

Productivity REVIEW

SEPTEMBER 2001



GMN GROWTH

Much has taken place since our last edition:

Minerals has distilled the learnings from the extensive asset benchmarking performed over the past few years into a targeted Operating Excellence strategy around capability assurance called "moreCLASS". This strategy is focused strongly on failure reduction and increased planning and sets an aggressive annual goal of a 20 percent per annum reduction in stoppage time on critical production equipment (both production and maintenance stoppage time).

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The Pursuit of Excellence conference

The GMN's "Pursuit of Excellence" conference in New Zealand in March 2001 was described as the "best ever", achieving a score of 8.4 out of 10.

Participants found the conference to be "an excellent learning experience", allowing them to learn more about GMN people and functions, moreCLASS, Operating Excellence, Manufacturing Excellence and New

Zealand Steel, as well as providing the opportunity to network with other participants.

The conference was hosted by New Zealand Steel and drew 100 BHP employees across Minerals, Steel, Petroleum and Services divisions.

The main objective was to strengthen the understanding of strategic and local improvement initiatives across the

company. Presentations on measuring maintenance at Ok Tedi, SBS and GSAP, Operating Excellence, Manufacturing Excellence, standard KPIs, one BHP approach and the Operating Information Centre provided the strategic context. Implementation learnings were derived from a series of case studies, including seven New Zealand Steel case studies presented on site.

(More stories pages 2-6)

The LeRoy Dugger story – farewell and good luck!

Thomas LeRoy Dugger – statesman, diplomat, visionary leader, encourager and friend – faithfully led the Global Maintenance Network from early 1996 until May 2001 when he took up a position at New Mexico Coal.

Under his leadership, the GMN moved from turbulent times into a growth phase; from MIP to GMIP to GMN; from a single office and a full-time

staff of three to three offices and 10 full-time team members; and from a Minerals and Copper focus to a truly global focus spanning all business groups.

LeRoy became involved in maintenance improvement in 1991 when he helped organise the Newman maintenance improvement conference. In December 1995, the network received a much-

needed boost when the Minerals maintenance leaders unanimously agreed to support a full-time team to facilitate the sharing of best practices. LeRoy agreed to lead the MIP at the request of previous Minerals CEO, Jerry Ellis.

LeRoy was instrumental in helping to shape a disparate group into a global model of networking. Along the way,

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LeRoy in 'tribal dress' at his farewell.

Making every shift count with Manufacturing Excellence

Manufacturing Excellence at BHP Steel is about making every shift count, Coated Steel Manager Business Planning Bob Frizell told the GMN conference.

It is also about bottom-up empowerment and management through systems.

Bob strongly believes that given the resources (data, knowledge, skills and experience) and opportunities (time and a supportive performance environment), employees will excel.

Improving process knowledge

Bob said to improve equipment and process knowledge and work practices at Springhill, combustion specialist David McKechnie engaged the metal coating line furnace operators in on-the-job coaching.



Springhill's metal coating line 1.

"Once a week Dave would make himself available at the furnace cabin and informally discuss furnace operation, maintenance and process theory," he said.

"After word got around, attendance at these sessions expanded to include shift maintenance and supervisory personnel.

"Dave covered all aspects of the furnace's operation and maintenance, including trouble shooting and condition monitoring.

"The results have included high engagement and involvement of all functional groups; improved understanding of furnace operation, maintenance and safety; the development of people in key operation and support roles; and the provision of better information for improved maintenance planning."

Improving communication

Bob said at Coated Steel, functional groups had been brought together within the shift teams to provide a forum where information exchange was visible, freely available (on a whiteboard) and data was transferred from shift to shift.

"We are making the data visible to assist planning for the next shift, to help focus on potential problems and to allow input from others to develop solutions," he said.

"During the meeting, discussions focus on solving problems to root cause and testing the level of ownership of the shift team to follow through to root cause.

"Problems are followed through by owners and cross-functional groups who provide solutions on a shift basis.

"Specifically, this supports the pursuit of a root cause and prevention mentality, high involvement, data-driven shift changeovers, mentoring and coaching others to be the best they can be, and disciplined thinking around problem solving and decision making.

"We think we could make our performance even better by further training (process and technical), agreement on shift teams' expectations and improved team work."

ME routines and behaviours

The routines and behaviours encouraged by Manufacturing Excellence include:

- All people value and live the BHP Charter through their daily actions
 - Engage in safety audits as part of everything we do
 - Focus on process control by initially standardising our procedures, bringing them into control, then reducing the variation to achieve customer demands on our products
 - Disciplined thinking around problem solving, decision making and risk management for maintenance and process changes
 - High involvement, data-driven, shift changeovers
 - Pursuit of root causes and prevention mentality
 - Use weekly cost data to seek opportunities to reduce costs
 - Take every opportunity to technically train others and share information
 - Actively work with our customers and suppliers to improve the value chain
 - Mentor/coach others to be the best they can be
 - Shift managers engage and lead their people
 - Current business performance information is regularly shared and discussed across the entire workforce so people can perform as business owners
 - Managers, supervisors, technical people walking the floor, reinforcing the routines
 - Workgroups set and follow standards.
- Focused improvement initiatives produce:
- Engaged, multi-disciplined involvement
 - Priorities based on critical few and complexity reduction
 - Disciplined change control
 - Meeting the budget challenge.

NZ Steel achieves targets on Melter 1 rebuild

New Zealand Steel completed the NZ\$25 million Melter 1 rebuild at Glenbrook to specification, on time and within budget by focusing on seven critical factors.

The critical factors were:

- Investing well in planning and design to get the right scope, budget and timeframe
- Engaging experts to help
- Using comprehensive project management discipline, closely controlling variations, applying contingency planning and value analysis
- High ownership
- Using the best people from the start to the finish of the project
- Covering the critical areas – maintenance, process, refractories
- Involving the shopfloor.



Andrew Campbell

Melter 1 Rebuild Engineering Manager Andrew Campbell said although the plant management team believed the Melter 1 rebuild was essential for extending plant life, the project team was asked to carry out extensive research and an international review to clearly justify the rebuild.

"A high level of pre-work was done prior to the project being submitted for approval," he said.

"Gaining approval for this level of expenditure prior to finalising the project scope and budget enabled the project team to carry out sufficient work and bring in enough external resources to provide a high level of confidence in the bottom-line dollar value and expenditure details of the appropriate capital."

Andrew said considerable time and effort was allocated to determining the correct project team and contracting

structure, and ensuring a high degree of input from the plant operations and maintenance personnel.

"Three key plant personnel were seconded to the project for its duration – the project manager who was normally the refractory manager, the existing plant maintenance engineer, and the process engineer," he said.

"This provided direct input at crucial points and enabled a very high level of ongoing communication with the plant-based staff, leading to such successes as the enormous improvement in roof access.

"Having the project manager (effectively the client representative) drawn from the plant management also ensured that high level concerns could be conveyed and decisions obtained quickly.

"The rest of the team was selected primarily on the basis of expertise. This included bringing in project engineering and management expertise from Beca Carter (the consulting engineering company that Andrew works for), a construction manager and key site supervision staff with blast furnace rebuild experience from BHP Engineering in Australia, furnace design expertise from Hatch in Canada and electrode assembly expertise from Scandinavia."

Hatch was initially commissioned to review and provide recommendations on the design of New Zealand Steel's melters. The company also provided a wide range of options to improve the integrity and throughput. The option selected by New Zealand Steel retained the original capacity but greatly increased the furnace integrity, with a comprehensive package of structural and refractory enhancements. The package included copper penetrative side wall coolers,



A final check of Melter 1 before recommissioning. improved taphole cooler blocks, thicker wall refractory with tongue and groove construction, thicker roof refractory, improved refractory materials, much larger springs and tie-rods, considerably stronger end-wall structural beams, and much stronger water cooled roof beams.

Another critical factor in the success of the rebuild was that New Zealand Steel had a well-developed project management system which was adhered to and supplemented where necessary.

"We used the BHP MTEC system (maintenance, training, engineering and commissioning) principles with Beca's proven quality systems," Andrew said.

"The MTEC system is based on nominating and involving plant personnel in the project at every stage, from concept to completion and hand over, so that their requirements are identified, built in and refined. The result is a high degree of ownership and a delivered project that incorporates the 'wisdom from guys that are there working with it every day'.

"Extensive use was made of the Kepner-Tregoe decision analysis methodology to assist in finalising difficult crucial decisions, including whether to retain or replace the hearth. Other helpful tools used included Hazop's, project value analysis, potential problem analysis and external peer reviews.

Andrew said the scope and budget were carefully controlled so that any deviations were identified, approved and actively managed.



Taharoa relocates 2000t of equipment 3km overland

New Zealand Steel's Taharoa titanomagnetite mine, south of Auckland, set two national load records when it transported around 2000t of mining equipment 3km overland on time, under budget and without safety incident.

It was the first time in New Zealand that four Cometto trailers were assembled end-to-end to transport a load. It was also the first time that a single load of 1000t was transported on platform trailers. Marsden Point oil refinery held the previous record with the relocation of a 750t reactor.

The need to relocate the equipment was first mooted five years ago. It took two years of planning and specialist advice to relocate the mine's 250t dredge, 500t surge bin, 1000t concentrator plant and ancillary equipment from the Southern Mining Region across a specially designed haul road to the Central Mining Region. The project was carried out during a six-week shutdown in early 2001 with the assistance of 29 BHP Billiton employees comprising five fitters, three electricians, one instrument technician and 20 production workers.

Two dry docks were constructed, one at each end of the relocation route. The equipment was floated into a dismantling pond that was interconnected with the dry dock in the Southern Region. Through pumping, the water levels were controlled to allow transfer of the separated units from the dismantling pond into the dry dock. Once drained, sets of self-elevating platform trailers were used to transport the main

units, one at a time, between the dry docks. Five prime movers were used to pull the loads. At the receiving end, the units were off-loaded in a dry dock interlinked with the first mining pond.

Project Manager Bernard van Deventer said the equipment was relocated because the reserves in the Southern Mining Region had been mined out.

"The northern boundary of the Southern Region is defined by a natural water course – the Wainui Stream – and the objective became to relocate the mining plant to the other side of the stream and re-establish in the Central Region," he said.

Bernard said the project team selected the trailers as the most effective means of transporting the equipment, particularly given the non-invasive means of crossing the Wainui Stream. Discussions began with prime contractor Tranzcarr Heavy Haulage Ltd in mid-2000.

"The remainder of 2000 was spent in developing concepts with the contractor, detailed designing, preparing the dry docks and haul road, and the initial mine plan for the Central Region. These activities occurred with no conflict to the normal site production," he said.

Transport equipment

The equipment was transported by Cometto and Nicolas self-elevating platform trailers supplied by Tranzcarr Heavy Haulage. Each trailer comprised a single longitudinal beam (the backbone) with parallel stringers attached to either side. The steering pivot bearing of each bogie assembly was

fixed underneath the stringers. Each bogie comprised a suspension linkage carrying an articulated single axle with four wheels.

The line of bogies at mid-trailer length were fixed. The bogies in front were progressively linked to steer one direction while the bogies behind steered the opposite direction. This minimised the road width requirement on corners.

The trailers were powered by four Mack 500HP and one Mercedes 530HP prime movers supplied by Tranzcarr. They featured torque converters driving to either manual or power shift transmissions, and then to tandem drive axles with differential locks and cross locks. Each prime mover had a drawbar connection at the front and rear so they could be pushed or pulled end-to-end. The truck units were ballasted to achieve 16t on each of the drive axles.

During transit, the dredge and surge bins were carried on two trailers side-by-side powered by two prime movers pulling in front with an additional two assisting with moving and steering at the back. The wet plant was transported on three trailers side-by-side, powered by two trucks in series at the front on each of the outside trailer drawbars (total four trucks) and one truck at the rear pushing. This provided working space between the front trucks for personnel to attend to trailer monitoring.

ABOVE LEFT: Relocating the 1000t concentrator plant 3km overland. ABOVE RIGHT: Taharoa titanomagnetite mine.

Ok Tedi turns around maintenance performance

Ok Tedi Mining has turned its maintenance performance around in less than four years, with vastly improved equipment availability and reduced operating costs.

With strong leadership from the top, Ok Tedi has tackled its "areas of opportunity" – safety, planning and scheduling, failure analysis and equipment strategies – head on, using more CLASS strategies, Operating Excellence tools and "measuring up" performance management.

Managing Director Roger Higgins said the company was focused on taking action, measuring productivity improvements against predetermined targets with clear definitions for each individual in terms of output.

"If you are not keeping score, then you are only practising," he said.

Performance targets are now set for each part of the operation based on the tonnes of copper concentrate set in the budget.

Already, the maintenance contribution to business performance has resulted in mine division unit costs falling from US\$1.13 in 1992-93 to US\$0.67 in 2000-01.

Ok Tedi's performance improvement is reinforced by its GMN maintenance evaluation results. The mine scored 65 percent in the March 2001 evaluation, up from 51 percent in October 1998. With a commitment to continuous improvement, Ok Tedi is targeting 75 percent for its next evaluation in June 2004.

Improvements in safety have been made by reducing unsafe acts. The mine has implemented a comprehensive safety risk management plan and treatment plans, appointed a QA/safety coordinator, implemented more than 200 JSA/SWIs, introduced compulsory JSOs and hazard identifications and set personal KPIs.



Ok Tedi Managing Director Roger Higgins.

To minimise job delays and maximise preventive work, Ok Tedi has developed and implemented formal policy and written procedures, formalised a procedure for preparing the weekly maintenance schedule, improved the preventive maintenance program on Caterpillar 789 rear dump trucks and Caterpillar D11 dozers, and focused on quality and timeliness of preventive maintenance. Supervisors are now committed to achieving the weekly maintenance and shutdown schedules.

The mine has implemented a detailed failure analysis procedure and conducted training in Apollo root cause analysis and effective problem solving for key personnel.

The maintenance engineering team is now accountable for failure analysis, all significant failures are investigated to the root cause using either Apollo root cause analysis methods or ICAM, and all downtime and some causes are being captured by dispatch.

In addressing maintenance strategy, Ok Tedi has introduced lubrication awareness and fuel/lube contamination control, established an equipment maintenance strategy development program using failure history which is continually revised, established maintenance plans for all productive equipment (directly linked to budget), and established an on-site condition monitoring program.

The mine has also reduced work delays by establishing an area tool stores and auto-requisitioning of preventive maintenance kits and fit kits, developed and communicated the mine maintenance mission, policies and key work management procedures, and carried out extensive maintenance process training programs. New job summaries have been created and existing summaries revised to ensure positions are aligned with equipment types and functions.

Ok Tedi's maintenance vision is to achieve defect elimination through careful operation, lubrication management, designing reliable and maintainable equipment, life cycle maintenance of equipment ... and the mine is well advanced on that journey.

~ Andy Malcolm wins Placer Dome award ~

The Ok Tedi Mine Maintenance Manager Andy Malcolm was awarded the best presentation at the Placer Dome Down Under Maintenance Conference in Cairns in July. Andy spoke about the turnaround in Ok Tedi's maintenance

performance.

The perpetual award is on display at the Porgera Joint Venture office in Cairns.

Andy was also presented with a book from Metso (Nordberg).

"There were about 80 people attending the conference, representatives



Andy Malcolm.

from all Placer Dome sites around the world and also some critical suppliers," Andy said.

"It was quite an honour to win the award."

Congratulations also to Peter Townson from GMN full time team for his input into the presentation.

Benchmarking team gets runs on the board

Operating Excellence uses benchmarking to identify areas of opportunity for business improvement, prioritise opportunities, initiate improvement projects, and provide input for budget, merger and acquisition activities.

Practice Leader - Benchmarking Phil Clark said the goal was to provide all BHP Billiton Minerals assets with easy access to high integrity data with a low level of manual input, so they could achieve focused business improvement.

The benchmarking team has developed a four-stage strategy to achieve this goal

In stage one, data definitions and standardised measures have been developed, data warehouses/operating information centres (OIC) for transfer and storage of data created. In stage two, the assets will be able to carry out performance

reporting using the OICs, compare business performance with other BHP Billiton Minerals assets and external companies, and undertake capability assessment and data mining capability.

In stage three, the assets will be able to carry out gap analysis and capability analysis, and identify those Operating Excellence improvement projects which are critical to their business imperatives.

In stage four, Operating Excellence teams are established and the projects are carried out.

Over the past 12 months, the benchmarking team has made significant inroads into stage one. A comprehensive set of standard operating data definitions integrating global maintenance and operating definitions has been developed. The data definition for volume measurement, for example, is metric tonnes. The definitions ensure that BHP Billiton Minerals employees around the world have a common technical language and

understanding so they can accurately benchmark their asset against other Minerals assets. A guidance council comprising four or five senior business managers is in the process of being established. The role of the council is to manage the practical issues associated with data definitions, in particular, clarify definitions when requested and, in consultation with the assets, add and delete definitions where appropriate.

Phil said over the past 12 months the first OICs (data warehousing systems) were established in Queensland Coal and Escondida – both going live on 1 July

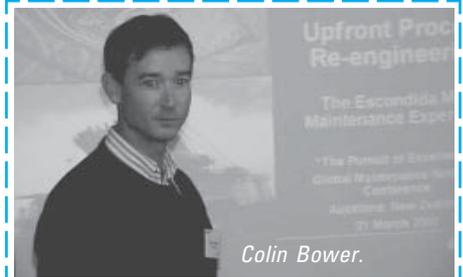
2001. A data warehouse or operating information centre is a repository for storing electronic data. Data warehouse technology brings the information into a common platform to enable cross-functional analysis.

“Using the electronic monitoring systems

already installed on equipment at each asset, data is automatically transferred to the asset’s OIC. A summary of that information is reported up to the Global Minerals Information Centre (GMIC). Data can also be input manually to allow GMIC to capture information. OIC implementation is being carried out in conjunction with the GSAP roll out to reduce the impact to assets. GMIC’s management reporting function is scheduled to go on line on 1 October 2001. The benchmarking team plans to have fully functional OICs at all BHP Billiton Minerals operations within the next two years,” he said.

“Plans are under way to publish a quarterly operations review that will benchmark equipment by asset.

“The benchmarking team has also held preliminary discussions with original equipment manufacturers and other mining companies around the feasibility of establishing a protocol for information sharing.”



Escondida’s re-engineering experience

After two false starts, Escondida successfully completed its SAP migration and re-engineering process through high employee involvement and ownership, addressing people issues and using consultants with a proven process.

Escondida spends US\$140 million a year on maintenance with planned work only accounting for 40 percent of all work performed. By increasing planned work to 70 percent, the asset has pledged a yearly savings of US\$4 million.

Mine Maintenance Engineering Superintendent Colin Bower said maintenance practices were not uniform at Escondida, there were few set standards with corresponding responsibilities, little effective process measurement, and there were different levels of competence in the organisation.

“The quality of information is poor. Information that is captured is not being used to full potential to drive improvement,” he said.

By linking improvements needed to the management systems with SAP implementation, Escondida was able to complete two difficult processes at the same time, thereby limiting disruption to the business.

Colin said the lessons learned from the Escondida experience included:

- Effort is easily under-estimated
- Experience in re-engineering is needed to avoid false starts and pit falls – you must have a process that is adequately resourced
- Some ‘neutral’ facilitation is needed to mediate conflicts
- You must have strong site ownership and involvement
- You need a long term vision
- You need to link strongly with the SAP migration team

Colin said the most difficult part was yet to come implementation.

GMN activities focus on moreCLASS strategies

Over the past 12 months, the GMN's major activities have centred around moreCLASS strategies.

The major moreCLASS goals are to help assets reduce the total stoppage time of critical equipment, reduce the amount of unplanned work, and decrease the real cost of repairs and maintenance.

Manager - GMN Phil St Baker said the team had worked hard on FLAC, root cause analysis, maintenance driven reliability and disciplined work management initiatives – and on the accelerated implementation of GSAP, particularly at the BM Alliance and Escondida operations.

He said a major investment of time, funding and energy had been needed in maintenance business

process re-engineering to manage the risks associated with the migration process and the introduction of better business processes.

"This year, the GMN has conducted eight facilitated self-evaluations, seven FLAC evaluations and six venture maintainability evaluations, held four FLAC training sessions, and conducted two

root cause analyses, two maintenance driven reliability projects and 12 disciplined work management projects," Phil said.

"Operating Excellence has helped to standardise improvement methods, tools and language in the Minerals businesses through



Phil St Baker.

alignment and training.

"GMN has adapted many of its tools and language to align with the OE tool-kit and has been proactive in integrating OE tools with the evaluation processes, with benchmarking and project selection and execution."

Operating Excellence tools used for maintenance evaluations

BHP operations world-wide have embraced the introduction of facilitated self-evaluation for maintenance.

Replacing the Global Maintenance Network's "classic evaluation", which uses an external team, this facilitated approach has also been enhanced by the incorporation of a selection of Operating Excellence tools (affinity grouping, business case, project charter).

Phil St Baker said the result provided sites with greater ownership of the outcomes. Rather than outsiders "telling" operations how they needed to improve their site, personnel discovered for themselves their strengths, weaknesses, causes and priorities

for improvement.

"The evaluation process, now combined with OE tools, is a comprehensive approach for selecting the right projects for improvement, based on the premise that the whole maintenance system needs to be addressed," he said.

"With limited resources to invest in improvement, selecting the right projects is critical.

"The process is methodical and thorough, which is important when resources are limited. It addresses the critical enablers, ensures that action is taken and that the programs are monitored.

"It's a good example of using some OE tools (rather than the whole toolbox) to enhance an existing

methodology to achieve a better overall result.

"It also shows that you don't have to have a 12 week OE project to effectively use the OE tools."

Phil said he had received positive feedback about facilitated self-evaluations.

"Every single person has enjoyed it and learned a lot from the process," he said.

"Each site that has undertaken a facilitated self-evaluation has had a far better take up than those that completed the previous style of evaluation.

Facilitated self-evaluations have been conducted at Navajo, Ekati, Cannington, Tintaya, Westernport, Ok Tedi and Spring Hill.

Phil St Baker's column

(From front page)

GMN had an excellent conference in Auckland, hosted by New Zealand Steel, based on the theme "In Pursuit of Excellence" which was very well attended by all parts of BHP.

Since the merger with Billiton, the maintenance network has started to grow again. Already, we are seeing a

strong desire to work together globally to accelerate the improvement. In July, GMN facilitated a self-evaluation at Ingwe's Middelburg mine in South Africa and we will be conducting further evaluations at Samancor Chrome in September. GMN has also helped to organise benchmarking visits between South African and Australian

sites.

These are exciting times for us all with many new faces and places to share, learn and improve faster with.

I hope you enjoy the excellent case studies and success stories in this edition and please do not hesitate to contact us with feedback and suggestions.

Yours sincerely
Philip St Baker
Manager - GMN

FLAC is helping to improve equipment reliability

A GMN-developed evaluation tool is helping BHP Billiton run its equipment with the cleanest fuel, lubricant, air and coolant (FLAC) in the industry as a means of improving equipment reliability.

Research has shown that being proactive about contamination control has the potential to significantly extend equipment life. By addressing contamination, Nippon Steel Corporation's Kimitsu plant has been able to achieve a 90 percent reduction in lubrication failures, 90 percent reduction in pump overhauls and 50 percent reduction in bearing purchases over five years.

GMN Maintenance Improvement Engineer David Archinal said FLAC was one of 12 moreCLASS strategies.

"It's been in development for close to 12 months and so far we've evaluated five different areas – two at Port Kembla, one at Cannington and two at Newman," he said.

"By the end of the year, we hope to have completed evaluations for Tintaya, Ok Tedi, Escondida, Nelson Point, Ekati and New Mexico."

Methodology

David said the FLAC methodology was developed with input and support from the Port Kembla Lubrication Network, the Maintenance Technology Institute at Monash University, Mount Newman mine, MMS, Hatch, original equipment manufacturers, and suppliers such as Mobil and Shell. The Lubrication Network was also involved in the development of the FLAC evaluation question set.

The FLAC methodology comprises five steps – leadership, problem realisation, self-evaluation, development of an improvement plan, and sustained improvement.

FLAC leadership is about identifying a champion and team members and gaining business alignment. The team needs to identify a management sponsor, clarify leadership and commitment requirements, identify roles and responsibilities for the FLAC champion, team and stakeholders, and communicate the strategy to all employees.

To achieve business alignment, the team needs to establish a problem statement showing business impact, conduct a business risk analysis



(problem frequency and consequence), gain operations and maintenance management team support, and conduct loss analysis to determine the impact of FLAC – such as equipment stopped, slow running, maintenance shutdown, poor quality or slow start up.

Problem realisation has three components – evaluation preparation, awareness training, and identifying critical processes, equipment and components. To prepare for an evaluation, the site reviews data in their delay, SAP and cost systems to understand the impact FLAC is having on their site. Other site information is also reviewed such as OEM and supplier improvement recommendations and the effectiveness and efficiency of the sampling and analysis processes.

Awareness training is provided by a 2.5 day lubrication training course

developed by Dr Jian Ding from Monash University. The course covers costs of lubrication-related maintenance in BHP Billiton, the benefits achieved from lubrication maintenance improvement, benchmarking and self-examination of lubrication maintenance performance, shared experiences of lubrication maintenance improvement, lubricant fundamentals, proactive plant lubricant contamination control, how to take a good oil sample, and oil analysis basics.

The training program is designed to support site FLAC champions. Training is in small groups – train-the-trainer style – to enable champions to train and further support their own teams on site.

Fuel training is being developed. Coolant and air training have not yet been developed.

To complete step three, team members need to identify the equipment and components with the greatest business impact, and determine whether FLAC can influence safety, environment, operations, production rate, shut down duration and reliability of the equipment or process.

David said facilitated self-evaluations were being used to develop greater understanding of site contamination levels and causes, and provided the basis for ongoing improvements in cleanliness. They focused heavily on the interaction of operators and maintainers with the fuel and lubricant. A kit had been developed to help operations measure fuel and lubricant cleanliness.

(Continued page 9)

ABOVE: The patch kit, developed to help sites measure fuel and lubricant cleanliness.

(From page 8)

"The self-evaluation process consists of plant observations; analysis of fuel and lubricant samples; review of fluid management practices; cross-functional team evaluation; desktop review including drawings, data, reports and procedures; constructing and reviewing summary posters; and enhancing the site's FLAC plan with additional actions agreed to by the team on site," he said.

"There is also an opportunity to share experiences with different people from other sites to help the solutions be realised in practical terms.

"It's about sustained improvement – locking it in, getting it to be part of the culture and that's done by giving participants control, working through

the plan and getting people engaged in working for the outcomes.

"We're not trying to rewrite the book. We recognise that the sites are already doing something in this area. The aim is to enhance what they are doing and help them achieve sustained FLAC improvement."

Following the evaluation, senior managers sign off on the FLAC team charter; the FLAC champion develops a training program for site teams (operations and maintenance); and measures are developed for improvement process, such as actions completed; FLAC inputs, such as oil cleanliness; and FLAC outputs, such as equipment reliability.

To develop an improvement plan, the team needs to set clear goals for equipment ISO cleanliness, recognise

existing good practices, budget for improvements, determine whether the plan is adequately resourced, document the agreed plan, generate a task list including responsibilities and milestones and include change strategy actions.

The change strategy requires the full involvement of all stakeholders to identify barriers and address why previous improvements may not have succeeded, develop a strategy to gain acceptance and ownership of the program, communicate evaluation findings and improvement plan, and develop a site vision or mission that has a link to FLAC.

Improvements can be sustained through FLAC network support, training and developing a change strategy, improvement plan and measures.

Newman fixed plant FLAC case study

Newman fixed plant is using the clean fuel, lubricant, air and coolant (FLAC) strategy to improve its equipment reliability. The site has identified and trained a FLAC champion and has established a cross-functional project team with support from the Ore Processing Manager.

Newman completed a FLAC self-evaluation in June 2001, which identified 31 opportunities and 10 strengths. One of the strengths was the lubrication crew's good practices – despite dusty conditions, the cleanliness of compartment lubes has not decreased. The evaluation team comprised the lubrication crew, an operator and an electrician, with support from Port Kembla engineering, MMS and GMN.

As a result of the evaluation, a plan of key improvement tasks has been identified and agreed on by site. In addition, Newman's business plan now includes FLAC and other moreCLASS strategies, specific training is being developed and sample points are being installed to allow lubrication cleanliness to be measured.

Although FLAC projects, including Newman, are in their infancy, business impact analyses have indicated significant potential savings.

FLAC has helped Escondida to reduce operational delays on the SAG 3 concentrator plant, Whyalla Steelworks has been able to delay the replacement of its \$500,000 twinducer gear box for three years, Port Kembla slab caster has reduced its hydraulic oil usage by 210,000 litres a year, saving \$900,000 a year, and the Port Kembla No 5 blast furnace has extended the life of the 501 feed



Ian Wright (MMS Fluid Filtration, Mackay), Lloyd Shay (Mining), Kurt Steiner (Mine Maintenance), Andrew Behn (BHP Billiton Global Maintenance Network), Tristan Croft (Westrac), Matt Sayers (Mine Maintenance), David Archinal (BHP Billiton Global Maintenance Network), Dr Jian Ding (Monash University MIT) and Rod Burchby (Ekatic diamond mine, Canada) discuss the Newman FLAC evaluation.

conveyor gear boxes by eight years through cleanliness control.

GMN Comings and Goings

COMINGS

Ronald Marroquin, from Chile to Brisbane
Pat Bourke, Wollongong
Dave Archinal, Wollongong
Pete Townson, Brisbane
Paddy Byrne, Melbourne

GOINGS

LeRoy Dugger, New Mexico

WELCOME BACK

Kate Flintoff and Michelle Lewis (nee Becker), job sharing in Brisbane. Kate is in Monday to Wednesday and Michelle is in Thursday and Friday.

Reducing mill maintenance down time at Escondida

Escondida has improved its sag mill availability by 3.5 percent and increased total revenues by \$35 million through an OE project that has optimised mill maintenance shutdowns.

Escondida's concentrator has three grinding lines – lines I and II with 28'x14' sag mills and line III with a 36'x19' sag mill. From start-up in 1995 through to mid-2000, availability on line III was consistently poor, predominantly due to the time needed for programmed maintenance. On average, programmed maintenance required eight percent of the total availability, which represents about 700 hours per year compared with 400 hours a year (about 4.5 percent of the total availability) for best in class.

By the end of 2000-01, line III had reduced the total programmed maintenance time by 260 hours, or three percent.

Luis Jofre, Group Leader Shutdown Planning and OE Coach, said the successful implementation of ideas identified by the OE team and the introduction of a culture of continuous improvement would take the availability of line III to the best in class level of 95 percent for 2001-02.

He said the original OE project was defined as 'mill shutdowns, impact on availability' and multi-disciplinary teams were formed to analyse every aspect of the shutdown process.

"Not long after the analysis began, the teams realised the gigantic scope of the project and, based on the initial findings and on the advice of consultants from DESTRA, the project was broken into two projects – 'shutdown planning, improving the process' and 'mill relines, impact on mills availability'.

Luis said the aim of his project was to analyse why line III programmed maintenance took so long and to propose solutions to improve its availability.

"In order to involve as many of the workers as possible, and to

compensate for the shift system at Escondida, teams were formed in each of the two shifts with me and some members taking part in both teams," he said.

"The highest priority was given to relines and, after mapping the process, the teams identified a

number of inefficiencies in the routine work of mill liner replacement. Most of these inefficiencies were simple things that individually did not have a big impact on the final result, but when added together represented more than 25 percent of the total time."

A major opportunity to put the findings of the OE project into practice arose in February this year when the teams were challenged to reduce shutdown time by 40 percent.

"Based on the historical data, the February shutdown would have taken 110 hours, so the challenge was set at 65 hours," Luis said.

"Two months of meticulous planning, the staging of all the ideas identified by the OE team, plus a major program to convince people it was possible to achieve the target, helped us to reduce the total shutdown time to 62 hours."

Luis said one of the key factors in improving shutdown time was the support of a relines specialist company from Australia.

"During the benchmarking stage of the project we started looking for the best reliners in the market. We appointed Kaltech (former Murchison Relines) of Australia to assess our reline practices.

"Later we decided to form a combined reliner crew with half of the personnel provided by Kaltech and the other half by Escondida (most of them



Sag mill shutdown maintenance.

members of the OE team).

"The idea of using the combined crew is still in use and it will continue as a way of exposing our people to the best practices brought by Kaltech."

This OE project also showed Escondida that it was possible to achieve significant improvements in shutdown planning and liner replacement.

"Our experience has shown that, although most of the findings of the OE team were known to the concentrator's middle and upper management, the OE methodology gave us the tools to create the ownership of the ideas among the workers – ideas that without their commitment were just that, ideas," Luis said.

"The best practices are now being institutionalised. The future brings the challenge of maintaining the good results achieved and transferring the learnings to the new concentrator under construction (phase IV)."

Luis said the project would not have been successful without the hard work and help of Larry DeBry, Maintenance Manager and champion of the project; Guillermo Cavalli, Maintenance Superintendent; Stephen Kittel, Engineering Superintendent; Cesar Cabrera, Electrical Superintendent; Tim Jeffs, Planning Superintendent; Luis Amigo, General Foreman and all the mechanical, electrical and operations crews.

- By Luis Jofre

Operating Networks add value to BHP Billiton business

Other operating networks are joining GMN under the Global Operating Networks banner to leverage the knowledge of the entire BHP Billiton organisation and focus on business issues.

Operating Networks Leader Chris Ellefson said Operating Networks existed to help accelerate the delivery of value through business improvement across all assets.

"They share a common evaluation methodology, common problem solving/improvement methods and will achieve accelerated technology transfer and trust through alignment," he said.

"They also bring the best knowledge to the critical problems."

There are four networks in operation, with a fifth scheduled to be up and running by the end of the year.

Over the past 12 months, the GMN has developed the moreCLASS strategy as a result of its evaluation learnings across BHP.

The Weights and Measures Network was established in 1998 and has developed a set of measurement standards. Since its inception, the network has focused on achieving revenue savings through improvements in the precision of out turn assays.

The Ore Reserves and Mine Planning Network was established in 2000 to implement regulatory reporting standards for ore reserves and resources.

The Minerals Processing Network was established in November 2000 when it held its first conference in Newcastle. In addition to sharing several high value improvements across the globe, the network has also developed a charter, established a Steering Committee and has four developing communities of practice.

A fully functioning Operators Network is expected to be in place by the end of 2001.

Chris said one of the most important initiatives undertaken by Operating Networks over the past 12 months was the development of an operating evaluation of management

processes for minerals sites, based on the GMN's experience with evaluations.

"A broad cross-sectional team was established to develop evaluation questions for each management process in the resource development, mining, downstream processing and transportation functions," he said.

"The Operating Networks team expects to pilot the evaluation at a coal mine and fine-tune the methodology by the end of the year."

Ore Reserves and Mine Planning Network

The Ore Reserves and Mine Planning Network held its first workshop in Melbourne in April 2000. The focus of the workshop was on regulatory compliance and the development of public reporting standards for ore reserves and resources. The company's report to the Australian Stock Exchange and the US Securities Exchange Commission in June 2000 was its first report to comply with the Joint Ore Reserves Committee Code since the Code was incorporated into the listing rules in 1996. Over the past 12 months, the company has achieved best practice in its ore reserves reporting.

Another significant result from the workshop was BM Alliance's realisation that it could significantly increase its ore reserves if it interpreted the Code the same way as the other BHP Billiton assets. As a result, BM Alliance was able to increase the period used to amortise debt from 17 years to 60 years and save millions of dollars in the process.

A second workshop was held in Mackay in April 2001 to address mine planning issues. The network invited an analyst to comment on the mooted merger with Billiton and to explain what analysts look for in a company's mine plans and ore reserves. Site representatives, researchers and consultants delivered presentations on best practice mine planning. During the workshop, the network made inroads into developing a common planning framework.

The Ore Reserves and Mine Planning Network is looking to



Chris Ellefson.

appoint a part-time coordinator employed in Project Development Services, but with dotted line reporting to Operating Excellence.

The network members communicate regularly by email and telephone.

Minerals Processing Network

The Minerals Processing Network comprises operators, supervisors, metallurgists and engineers who work in minerals processing businesses. The network aims to accelerate improvements in BHP Billiton's business by sharing knowledge and working together on benchmarking and measurement of losses; process control; matching technology with business needs and spreading innovation quickly. Four communities of practice led by operations managers have been developed around these goals.

The network holds annual global conferences and monthly conference calls to facilitate knowledge sharing. The first conference was held in Newcastle in November 2000 with a second conference planned for Escondida in November 2001.

The Minerals Processing Network is planning to appoint a network coordinator reporting to Operating Excellence to help accelerate the delivery of value across BHP Billiton.

Operators Network

An Operators Network should be up and running by the end of the year, with a coordinator appointed and a global conference organised. Work has already started on developing a steering committee.

Port Kembla is living total productive maintenance

Port Kembla Ironmaking is living total productive maintenance (TPM) values and reaping the rewards from full employee involvement.

TPM is a means of optimising the effectiveness of production in a structured manner and it has demonstrated quantum leaps in sustained improvement across entire organisations. TPM is based on five strategic components:

- Building a corporation constitution that will maximise the effectiveness of production systems
- Using a shop floor approach to build an organisation that prevents every type of loss (by ensuring zero accidents, zero defects and zero failures) for the life of the production systems
- Involving all departments in implementing TPM
- Involving everyone from senior management to shop floor workers
- Conducting zero-loss activity through overlapping small group activities.

Losses are caused by breakdowns, set up and adjustment, cutting blade change, start-up and yield, idling and minor stoppages, reduced speed, defects and rework and shutdowns.

Although Ironmaking introduced TPM in the early 1990s, it didn't really take TPM forward until it created a co-ordinator position in October 1999.

TPM Co-ordinator Mick Masland said the week after he was appointed, he was off to Japan for three weeks of training, including a world TPM conference. When he returned, he realised that Ironmaking had been taking the wrong approach. Instead of using middle management to push TPM down to the shopfloor, the operation needed to attain senior management support first.

"The company representatives I spoke to at the conference said forget about pushing it down until you push it up. As soon as you get back home to sunny Australia, get all those managers in one room," he said.

"They actually went to the extent of telling me that I would have to plan two months in advance to nail them down, to get their timetables in a state so you can get 30 of them in a room all at once and teach them about TPM."

Mick said previous experience had illustrated the best way of learning was by teaching, so he structured the

senior management seminars to include a teaching component.

"The managers formed small groups across what we call our primary operations, and they had to teach the rest of the managers what they knew about this particular topic," he said.

"That proved to be very, very beneficial. They had first-hand experience because they had to read the book and had to draw a conclusion, they had to have an opinion and they had to teach it. It took several full-day sessions to cover all the topics."

Seminars were then held for shopfloor supervisors using the same principles but with the addition of pilot projects so that the supervisors would have some tangible experience

to call on when their crews became involved in TPM.

A series of seminars were then held for operators, including provision of information that they were not previously privy to, such as the budget and business plan.

"The operators appreciated seeing some of the numbers and dollars that were involved, and they could point to something that they actually work on – the stockhouse vibrators, the casthouse floor or the sinter strand – and see how much money is being spent there, and it's always huge numbers," he said.

"They could see that they could save some money in those areas and they picked a project that they could work on in a team, using some of the TPM principles."

Over the past nine months, the teams have been working on projects that interested them, such as fixing the sampling bins, giving them a coat of paint and cleaning up the floor – not necessarily "big ticket items". Some projects have taken longer than expected, so tougher deadlines have been set. The operators are now being encouraged to tackle projects that have real bottom line benefits.

Mick said there had been a big turnaround in attitude towards TPM since the early days.

"The old response we had to TPM was 'that's all about operators taking maintenance jobs', 'that's not my job', 'that's not in my job design', or 'I'll do that if I get more money'," he said.

"But now we're getting, 'oh, I can see the benefit in that'.

"If they ask questions, we find the answers and get back to them, and we've found that they can be trusted to go those few extra yards to complete a

project in the normal shift time."

Mick said the advantage of TPM over Port Kembla's cost-cutting exercises such as PIM and BIP was that it saved costs without focusing on cutting costs.

"Everyone was cost-cutting to the nth degree, but TPM focuses on loss removal, so instead of saying 'here's how much we're spending on gloves, let's halve that', it's 'we lose this much productivity every time this machine breaks down, let's fix this machine.'

"It's all about reducing losses rather than looking at the budget and cutting costs."

Mick said one of the key learnings from Ironmaking's TPM experience was that people learn by teaching.

"To teach is to learn and that's been very valuable. Getting the supervisors to do some of the work was unheard of before because of demarcation issues – you can't get the boss to pick up tools.

"But we did it and we didn't have any industrial problems. Because we'd done so many workshops, we involved everyone, told them why we were doing it and what the long-term benefits were, we managed to get everyone on board."

TPM PROJECTS

Blast Furnace Sinter Feed Sequence Conveyors

Problem: Repeated problems with both S7 tipper dog leg chute full sensors. When either are activated, the sequence stops, resulting in delays of more than five minutes.

Impact: Sinter machine production is halted.

Solution: Reprogram the PLC so that a warning sounds when one of the chute's full probes activates, the other chute remains on line for five to 10 minutes, giving the operators time to fix the problem before the conveyor system is halted.

S4 Conveyor

Problem: The under speed sensor on the S4 conveyor is continually being fouled by fugitive dust and grime.

Impact: Constant nuisance delays on the conveyor.

Solution: Construct a cover over the sensor.

Blast Furnace Sinter Feed

Problem: Wear on the sinter screen allows sinter greater than 6mm to be removed from the blast furnace feed.

Impact: Increase in sinter reject, increase in recycling costs (about \$200,000 for a 10 percent increase in reject material).

Solution: Project not completed.

The LeRoy Dugger story

(From page 1)

he earned the respect of all who worked with him.

With LeRoy's support, BHP's maintenance community achieved several important outcomes. These include an evaluation standard and KPIs for maintenance management, agreed maintenance improvement strategies for accelerating business improvement, effective knowledge sharing through several face-to-face meetings and several self-sustaining email newsgroups. Overall, LeRoy has helped to develop a powerful network for improvement, which has successfully transferred learnings to new businesses, and delivered significant business benefits to the company.

He is renowned for a number of "LeRoyisms" including "no-one has all the answers, but together we do" and "skin this bear and I'll go catch you another one."

Some of his unforgettable quotes include: "The aim from Jerry Ellis right at the start was to raise the professionalism of maintenance in the mining industry from being seen as a bunch of gorillas with monkey wrenches to business people making right decisions."

"We built a young energetic team with credibility with the sites they are working with. We needed a team that could listen more than tell."

"We never take the future funding of the network for granted, every year the value has to be demonstrated."

"Survival implies the acceptance of value created by the network by both the business and the network members."

Good luck in your new role, LeRoy!

- By John Vucko

Getting hydraulic oil contamination under control

WESTERNPORT

Westernport CRD has developed a method of reducing hydraulic oil contamination at the pickle line.

Contamination levels in various hydraulic tanks were found to be far greater than industry specifications to assure reliable operation of the critical hydraulic components.

Maintenance practitioners discovered that every time a system was topped up with new hydraulic oil, the contamination level appeared to rise, indicating that the new oil was contaminated.

A Kepner Tregoe situation appraisal and potential problem analyses helped to separate the problem into most likely causes of contamination:

- New oil contamination (drums and bulk tankers)
- Tank filling practices
- No filling line filtration

Because of chronic leaks, the system was topped up frequently.

Analysis

A 12-month study of new oil contamination was undertaken. Every new drum of oil in the pickle line (120 drums) was analysed to determine its contamination level.

The results showed clearly that new oil was not being supplied to the BHP cleanliness specification. The average contamination level was ISO 18/15 or NAS 9 compared with BHP's maximum requirement of ISO 17/14 or NAS 8.

Resolution

Mobil was served a non-conformance notice. As a result, Mobil implemented high quality filtration and monitoring, and has trained its operators and technical staff on the

importance of supplying customers with clean oil. Average new oil contamination is now ISO 14/12 or greater than NAS 6.

FILTER CHANGE PERIOD/ OIL CHANGE PERIOD LIFE EXTENSION

A GMN-funded research project was initiated at Norwich Park and Saraji coal mines to investigate the potential of replacing mineral oil in heavy-duty diesel engines with synthetic oil. The initial task brief was expanded to include:

- The evaluation of synthetic engine oil
- A recommendation for the optimum oil change period for mineral oils
- The development of guidelines for oil change period extension trials.

Dr Jian Ding from Monash University MIT carried out the research. Early on in the project, it became apparent that the current practices for controlling lubrication contamination and the deficiency of existing spectrographic oil analysis programs in detecting failures were impacting on hydraulic oil quality.

Analysis

The oil change period/filter change period life extension of Norwich Park's Cat 784B coal hauler fleet was examined. The initial oil change frequency was recommended at 250 to 330 hours. Analysis of the oil samples taken during the trial at 150, 320, 400, 500 and 600 hours revealed that:

- Oil was being cleaned up in service by the engine oil filters to a level between ISO 17/14 and ISO 16/13
- The determining factor for changing oil was contamination. The residual properties of the oil such as viscosity and TBN were sufficient to extend the oil life to between 530 and 550 hours
- The oil that was being added to the engines was dirtier than the oil taken out after 350 hours running (this was the most significant issue in terms of average engine life).

Maintenance practitioners investigated the source of the

contamination. Due to the large volumes of oil used, it is transported and stored in bulk. Base mineral oil stock is mixed with additives at the manufacturer's plant at Colmslie in Brisbane. Samples were taken and new oil cleanliness was tested at an average of ISO 19/16, 3302 particles/mL.

The next step in the supply chain was the bulk transport to the site, carried out by a third-party contractor. The oil tested from the tanker outlet after delivery was ISO 19/16, 3298/mL. This was not a significant contributor to the oil contamination.

Oil from the storage tanks at Saraji and Blackwater were then tested. Results were ISO 19/16, 2555-4316/mL. The workshop delivery guns results were ISO 18/16.

After more than 350 hours running, oil samples from Saraji tested at ISO 20/17 – the oil filters were being prematurely blocked with contaminants from the new oil.

Results

The research found that the supplier was causing the oil contamination. Due to the lack of oil cleanliness specifications, the oil was "filtered" through an 80-micron bag filter, despite most damage being caused by particles in the three to 20 micron range.

Oil is now supplied at ISO 15/12 after a filtration package was fitted at the plant at no extra cost to BHP Billiton.

Oil cleanliness specifications are now being included in all new tendering arrangements for engine oil at BM Alliance, which has significantly extended engine life.

Synthetic oil is approximately six times the cost of mineral oil delivered in central Queensland. Engine trials carried out using synthetic oil proved that the engines can be run for longer periods on synthetic oil (the Norwich Park trial ran up to 1000 hours). However, there are many other checks and procedures that must be carried out in the period before the oil change and the cost/ benefit did not justify changing to synthetic oil.

Port Kembla Ironmaking achieves impressive performance

Port Kembla Maintenance Services Ironmaking has achieved some impressive results over the past 10 years due to the efforts of its employees.

Despite a 49 percent reduction in employee numbers, the team reduced injuries by 74 percent, MTIs by 81 percent and LTIs by 100 percent, reduced costs from \$20.1 million in 1995-96 to \$17.3 million in 2000-01 budget (a cost saving in real dollars of \$8.3 million or \$1.65 per tonne of steel delivered), achieved AS3901 accreditation and shutdown management best practice, and introduced labour sharing and contract management.

Employee numbers dropped from 387 in 1992 to 198 in 2001 due to workload reductions, improved maintenance practises (multi-skilling, removal of demarcations, increased flexibility, removal of duplication) and a team approach to operational maintenance.

Trevor Castle, Superintendent Maintenance Services Ironmaking, said the results reflected a sustained and genuine willingness from employees to continually work towards the goals and challenges put before them.

"This will be the focus for the future as we clearly articulate the manufacturing team vision and, through good leadership, communicate the goals around improving equipment reliability and operational capability," he said.

"Maintenance Services Ironmaking employees have already shown a willingness to do whatever is safe, legal and sensible to achieve the desired outcomes for the business and their own future.

"All involved should be very proud of their contribution, which is reflected in the overall performance of the Ironmaking operational departments in an ever changing global environment."

Trevor said Maintenance Services Ironmaking had also achieved unprecedented improvements in areas that were not easily measured.

"This includes relationships and mutual respect across all facets of the Ironmaking business, such as improved team work within our crews, improved working relationships and support between Maintenance Services, Operational Maintenance, Operations, Management and shop floor, focusing on creating win-win outcomes," he said.

"This improvement is reflected in our industrial relations environment, in some of the tangible KPIs and the continued improvement in operational performance. More importantly, our people are more receptive and willing to be involved in what needs to change for the future success of the business and the voluntary engagement in working parties looking at what is possible for the future."

Safety

Maintenance Services Ironmaking has also improved its overall approach to safe work systems and employees' attitudes to safety and caring for their colleagues. The team has driven and contributed to several safety initiatives, such as the development of the job safety analysis (JSA) process, the authority to work (ATW) system review, critical procedure coach and audit sheet development, and the 10 point safety card. The department was also

actively involved in National Safety Council of Australia rating system where it was the first plant maintenance organisation to achieve the highest safety rating of five stars. Maintenance Services Ironmaking has just completed the milestone of 12 months lost time injury free.

Costs

The team has also significantly reduced costs. Trevor said if Maintenance Services Ironmaking had not improved the way business was done, the real costs today would be around \$25.6 million.

"These savings have been a result of various initiatives that focused on improved maintenance practises such as multi-skilling, a mobile and flexible workforce which, in turn, reduced external contract spend and an overhead reduction focus," he said.

"A campaign was carried out to educate all our employees in how the costs and budgeting process worked and how their actions impact on the bottom line."

Labour sharing

Maintenance Services Ironmaking introduced labour sharing in 1992 to supplement crews to reduce external spend, use spare labour and share expertise across departments.

Labour share commitments for down days were established in 1997 after several agreements were negotiated with various departmental repair crews and plant customers. Various crews participated in other department shutdowns every nine weeks. During this time (usually two shifts), no work was scheduled in their own area.

Trevor said examples of labour sharing included the 7A coke oven mechanical crew and a composite electrical crew at the sinter plant shutdown, the involvement of the coal preparation and gas processing mechanical crews at the raw materials shutdown, and the blast furnace pipefitting crew that carried out stand

(Continued page 16)

Port Kembla Ironmaking achieves impressive performance

(From page 15)

pipe changes at the batteries (saving around \$290,000 a year in contract costs). The most successful labour sharing exercise was the involvement of the ore preparation mechanical crews in energy services boiler overhauls.

"The average mechanical cost for 23 and 24 boilers before labour sharing commenced was \$833,788," he said.

"With the help of the ore preparation crews, the energy services departments were able to take back a lot of this work resulting in a reduction in contract cost to \$240,626, a saving of around \$593,162.

"What makes this exercise even more remarkable was the fact that boiler overhauls usually last from four to six weeks and the ore preparation crews spent most of this time out of their own area, only coming back for shutdowns.

"This meant that the customer department had to fully support this process because the mechanical crews that would normally service the ore preparation area were reduced from two to one."

The Maintainer

Trevor said one or two tradespeople were frequently shared, which allowed crews to take on work that they could not handle on their own, which had previously been contracted out.

Contract management

In 1994 following a contract process redesign (CPR), Maintenance Services Ironmaking developed a significant number of term contracts.

Trevor said term contracts allowed Ironmaking to determine what work was best suited for BHP employees and what work was best suited for contractors.

"This allowed appropriate contractors to obtain major performance improvements and simplify the process of payment. The contract supervisors played a very important role in performing 'day-to-

day' contract management focus in association with the plant department contract officers.

Results include:

- Targeting the deliverance of best value and service for contracting.
- Maintaining a primary focus on using BHP resources before allocating work to contractors, resulting in no increase in average contract spend over the past seven years in Ironmaking.
- Defining and optimising workload throughout the Ironmaking departments, resulting in the ideal contract numbers established for coal and coke, blast furnace and ore preparation.
- Through the job safety management (JSM) program, the contact supervisors were seen as the subject matter experts which significantly helped the contractors to improve their safety and act as mentors for BHP and contract employees.
- Developing of relationships with the plant departments and contract companies, which included participating in leading organisational change (LOC) workshop.

External Perspectives – Alcoa reaps benefits from maintenance focus

Alcoa Primary Metals Division has increased scheduled maintenance work, reduced breakdowns and significantly reduced aluminium production costs by adopting a strategic approach to maintenance.

Vince Adorno, Vice President – Engineering, Maintenance and Procurement, Primary Metals Division, told maintenance practitioners at a reliability conference in Tennessee that Alcoa had developed a vision, strategy, clear sponsorship, identified imperatives and established teams and common metrics to address maintenance issues.

He said that as a result of this new approach, planned and scheduled work had increased from 10 percent to 60 percent, emergency breakdowns had decreased from 20 percent to five percent and the cost of aluminium production

had dropped by \$10 million. Maintenance practitioners were also working on seven additional metrics, developing best practices training and producing matrices for tracking progress. The Primary Metals Division had also employed planner/schedulers and reliability engineers at each site.

"Alcoa spends approximately \$US180 million on maintenance within the 11 primary metals locations. Achieving Ultramax objectives through Alcoa Production System (APS) implementation is key to Alcoa's success," he said.

"Appropriate maintenance – resulting in equipment reliability – plays a critical role in supporting the manufacturing centres and the organisation's initiatives on pull, inventory reduction and implementation of APS tools that will

help drive overall costs down for the corporation."

Vince said a Primary Metals maintenance-led team had been formed to drive the reliability, productivity and maintenance cost reduction opportunities across the Division.

"Our vision is to provide safe, efficient operation facilities by minimising process downtime, responding rapidly to process disturbances, preserving the company's assets and minimising cost over the long run, while living the Alcoa values," he said.

The strategy is to align APS and the maintenance process to achieve reliability excellence and, with the sponsorship of the smelting operations-led team, lead the plants in the implementation of appropriate maintenance technologies and the measurement of maintenance effectiveness at each location.