IsaMill™ Technology in the Primary Grinding Circuit

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IsaMill™ Development - UFG

- **Developed to address ultra fine grinding requirements for McArthur River and Mt Isa Pb/Zn deposits**
- **McArthur River required 7µm grind**
- **Conventional technology was unsuitable due to poor efficiency and surface contamination**
- **Looked outside of the mining industry**
- **Collaboration with Netzsch of Germany – history of manufacturing stirred mills for paint, inks, pharmaceuticals**
- **1.1MW M3000 (litre) IsaMill™ developed – became the enabling technology for McArthur River Mine 1995**

IsaMill™ Development - UFG

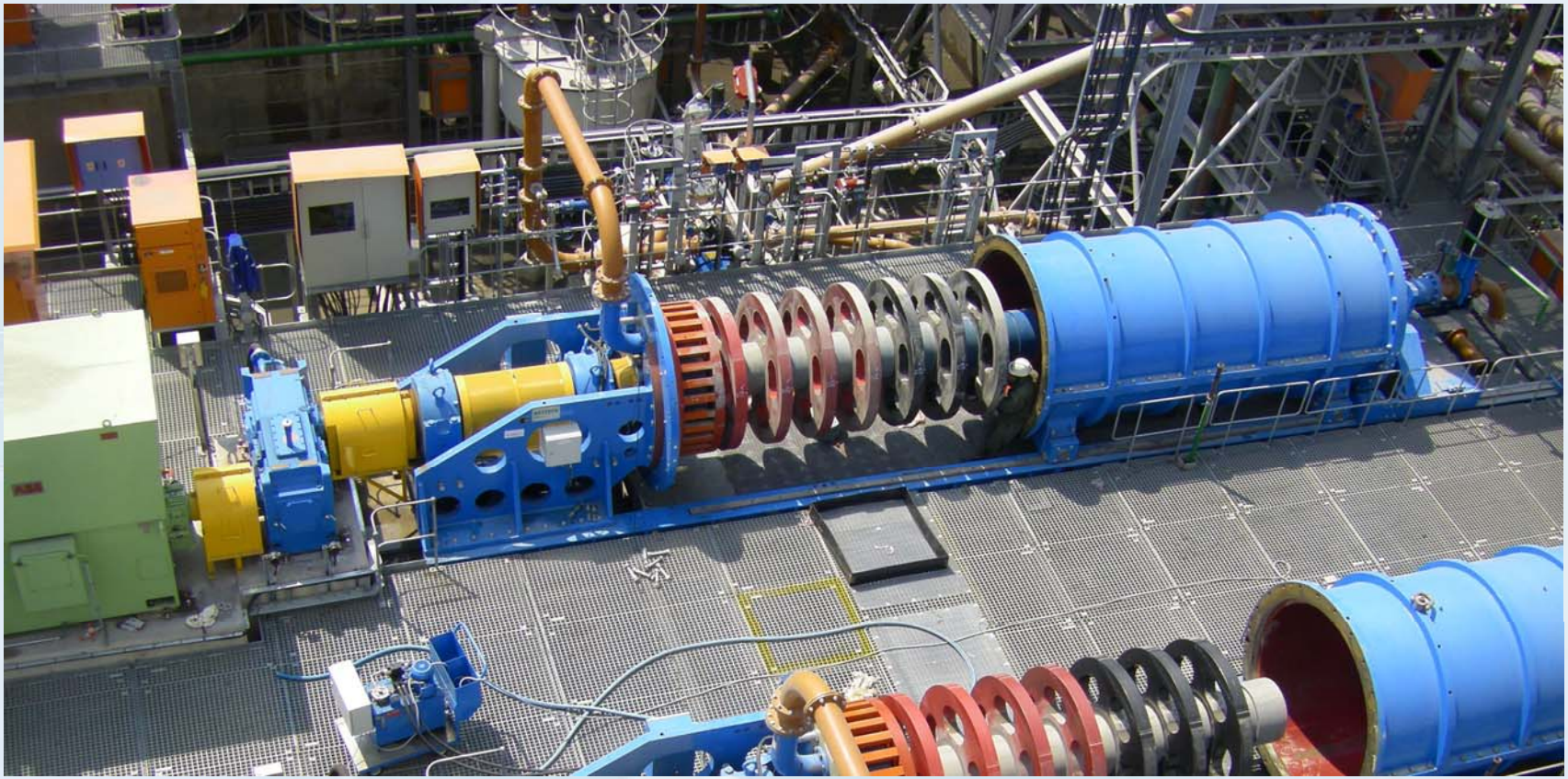
IsaMill™ Development – Coarse Grind

- **Requirement for larger scale IsaMill™ identified by Anglo**
  - Inert and efficient grinding to improve mineral liberation and recovery
- **M10,000 IsaMill™ development with Anglo/Netzsch 2003**
- **1st M10,000 in UFG at Western Limb Tailings Retreatment**

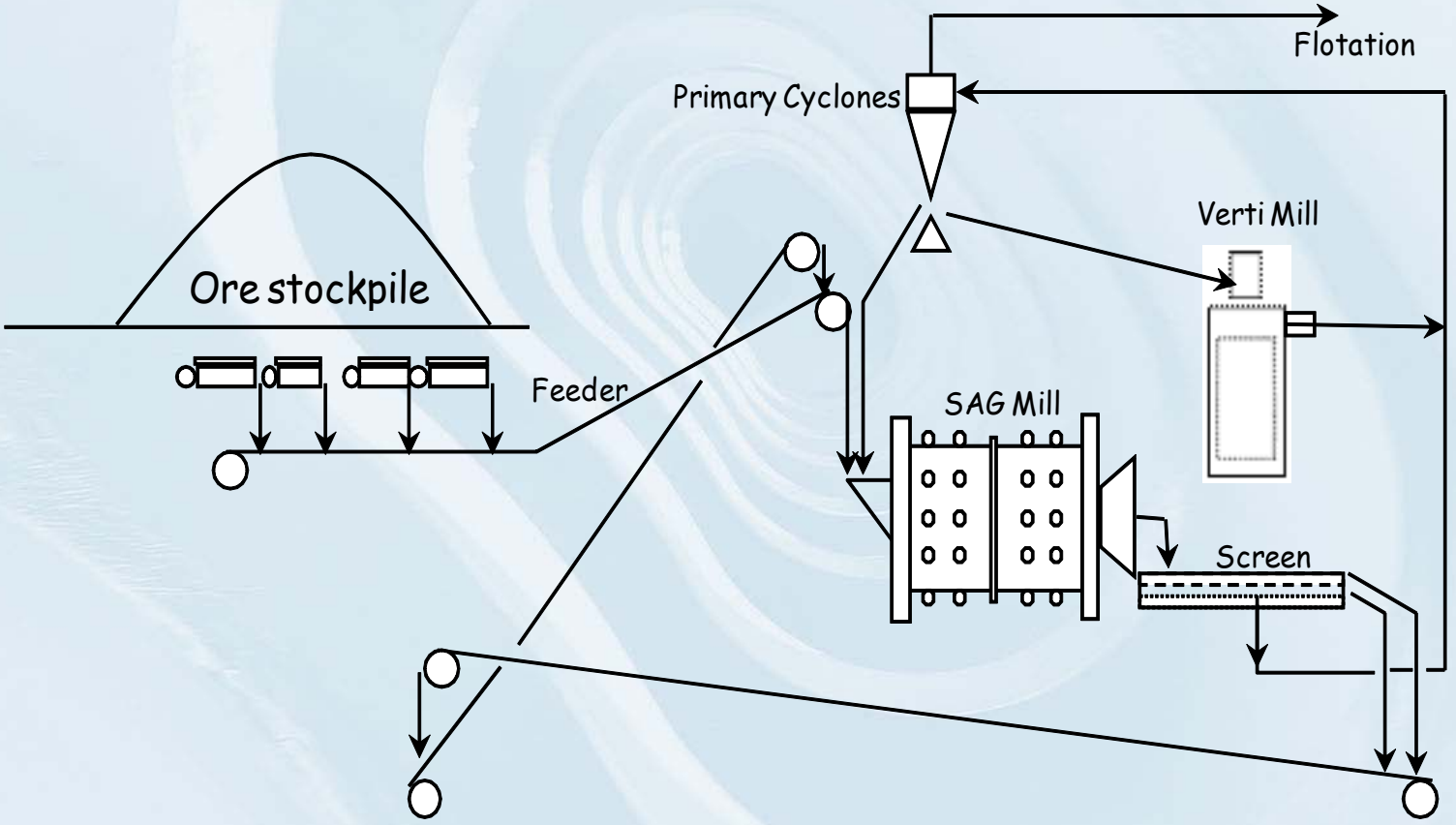
- **Development of 3.5mm ceramic media with Magotteaux**
- **18 x 3MW M10,000 IsaMills™ installed within Anglo**
- **F80 of 75-100µm; P80 of 53µm**
- **Further 4 x 3MW on order for Anglo**
- **Worldwide over 100 IsaMills™**

IsaMill™ Development – Coarse Grind

IsaMill™ Operation

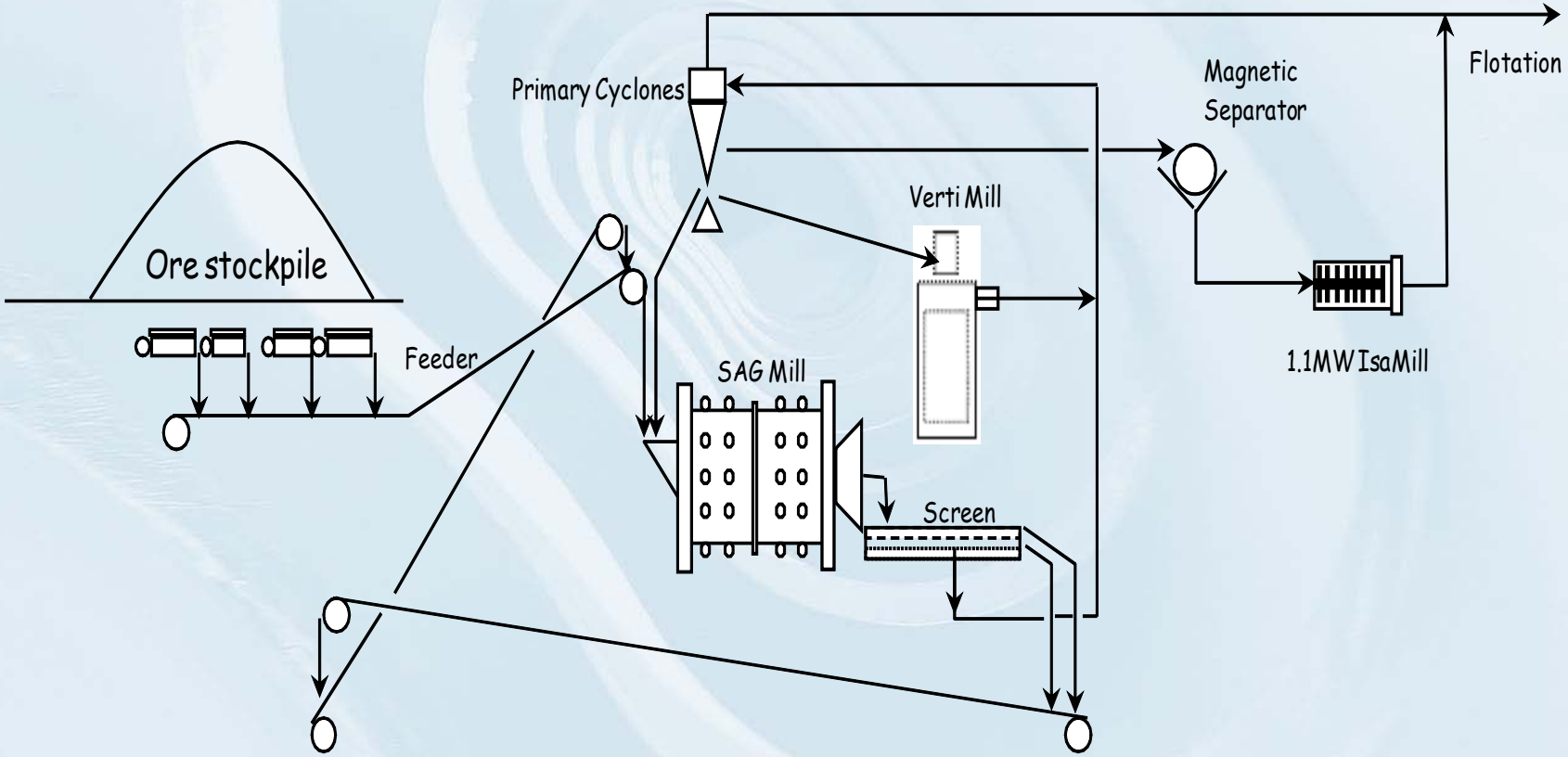


McArthur River - 2006

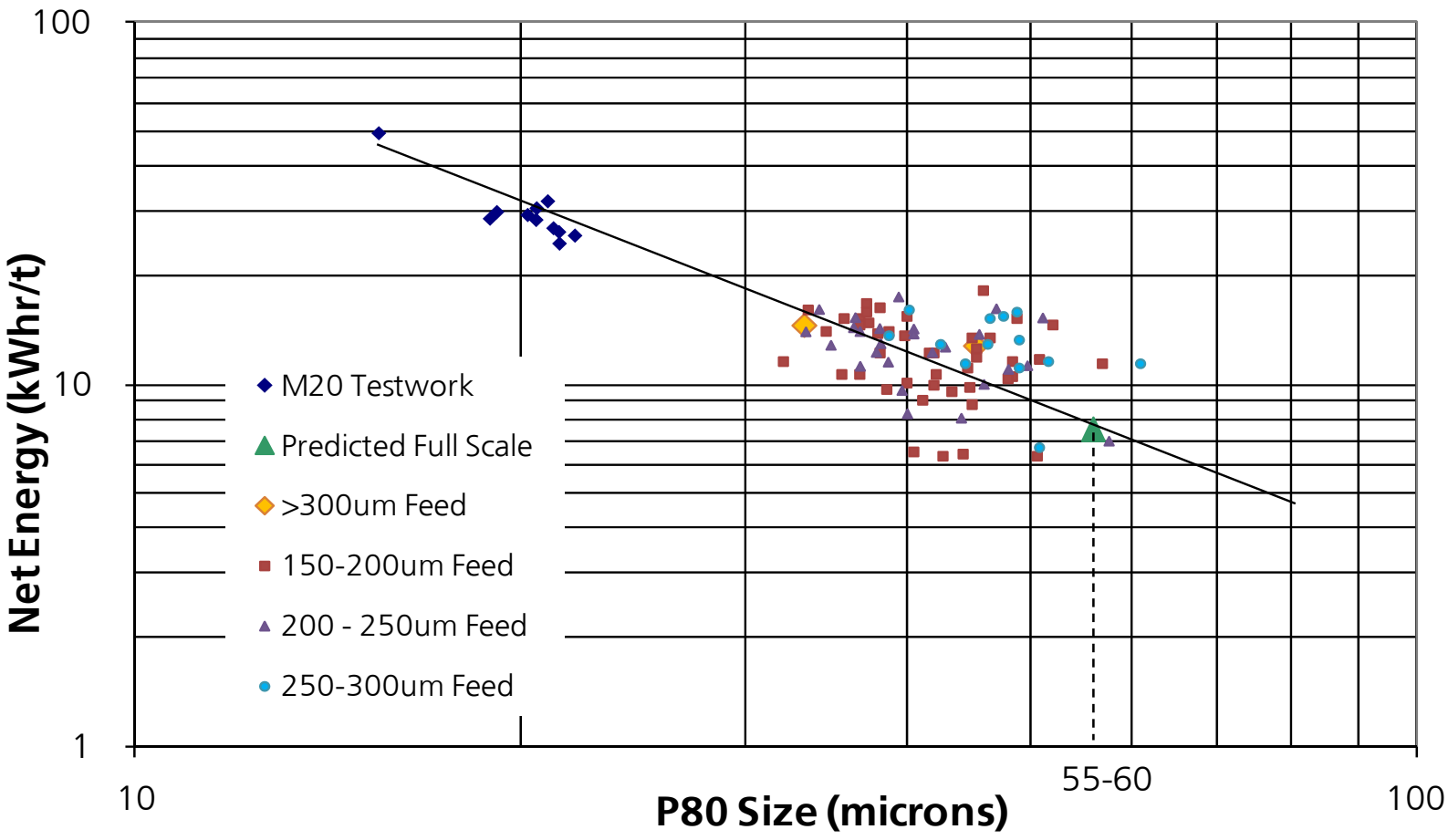


McArthur River – Plant Trial

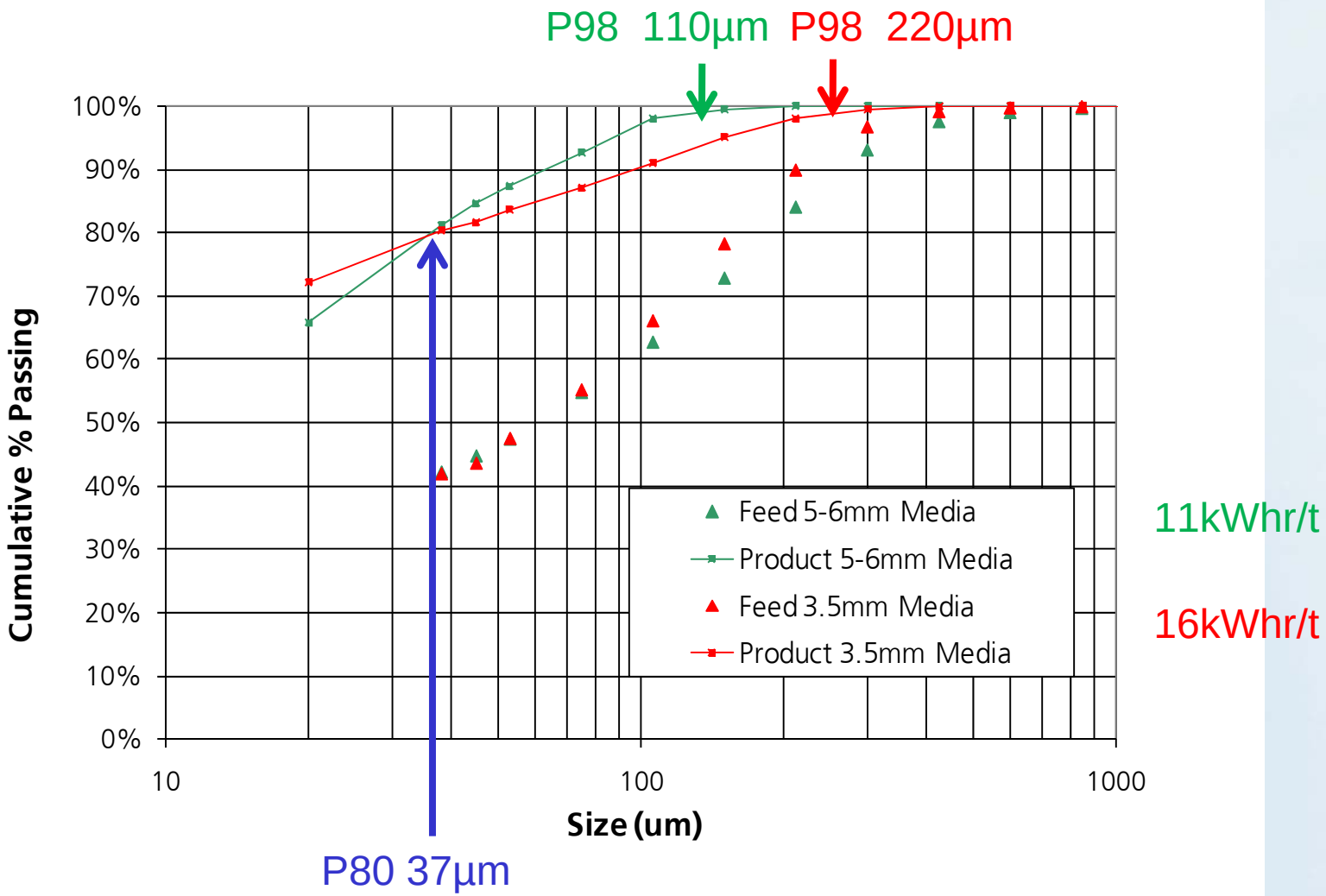
- **Plant trial commenced in May 2007**



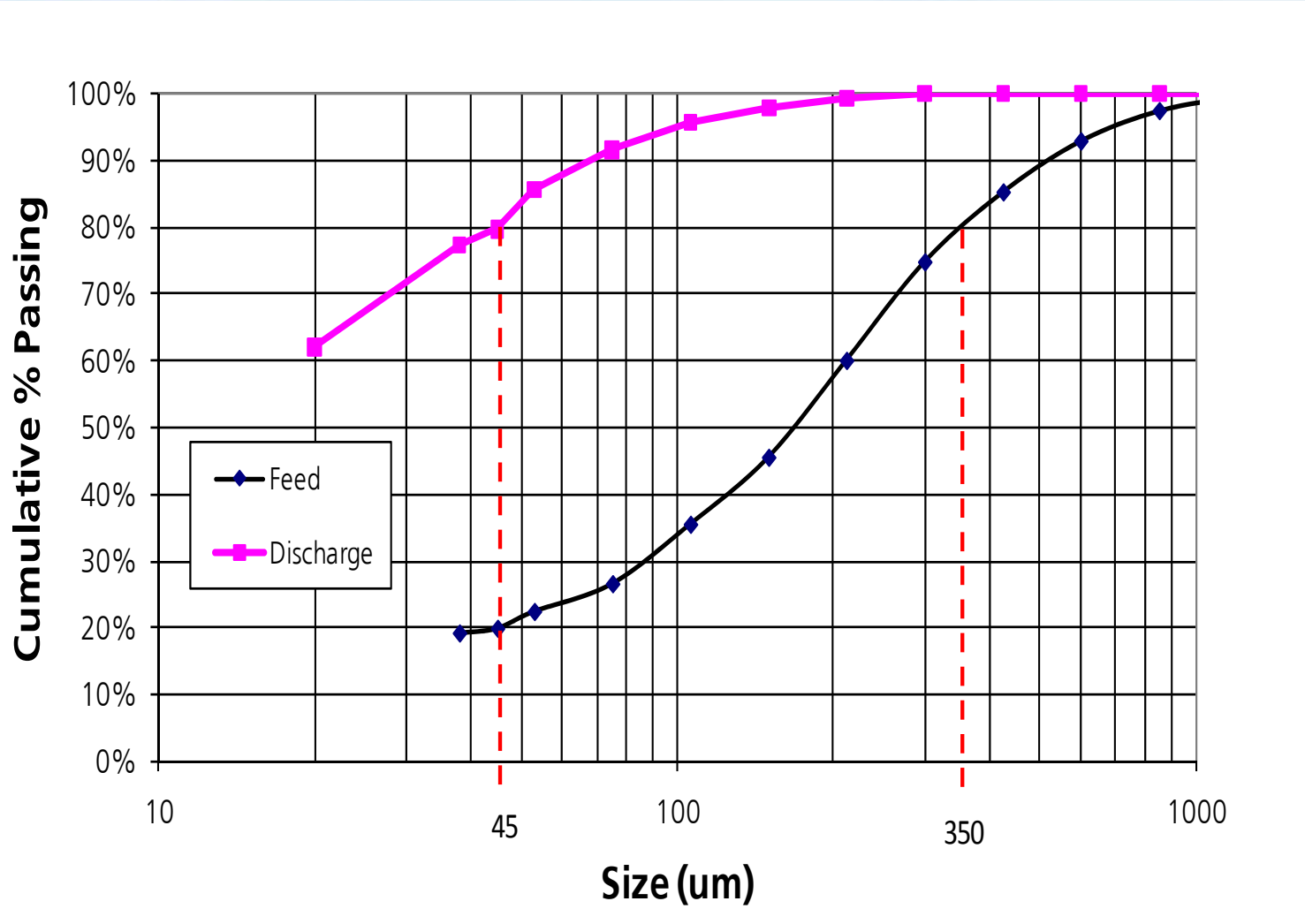
IsaMill™ Survey Data



Effect of Media Size



F80 350µm @ 12.8kWhr/t



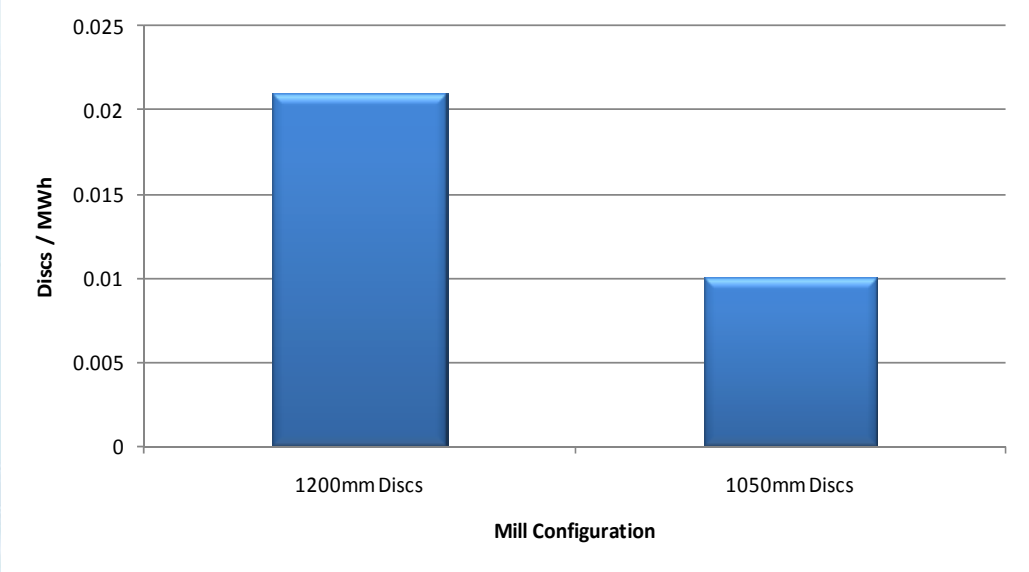
IsaMill™ Wear Performance

- **Initial 400 hour service life**
- **Disc and shell replacement**
- **Still beneficial to operate - trial became permanent production mill**

- **UFG mills 2000 hour service intervals**
- **Higher wear a function of**
  - coarser feed/media size
  - mineralogy
  - mill geometry designed for UFG

IsaMill™ Wear Performance

- **Smaller Diameter Discs : 1200mm to 1050mm**
- **Service life increased 400 to 1200 hours**



- **Max power reduced from 1MW to 650-700kW**
- **Proportionally limited the throughput to maintain grind performance**

McArthur M10,000 IsaMills™

- **Successful M3000 trial – permanent production mill**
- **2 x M10,000 installed for plant expansion Nov 2008**

- **M3000 development work continued**
- **M10,000 commissioned in UFG circuit - allowed 2 x M3000 for primary grinding circuit**

Primary Circuit Performance

- **Plant throughput increased by 25% from 260 to 325 tph**

	P_{80}	tph	kW	kWhr/t*
Fresh Feed to SAG Mill	6377	323	3800	11.76
SAG Cyclone Feed	586	1548		
SAG Cyclone OF	87	245		
SAG Cyclone UF	582	1303		
Tower Mill Feed	582	1187	950	0.80
Tower Mill Discharge	571	1187		
1st IsaMill™ Feed	253	39.6	600	15.15
1st IsaMill™ Discharge	43	39.6		
2nd IsaMill™ Feed	247	38.7	600	15.51
2nd IsaMill™ Discharge	36	38.7		
Total Rougher Feed	76	83.4		
Total		323	5950	18.41

- **With no IsaMill™ case, P80 85µm, OWi = 19.3kWhr/t**
- **With 2 x IsaMill™ case, P80 76µm, OWi = 18.4kWhr/t**

Development

- **IsaMill™ Development**
  - Alternative disc designs and configurations to recover power draw
  - Shell design – M5000 IsaMill™ - can be retrofit to M3000 IsaMill™
    - Allow geometrical ratios established with SDD in M3000 to be scaled up

- **Circuit Development**
  - McArthur River Phase 3 Development 2014
  - Increase capacity to 5 mtpa
  - M10,000 included in study for upgraded primary circuit
    - Secondary or tertiary duty ahead of flotation

Conclusions

- **Successful lab, pilot and full scale testwork**
- **IsaMill™ now integral, permanent part of primary grinding circuit - operating for over 4 years**
- **Improvements made to wear life and performance with further development work ongoing**
- **Success of the program**
  - IsaMill™ permanent part of grinding circuit
  - 2 x M10,000 installation
  - Further IsaMills™ under consideration for the Phase 3 expansion of the primary grinding circuit