

# CONTENTS

## Overview

'We're metallurgists, not magicians!' 3

*E McLean*

Presented at MetPlant 2011, this paper has been updated and edited for this compilation.

Back to the future – why change doesn't necessarily mean progress 11

*P D Munro and P A Tilyard*

Presented at MillOps 2009, this paper has been updated and edited for this compilation.

Back to the future – still on the dark side 19

*P D Munro*

Presented at MillOps 2016 as a follow-on to the paper: 'Back to the future - why change doesn't necessarily mean progress', this paper has been updated and edited for this compilation.

Undermining productivity – when good key performance indicators go bad 27

*J Pease*

Presented at MillOps 2014 as a PowerPoint presentation, this paper has been written specifically for this publication.

## Geometallurgy

Geometallurgy – what do you really need to know from exploration through to production? 33

*K Ehrig*

Presented at MetPlant 2013, this paper has undergone minor edits for this compilation.

Integrating geometallurgy with copper concentrator design and operation 37

*G Harbort, K Jones, D Morgan and C Sola*

This paper was presented in various forms at MetPlant 2011, MillOps 2014 and MillOps 2016. It has been updated with a new geometallurgy model, undergone significant edits and is the integration of the papers presented at the three events outlined above.

Integrated mining and metallurgical planning and operation 55

*P L McCarthy*

This is a compilation of three papers presented and published for MetPlant 2011, MetPlant 2013 and MetPlant 2015.

## Project economics

Guidelines for economic evaluation of projects 65

*P Card*

Presented and published at MetPlant 2011, this paper has been significantly reviewed and updated for this compilation.

Sensible cost cutting for resource projects 69

*D Connelly*

Presented at MetPlant 2011, this paper has undergone significant edits and updates for this compilation.

When does further processing at the mine site make sense? 75

*C Fountain, S La Brooy and G Lane*

Presented at MetPlant 2008, this paper has had minor edits for this compilation.

The ABC of Mine-to-Mill and metal price cycles 85

*P Cameron, D Drinkwater and J D Pease*

Presented at MillOps 2016, this paper has been reviewed and abridged for this compilation.

Base metals concentrate sales contracts – change Pavlov and the dog 91

*P D Munro and S E Munro*

Presented at MetPlant 2015, this paper has undergone minor edits for this compilation.

## Project design

Karouni Gold Project from drill core to commissioning 101

*K Nilsson and D Connelly*

Presented at MetPlant 2015, this paper has undergone minor edits for this compilation.

Upgrades, modernisations, automation and expansions . . . where will the expertise, capability and skills come from in the future?	<b>107</b>
<i>R Coleman, J King and T Hunter</i>	
Presented at MillOps 2016, this paper has undergone minor edits for this compilation.	
Is an 80th percentile design point logical?	<b>115</b>
<i>D David</i>	
Presented at MetPlant 2013, this paper has undergone significant edits for this compilation.	
Measuring and taking notice of orebody variability – an essential ingredient for reliable plant design	<b>121</b>
<i>D David</i>	
Presented at MetPlant 2015, this paper has undergone significant edits for this compilation.	
Getting optimum value from ore characterisation programs in design and geometallurgical projects associated with comminution circuits	<b>131</b>
<i>S Morrell</i>	
Presented at MillOps 2009, this paper has been updated and edited for this compilation.	
Cost-effective concentrator design	<b>137</b>
<i>G Lane, P Dakin and D Elwin</i>	
Presented at MetPlant 2011, this paper has undergone minor edits for this compilation.	
 <b>Project management and delivery</b>	
Fatal flaws in technical due diligences	<b>145</b>
<i>A J H Newell</i>	
Presented at MetPlant 2015, this paper has undergone significant updates and edits for this compilation.	
Guidelines for mineral process plant development studies	<b>155</b>
<i>P R Whincup</i>	
Presented at MetPlant 2008, this paper has undergone minor edits for this compilation.	
Project delivery	<b>163</b>
<i>G Lane and E Skinner</i>	
Presented at MetPlant 2013, this paper has undergone minor edits for this compilation.	
Mineral project management – a perspective from four decades in the industry	<b>173</b>
<i>J S Dunlop</i>	
Presented at MetPlant 2013, this paper has been updated and edited for this compilation.	
Keeping projects on the rails	<b>183</b>
<i>J Canterford</i>	
Presented at MetPlant 2011, this paper has undergone significant edits for this compilation.	
Operations versus projects – how do people think and what are the implications?	<b>187</b>
<i>G Lane and B Clements</i>	
Presented at MillOps 2012, this paper has undergone minor edits for this compilation.	
Performance testing – when, what and how?	<b>193</b>
<i>G Lane, M Davis, E McLean and J Fleay</i>	
Presented at the Project Evaluation 2007 conference, this paper has undergone minor edits for this compilation.	
 <b>Unit design and development</b>	
Process development and throughput forecasting at the Phu Kham copper-gold operation, Laos PDR	<b>201</b>
<i>D Bennett, I Crnkovic, P Walker, A Hoyle, A Tordoir, D La Rosa, W Valery and K Duffy</i>	
The subject matter for this paper was written, published and presented at three AusIMM conferences: MillOps 2012, MillOps 2014 and MetPlant 2015. Significant effort has gone into combining, updating and editing this combination of the three papers for this compilation.	

What can go wrong in comminution circuit design? <i>C Bailey, G Lane, S Morrell and P Staples</i> Presented at MillOps 2009, this paper has undergone significant edits for this compilation.	235
Do we need a gravity circuit or not? A case study in applying best practice <i>A Giblett and K Afewu</i> Presented at MetPlant 2015, this paper has undergone minor edits for this compilation.	243
Solvent extraction of uranium – towards good practice in design, operation and management <i>P Bartsch and S Hall</i> Presented at MetPlant 2011, this paper has been updated and edited for this compilation.	249
Design of copper-cobalt hydrometallurgical circuits <i>G Miller</i> Presented at MetPlant 2008, this paper has undergone minor edits for this compilation.	257
A review of best practice in gravity circuit design and operation <i>A Giblett, A Bax, G Wardell-Johnson and W Staunton</i> Presented at MetPlant 2013, this paper has undergone minor edits for this compilation.	263
Leach residue and pregnant liquor separation – process and capital comparison of counter-current decantation and counter-current washing with vacuum filtration <i>R Klepper and P McCurdie</i> Presented at MetPlant 2011, this paper has been updated and edited for this compilation.	273
Filtration test work – extracting the whole story for studies and design <i>G Bickert and B Länger</i> Presented at MetPlant 2011, this paper has been updated and edited for this compilation.	285
Considerations for effective gold process development <i>A Giblett, D Appelhans and R Dunne</i> Presented at MetPlant 2013, this paper has undergone minor edits for this compilation.	297
Energy efficient ball mill circuit – equipment sizing considerations <i>A Jankovic and W Valery</i> Presented at MetPlant 2013, this paper has been updated and edited for this compilation.	307
Advances in dense medium cyclone plant design <i>T J Napier-Munn, G Gibson and B Bessen</i> Presented at MillOps 2009, this paper has undergone minor edits for this compilation.	315
<b>Sampling, metallurgical accounting and control</b>	
Using metallurgical data to drive continuous improvement <i>R Dunne</i> Presented at MillOps 2016, this paper has been updated and edited for this compilation.	327
The importance of sampling in the mineral industry <i>R J Holmes</i> Presented at MetPlant 2013, this paper has been updated and edited for this compilation.	333
A progressive, iterative approach leading to reliable metallurgical accounting sampling systems <i>F F Pitard</i> This paper was written for MetPlant 2015 but not presented at the conference. It has undergone significant edits for this compilation.	343
Sampling, corporate governance and risk analysis <i>G J Lyman and F S Bourgeois</i> Presented at MetPlant 2015, this paper has been significantly edited and updated for this compilation.	349

Metallurgical management tools for continuous improvement	<b>355</b>
<i>W McCallum and R Dunne</i>	
Presented at MillOps 2012, this paper has undergone minor edits for this compilation.	
Measuring the influence of sample size on the precision and accuracy of gravity gold estimation	<b>361</b>
<i>A Giblett and T J Napier-Munn</i>	
Presented at MetPlant 2015, this paper has been updated and edited for this compilation.	
Defining practical metallurgical accounting discrepancy limits for gold operations	<b>365</b>
<i>A Giblett, R Dunne and K McCaffery</i>	
Presented at MillOps 2012, this paper has undergone minor edits for this compilation.	
Manual control, process automation or operational performance excellence – what is the difference?	<b>373</b>
<i>P Thwaites</i>	
Presented at MillOps 2014, this paper has been significantly updated with new information for this compilation.	
Unlocking processing potential by empowering our operators	<b>401</b>
<i>X Li, M S Powell and W McKeague</i>	
Presented at MillOps 2012, this paper has been updated and edited for this compilation.	
Current developments in the operation and control of autogenous and semi-autogenous grinding mills in Australia	<b>411</b>
<i>J Karageorgos, Y Atasoy and D Baas</i>	
Presented at MetPlant 2008, this paper has undergone minor edits for this compilation.	
<b>Environmental management and sustainability</b>	
Mine waste risk minimisation by integrated waste management and process optimisation	<b>419</b>
<i>D Brett</i>	
Presented at MetPlant 2013, this paper has been updated and edited for this compilation.	
Sustainability, made easy – a business improvement case study	<b>427</b>
<i>G Corder, N Currey and G Becker</i>	
Presented at MetPlant 2013, this paper has been updated and edited for this compilation.	
Continuous improvement – how changes in metallurgy can have a substantive impact on environmental impact and closure: lessons learnt from environmental auditing	<b>437</b>
<i>P Mulvey and G McMillan</i>	
Presented at MetPlant 2013, this paper has undergone minor edits for this compilation.	
<b>Process improvements and case studies</b>	
Improving fines recovery by grinding finer	<b>445</b>
<i>J D Pease, M F Young and N W Johnson</i>	
Presented at MetPlant 2004, this paper has had significant updates and edits for this compilation.	
Cunning solutions to process improvement	<b>455</b>
<i>T J Napier-Munn</i>	
Presented at MillOps 2014, this paper has undergone minor edits for this compilation.	
How to prioritise process improvements	<b>461</b>
<i>D J Hill</i>	
Presented at MillOps 2014, this paper has had a significant update for this compilation.	
Some practical problems in running statistically valid plant trials and their solution	<b>469</b>
<i>T J Napier-Munn</i>	
Presented at MetPlant 2008, this paper has undergone minor edits for this compilation.	

The optimisation of semi-autogenous grinding and ball mill based circuits for mineral processing by means of versatile and efficient high pressure grinding roll technology	<b>475</b>
<i>S W Kirsch and M J Daniel</i>	
Presented at MillOps 2009, this paper has been significantly updated for this compilation.	
Optimisation opportunities for high pressure grinding rolls circuits	<b>483</b>
<i>M S Powell, M M Hilden, C M Evertsson, G Asbjörnsson, A H Benzer, A N Mainza, L M Tavares, B Davis, N Plint and C Rule</i>	
Presented at MillOps 2012, this paper has been significantly updated for this compilation.	
An update on applications of high frequency screens in closed grinding circuits	<b>499</b>
<i>S B Valine, J E Wheeler, B Packer and A N Cavendor</i>	
This paper is a compilation of two papers from MetPlant 2011 and MillOps 2012. It has been significantly updated with additional case studies and information obtained for the Alban Lynch publication <i>Comminution Handbook</i> .	
The influence of liner wear on milling efficiency	<b>509</b>
<i>P Toor, T Perkins, M S Powell and J Franke</i>	
Presented at MetPlant 2011, this paper has been significantly updated for this compilation.	
Development of the Fosterville gold mine heated leach process	<b>523</b>
<i>M Binks and P Wemyss</i>	
Presented at MetPlant 2011, this paper has been significantly updated for this compilation.	
Collector – addition point and consumption	<b>529</b>
<i>C J Greet, W J Bruckard and D MacKay</i>	
Presented at MetPlant 2008, this paper was revised several years later for <i>Transactions of the Institutions of Mining and Metallurgy – Mineral Processing and Extractive Metallurgy</i> , and has been further updated and edited for this compilation.	
The Ausenco carbon reactivation kiln initiative	<b>537</b>
<i>J K Clafin and S R La Brooy</i>	
This paper was specifically written for this compilation as an author foreword to the following two papers.	
Lessons learnt and performance – installing and commissioning an Ausenco carbon reactivation kiln in Africa	<b>541</b>
<i>J K Clafin, S R La Brooy and D Preedy</i>	
This paper was presented at MetPlant 2015. Context for this paper and the paper immediately below has been provided via an author foreword (above), which also provides significant new insights and updates.	
Carbon management in a high gold price environment	<b>549</b>
<i>S R La Brooy and J K Clafin</i>	
This paper was presented at MetPlant 2013. Context for this paper and the paper immediately above has been provided via an author foreword (above), which also provides significant new insights and updates.	
The impact of gravity gold recovery at Kalgoorlie Consolidated Gold Mines	<b>559</b>
<i>A Giblett, D Hillier, K Parker and V Ramsell</i>	
Presented at MillOps 2012, this paper has undergone very minor edits for this compilation at KCGM's request.	
Agglomeration – the key to success for the Murrin Murrin heap leach	<b>569</b>
<i>D Readett and J Fox</i>	
Presented at MetPlant 2011, this paper has been updated and edited for this compilation.	
<b>Author index</b>	<b>575</b>