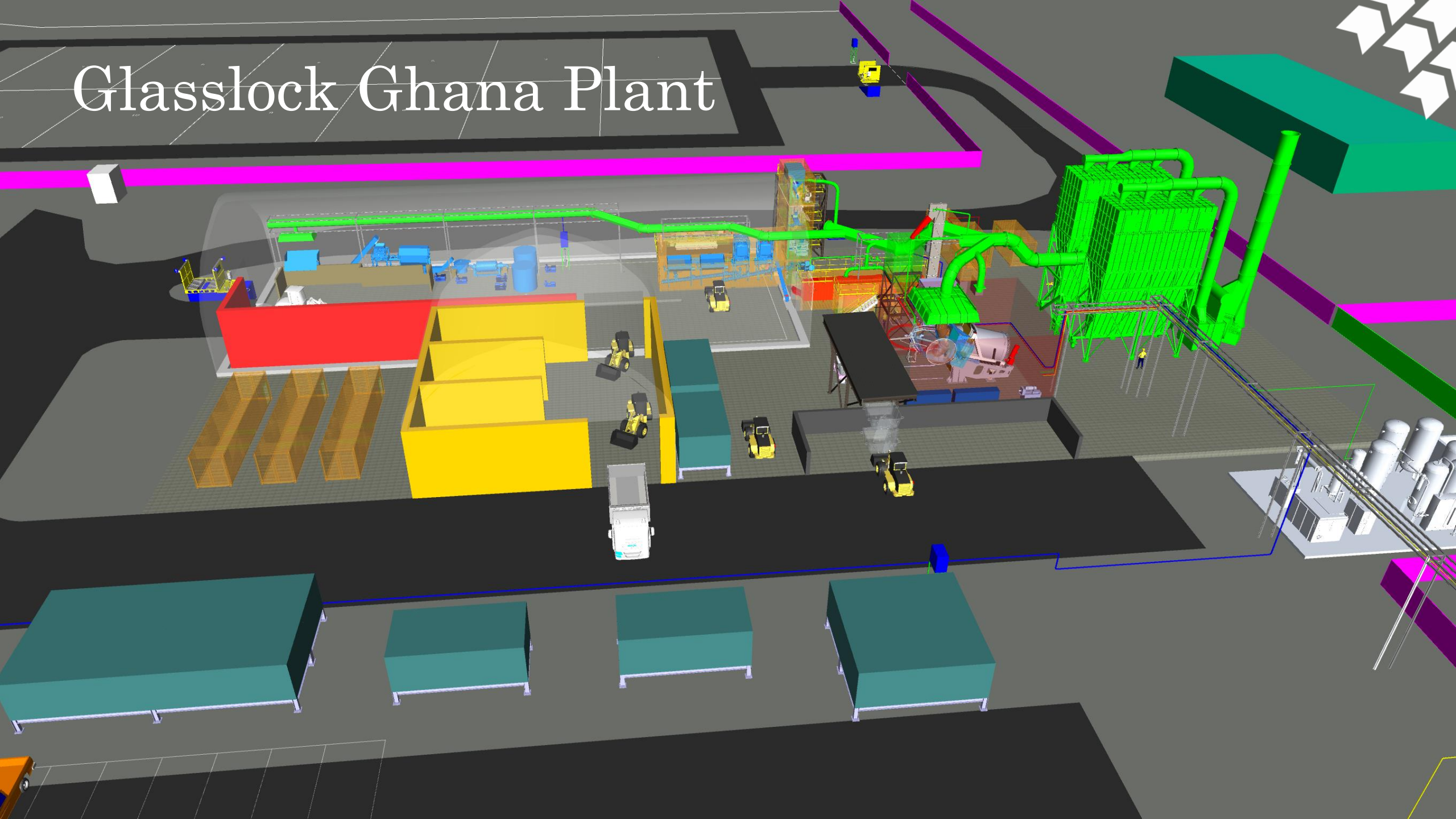
Typical GlassLock Product
XRD Diffractogram



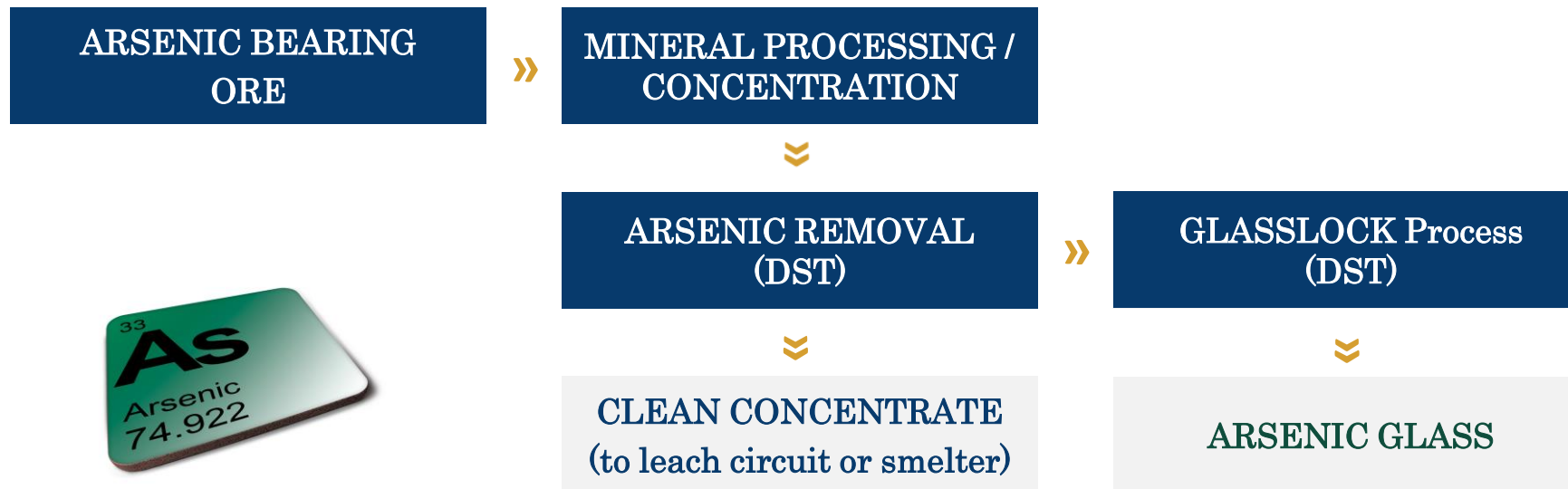


Glasslock Namibia Plant

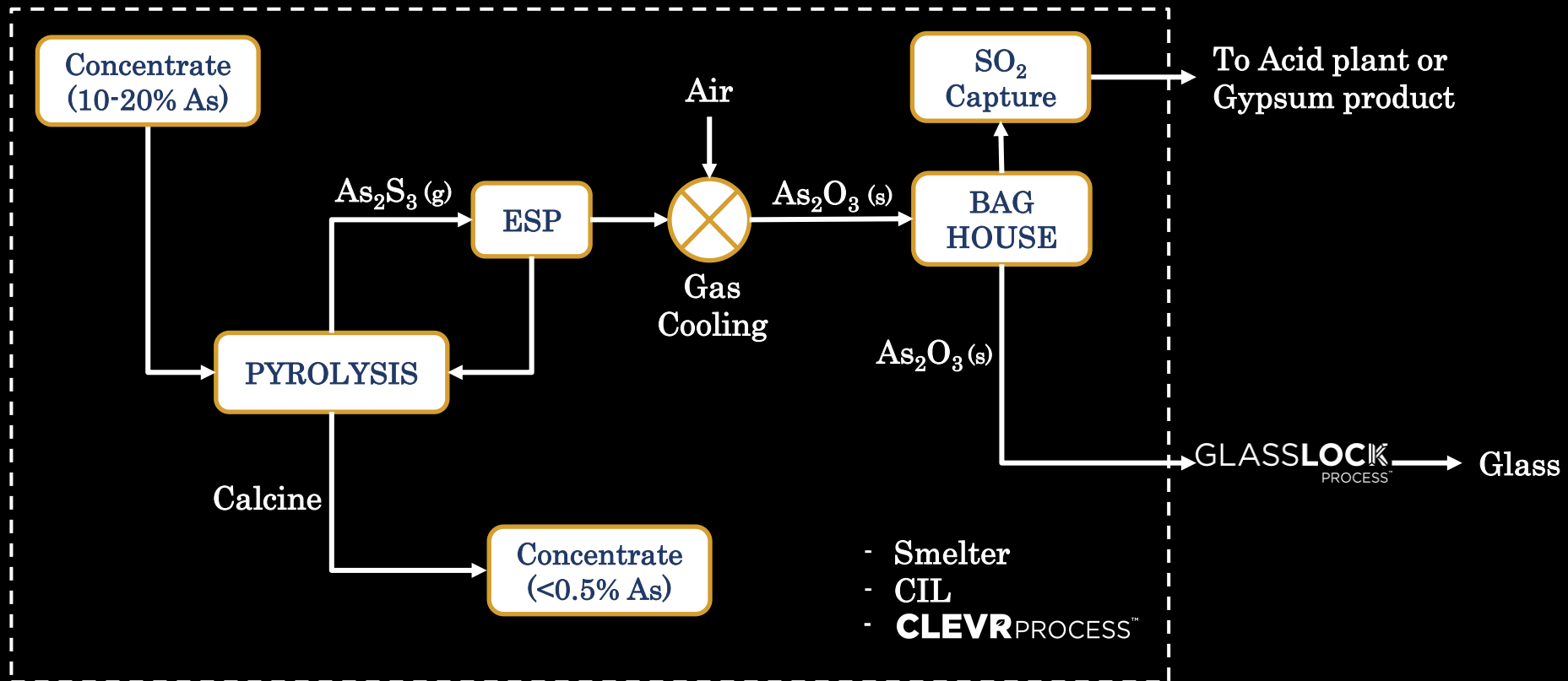
Glasslock Ghana Plant



Arsenic Bearing Concentrates – DST Approach



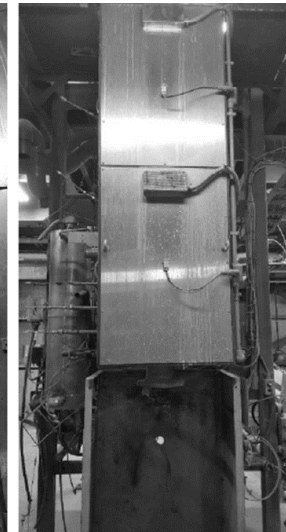
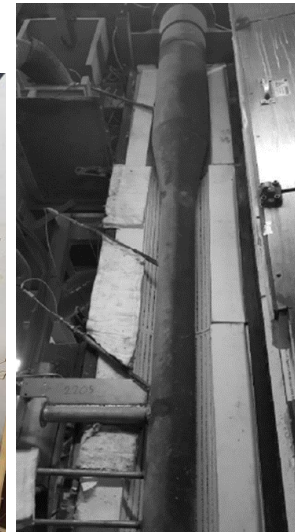
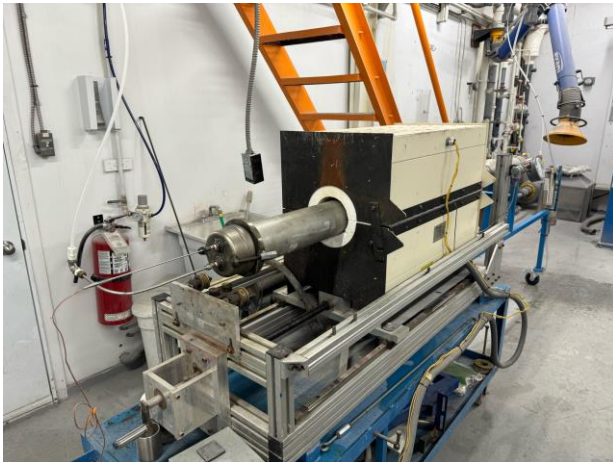
Arsenic in Complex Concentrate



- » Pyrolysis of arsenopyrite (As from 15+% to <0.3%)
- » Lower CAPEX due to single stage FBR vs. two-stages, and;
- » Partial oxidation leading to reduction of SO₂ capture

Arsenic Sulphide Concentrates

- » Complex concentrates (**5 to 20+% As**) subject to Market penalties or recovery constraints
- » DST Successfully removes **Arsenic to <0.3% As**:
- » **No Metal Loss**, ~25-30% Mass Loss = Proportional Grade increase
- » ~60% residual sulphides, all removed As to Stable Glass Product





GlassLock Process – Commercial Drivers

- » Product **Stability**, Quality Arsenic Glass Product
- » Process **Flexibility**, Adapts to Feed and Operation
- » **Arsenic Removal**, Unlocks Operations & Opportunities

PROCESS COSTS

- » 1,000 tpa up to **50,000 tpa** treatment Plant Designs
- » Improved OPEX **per tonne of As**
- » Advantageous CAPEX & **Alternative Treatment Flowsheet**



DUNDEE TECHNOLOGIES DURABLES

CLEVRPROCESS™

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