HEALTH, SAFETY, ENVIRONMENT & COMMUNITY
Worsley Alumina
## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>From the General Manager</td>
<td>2</td>
</tr>
<tr>
<td><strong>INTRODUCTION</strong></td>
<td>4</td>
</tr>
<tr>
<td>Introduction</td>
<td>5</td>
</tr>
<tr>
<td>Ownership</td>
<td>5</td>
</tr>
<tr>
<td>Mining, Refinery and Port Operations</td>
<td>6</td>
</tr>
<tr>
<td><strong>HEALTH AND SAFETY</strong></td>
<td>7</td>
</tr>
<tr>
<td>Workplace Safety</td>
<td>8</td>
</tr>
<tr>
<td>Star and Step</td>
<td>9</td>
</tr>
<tr>
<td>Fatal Risk Control Protocols</td>
<td>9</td>
</tr>
<tr>
<td>Occupational Health and Hygiene</td>
<td>9</td>
</tr>
<tr>
<td>Emergency Services</td>
<td>10</td>
</tr>
<tr>
<td>Health Promotion</td>
<td>10</td>
</tr>
<tr>
<td>Rehabilitation Research</td>
<td>16</td>
</tr>
<tr>
<td>Future Mining Operations</td>
<td>18</td>
</tr>
<tr>
<td>Forest Management</td>
<td>18</td>
</tr>
<tr>
<td>The Overland Conveyor</td>
<td>20</td>
</tr>
<tr>
<td>Refinery Operations</td>
<td>21</td>
</tr>
<tr>
<td>Water Conservation</td>
<td>24</td>
</tr>
<tr>
<td>Climate Change</td>
<td>26</td>
</tr>
<tr>
<td>Waste Management</td>
<td>27</td>
</tr>
<tr>
<td>Environmental Incidents</td>
<td>28</td>
</tr>
<tr>
<td>Bauxite Residue Disposal</td>
<td>30</td>
</tr>
<tr>
<td><strong>COMMUNITY RELATIONS</strong></td>
<td>32</td>
</tr>
<tr>
<td>Community Relations</td>
<td>33</td>
</tr>
<tr>
<td>Community Sponsorship Projects</td>
<td>34</td>
</tr>
<tr>
<td><strong>ENVIRONMENT</strong></td>
<td>12</td>
</tr>
<tr>
<td>Mining Activities</td>
<td>13</td>
</tr>
<tr>
<td>Noise Control</td>
<td>14</td>
</tr>
<tr>
<td>Dust Management</td>
<td>14</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>15</td>
</tr>
<tr>
<td>Feedback Form</td>
<td>40</td>
</tr>
<tr>
<td>HSEC Policy</td>
<td>41</td>
</tr>
<tr>
<td>HSEC Standards</td>
<td>41</td>
</tr>
</tbody>
</table>

*It’s a great business with great ideas and great people*
FROM THE GENERAL MANAGER

I welcome the opportunity to introduce our latest Health, Safety, Environment and Community report and encourage your interest in our business and in our performance.

We are a large business, operating in a competitive environment and with a high level of scrutiny from many different stakeholders. Transparency in our performance is a fundamental value in the way we operate.

My reflection over the past year is one of solid achievement yet continuous challenge. There have been many positive steps towards realising a consistent safety performance, but achieving Zero Harm remains an ongoing challenge for the organisation.

We strive to be a world-class business. We can only reach this goal if we have a strong and consistent safety performance.

We have introduced a Safety Excellence program to achieve another next step breakthrough in improving our safety performance. The program has seen the introduction of a wide range of safety initiatives, new systems, increased training and a focus on health issues such as fatigue management.

Our attention to detail in this area is heightened by the additional work now underway on our next expansion phase at the refinery and mine.

Another area that is both dynamic and challenging is climate change. Our managing company BHP Billiton has introduced new targets to reduce the intensity of greenhouse gas emissions and energy use at our operations. Worsley is at the forefront of this challenge and I am pleased to report that in 2008 the company was recognised as the global leader in energy efficiency within BHP Billiton by winning the company’s Energy Excellence Award.

We recognise that behavioural change is required to address climate change and we are working with employees, customers, suppliers and communities to achieve this change.

Our engagement with local communities is wide ranging and diverse. Over the past year we have also seen the emergence of key themes which underpin our community relations strategy. For example, we are working with community and government on a number of water resource management, renewable energy and biodiversity projects.

The Matched Giving Program, which rewards employees for their service to the community through volunteering and fundraising, has added a new dimension to our community support and to our reputation as an employer.

I want to recognise and thank our employees and contractors for their commitment to the success of Worsley as a business and for their contribution to our social standing in the region.

In 2009 Worsley will celebrate its 25th year in business. We are able to look back on those years with a sense of pride and take from that the comfort and confidence to continue to operate and grow this business, creating mutual benefits for our host communities for many years to come.

Julius Matthys
INTRODUCTION
INTRODUCTION

The Worsley Alumina Joint Venture gets its name from the former timber settlement of Worsley, situated on the eastern side of the Darling Range near Collie in the South West of Western Australia, now the location for the company’s refinery operations.

The project had its beginnings in the early 1960s when a group of local business people formed a company to explore, develop and sell deposits of bauxite ore in the area.

After several ownership changes, construction of a mine site and refinery started in 1980 and the first alumina was produced in 1984. Within a year production had reached 1 million tonnes.

Production has progressively increased and now exceeds 3 million tonnes a year as a result of expansion, upgrades, new technology and process efficiencies.

Ownership

Worsley Alumina Pty Ltd is a joint venture management company made up of:

- **BHP Billiton Ltd** 86 per cent
- **Japan Alumina Associates (Australia) Pty Ltd** 10 per cent
- **Sojitz Alumina Pty Ltd** 4 per cent

Expansion and Growth

The latest expansion – the A$2.5 billion Efficiency and Growth Project was announced in May 2008. The three-year project will lift Worsley’s annual alumina production to 4.6 million tonnes per annum, making the Worsley operations one of the biggest and most efficient in the world.

The expansion consists of a construction project to upgrade the capacity of the refinery near Collie, mining near Boddington and the port operations at Bunbury. Another A$500 million will be spent on a new multi-fuel cogeneration power plant.
MINING, REFINERY AND PORT OPERATIONS

Background
Alumina is the most abundant metal in the earth’s crust and is found in bauxite ore, first discovered in 1821 in the French district of Les Baux. Bauxite is formed by the weathering of clay in warm regions that experience wet and dry weather cycles. It is often found close to the earth’s surface so is mined by open cut excavation.

Worsley’s bauxite is a reddish, pebbly material that contains about 30 per cent alumina.

Mining
Before mining starts, flora and fauna surveys are undertaken. Areas of high conservation value are identified and excluded from mining plans. Forest timber is salvaged and milled or used as firewood while topsoil and overburden is removed and kept for use in rehabilitation.

The bauxite layer is ripped and loaded into trucks and carted to primary and secondary crushers before being transported 51 km by overland conveyor to the Worsley refinery.

The land profile is re-established by grading pit walls in mined areas and stored topsoil is used for the final layer.

Forest litter, including logs, leaves and rocks, collected before mining, is heaped into piles to help re-establish habitats for soil conditioning invertebrates like ants and reptiles, as well as to provide habitats for burrowing animals.

To prepare the area for seeding, the topsoil is scarified to encourage growth.

Locally collected seeds from ground covers, understorey and overstorey are spread by hand. Specially nurtured seedlings are also planted.

Refinery
After the bauxite ore is delivered to the refinery on the conveyor system, alumina is extracted using a 100-year-old process developed by an Austrian chemist named Karl Josef Bayer.

The four-stage Bayer Process – digestion, clarification, precipitation and calcination – turns bauxite into alumina.

Digestion
After arriving at the refinery the bauxite ore is stockpiled before being ground in rod and ball mills using caustic liquor to form bauxite slurry. The slurry is heated with steam and more caustic added to remove contaminants.

The alumina is dissolved into the slurry in digestion vessels through a combination of pressure and heat.

Clarification
The alumina dissolved in the liquor is separated from the red mud residue.

Liquor is pumped into settling tanks where a settling agent is added. The mud bonds with the settling agent and sinks to the bottom of the tank where it is removed.

The floating liquor is then filtered and sent to precipitation tanks.

The red mud residue is washed to recover any alumina not in solution, which is returned to the process. Most of the caustic soda is also washed from the red mud, which is then stored in specially built bauxite residue disposal areas.

Precipitation
The alumina hydrate-rich solution is now clean of the red mud. The alumina hydrate slowly precipitates from tank to tank as the temperature goes down.

Calcination
Washed and filtered hydrate is dried in hot air at 600°C before being passed into a gas furnace where is heated to 900°C to remove water trapped in the hydrate crystals.

The calcined alumina is cooled and then moved by conveyor to storage silos ready for transport 55 km by rail to port facilities in Bunbury.

The final product resembles a fine, white powder and is in excess of 99 per cent alumina.

Bunbury Port
Worsley operates a berth at the Bunbury port for vessels of up to 240m length, 38m beam, 12.2m draft and 70,000dwt.

Alumina is loaded without the ship having to be moved during loading. A caustic unloading facility is also located at the port.

The ship loading facilities incorporate the latest technology to minimise noise and dust during ship loading operations.

Economic Contribution
$185 million in direct salaries and wages
$114 million to local contractors, suppliers and service providers
$23 million to royalties
$10.2 million in State taxes and charges
1537 employees

More information
Visit www.bhpbilliton.com for a more detailed history of the Worsley Alumina project and for more information about the mining and refinery processes.
HEALTH & SAFETY
People are essential participants and the company has adopted a workplace-based scheme which empowers employees with responsibility for their own behaviours and that of their colleagues at all levels of the organisation.

Employees and contractors are coached to identify at-risk behaviours and are supported to implement controls that reduce any injury risk.

Safety is recognised as a personal responsibility and people modify their own behaviour to reduce risk.

Worsley Alumina’s attention to safety was recognised at the highest level in the nation when it was announced as the overall winner of the Minerals Council of Australia’s annual Minex Award.

The award is considered the most prestigious health and safety award in the mining and resources industry in Australia with Worsley being praised for exhibiting a well structured, well resourced commitment to safety and health with a high degree of employee participation.

The award recognised Worsley’s behaviour based approach to safety as being industry leading practice with ‘an extraordinary maturity and passion for safety and health’.

Fatigue Management

A strategic plan has been developed to embed fatigue management across the organisation in 2008/09. A training program will be rolled out which centres on equipping employees with the skills to manage fatigue.

The plan also aims to increase Worsley’s compliance with BHP Billiton Fit for Work, Fit for Life guidelines.
Clearance to Work
The Clearance to Work system has been imbedded across all areas of the organisation, following its implementation in 2006-07. This year it was extended to the operational mining areas at the bauxite mine.

The system was designed by a cross-functional team which used the Six-Sigma process to replace a fragmented isolation and tagging system.

The Clearance to Work system significantly mitigates the risk of injuries and incidents arising from the uncontrolled release of energy or hazardous materials. The system ensures that process and equipment owners hand over the plant to operators in a safe condition.

STEP/STAR
Worsley has gained an international reputation as a leader in behaviour-based safety implementation and practice. Team leaders are often invited to present papers at conferences and to other industry groups.

The customised program is known as Safety Through Everyone’s Participation at the refinery and Safety Targeting All Risks at the mine.

A team of experienced coaches with their own coaching manual make pre-arranged site visits to observe and record safe and “at risk” behaviour and conditions, communicate and consult with employees and management, and train other observers.

Nearly 65 per cent of the workforce has been trained as workplace safety observers.

Managers provide leadership and support for safety by being highly visible in the workplace and by conducting daily DuPont safety observations.

Data gathered through observation by employees, coaches, managers and supervisors is recorded in the risk management data base for tracking of safe and at-risk behaviours and conditions, including compliance or non-compliance with accepted standards such as use of personal protective equipment.

FATAL RISK CONTROL PROTOCOLS (FRCPs)
In 2007-08 there was a drive to improve compliance with the FRCP including the requirements for light vehicles and surface mobile equipment across all areas of the organisation.

Led by the FRCP champions from the management team, initiatives included high visibility striping, uniform numbering and ensuring vehicles complied with the plant and equipment requirements of the FRCP, such as striping, roll over protection and airbags.

The seven Protocols relevant to Worsley Alumina, its contractors and visitors are:

- Light Vehicles;
- Surface Mobile Equipment;
- Hazardous Materials Management;
- Equipment Safeguarding;
- Isolation;
- Working at Heights; and
- Lifting.

The requirements of these Protocols are classified into three broad areas:

- Plant and equipment requirements;
- Procedural requirements; and
- People requirements.

OCCUPATIONAL HEALTH AND HYGIENE
Worsley continues to improve its occupational health and hygiene management with an increased emphasis on monitoring and assessing potential workplace hazards and exposures.

A full-time occupational health hygienist is employed on site to assess, measure and develop management plans for potential hazards, which generally relate to exposure to noise and dust at the mine, refinery and port.

For the second year in a row, Worsley recruited an occupational health and hygiene trainee and has committed to continuing this into the future. BHP Billiton supports the occupational hygiene profession by providing traineeships on two sites over two years, while allowing a new graduate to complete a graduate diploma in Occupational Health and Hygiene through Deakin University in Victoria.

A study to identify equipment which may cause whole body or hand/arm vibration was completed at the Mine and Refinery this year.

An action plan to address areas where there is the potential for high vibration exposures has been developed and this will be implemented next year.

Worsley has reviewed its qualitative assessment on exposures, which include heat, ergonomics, vibration and electromagnetic radiation. As a result, an ongoing maintenance sampling program has been initiated.

Work groups that are exposed to atmospheric contaminants and noise were also identified and added to the site risk register.

Worsley adopted a BHP Billiton self assessment tool for occupational health and hygiene which is used to measure Worsley’s compliance for the organisation’s standards.

A study was carried out to determine alternative methods for sampling caustic mist to determine the best way to capture and represent workplace caustic mist exposures.

Noise management
Worsley is developing a noise control plan, following on from the development of a noise register last year. This will identify areas and opportunities for noise reduction through engineering controls.

EMERGENCY SERVICES
The emergency services unit responds to emergencies at the refinery, Boddington mine and Bunbury port ship-loading facility, and assists when incidents occur in the local community.

This year, Worsley’s emergency services team was recognised for its efforts in helping to respond to incidents in the community by the South West District Police.

The award was in appreciation of Worsley’s support to WA Policing and in particular the help given to local emergency services at a double fatality earlier in the year.

The skills of Worsley’s emergency services officers was rated “second to none” by an independent assessor during one of the regular training exercises which ensures ESOs are working within St John Ambulance guidelines.

During the year, Worsley donated life saving equipment to St John Ambulance in Mukinbudin.

A $12,000 defibrillator donated by Emergency Services Officers was presented to Mukinbudin volunteers to give them a better chance in saving lives, due to hospitals often being more than an hour away.

Relying on community support, donations and 50 volunteers, the sub centre responds to more than 100 calls a year spanning a 18,000 square kilometres.
HEALTH & SAFETY

HEALTH PROMOTION
With up to 1250 visits a month to the medical centres at the refinery and mine, Worsley Alumina’s Health Services section has continued to develop and provide a comprehensive service to employees.

The medical team consists of a full-time doctor (who visits the mine once per week), three full-time registered nurses (one based at the mine), one part-time registered nurse, one paramedic, an administration officer and a part-time exercise physiologist.

The Fit for Work/Fit for Life Program initiated in January 2007 has now been fully implemented. It has been well received by the workforce and has had significant success.

Medical Assessment Program
The Medical Assessment Program incorporates health surveillance, general medical assessment, exit medicals and extended medical assessments.

A number of employees were identified with risk factors for Cardio-Vascular Disease, Diabetes, Obesity and other lifestyle diseases. In these cases interventions specifically catered to the individual have been implemented.

Potentially life-threatening conditions such as Melanoma, Cardiomyopathy, Kidney Disease and Myocardial Infarction were also diagnosed.

Health Promotion Programs
A health promotion program has been fully implemented. A health needs assessment was carried out to ensure that any programs were specifically targeted to Worsley employee needs.

Major themes for the year included:
- Nutrition;
- Sun Awareness;
- Heart to Heart;
- Men’s Health;
- Stress Management; Mental Health
- Weight Management and Digestive Health;
- Sleep Disorders;
- Women’s Health; and
- Drug and Alcohol Awareness.

In addition on-going support programs were provided which included:
- Quit smoking, weight loss, exercise, peer support, blood pressure, glucose and cholesterol monitoring;
- Fitness Assessments – Personnel are encouraged to make use of the on-site gymnasium in an effort to improve their overall fitness levels. Each individual is assessed by medical staff prior to being referred to the exercise physiologist (refinery) or the physiotherapist (mine);
- Red Cross Blood Donor Days with about 150 units of blood being taken from employees; and
- Vaccination Programs such as Influenza for all employees and Hepatitis A / B for at risk employees.

Ergonomic Analysis
Ergonomic analysis is a health-orientated approach to identifying and evaluating all tasks of a particular job and the associated work conditions and where necessary, making recommendations for changes. These are carried out by our exercise physiologist.

Drug and Alcohol Program
Worsley Alumina carries out a comprehensive drug and alcohol program for all onsite personnel in accordance with relevant legislation. There is great emphasis on awareness, education and support for employees.

Travel Health Programs
All employees who travel overseas for work purposes are required to be seen by a recognised Travel Medicine Specialist prior to travelling. This ensures that adverse health risks associated with international travel are well managed in a variety of areas, eg, vaccinations, fatigue management, destination specific health advice and education regarding 24 hour access to medical advice and emergency medical evacuation.

Occupation Rehabilitation Program
The primary objective of the program is to help an injured or ill employee to remain at work or return to work as soon as safely possible following the report of a work or non-work related injury or illness.

Rehabilitation programs are tailored to individual needs in conjunction with the client, medical practitioner, supervisor and allied health agencies when required. The worker is closely monitored, and programs adjusted accordingly until optimum recovery is achieved.
2007-08 Health and Safety Performance

<table>
<thead>
<tr>
<th>Objective</th>
<th>Status</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce the frequency of recordable injuries occurring on site.</td>
<td>On going</td>
<td>Initiated programs through the Safety Excellence initiative to improve safety performance.</td>
</tr>
<tr>
<td>Achieve a minimum of 90% compliance with each relevant BHP Billiton Fatal Risk Control Protocol.</td>
<td>Achieved</td>
<td>A plan was developed and implemented to ensure compliance was reached.</td>
</tr>
<tr>
<td>Achieve an average of 90% compliance with the BHP Billiton Fit for Work- Fit for Life Guidelines.</td>
<td>Ongoing</td>
<td>The Program has progressed significantly within the last 12 months and we are currently on track to reach 90% compliance with the Guidelines. The benefits for employees have been significant and in some cases, life saving!</td>
</tr>
<tr>
<td>Implement a health promotion plan for employees.</td>
<td>Achieved</td>
<td>A health promotion campaign was launched in January 2007 and is now fully implemented and has been very well received. Health promotion themes were based on the results of a health needs survey carried out in January 2007.</td>
</tr>
<tr>
<td>Complete a site-wide survey to assess employee exposure to physical agents (eg vibration, heat).</td>
<td>On going</td>
<td>A survey has been started and will be ongoing during 2008-09.</td>
</tr>
</tbody>
</table>

2008-09 Health and Safety Objectives

<table>
<thead>
<tr>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce the frequency of recordable injuries occurring on site.</td>
</tr>
<tr>
<td>Achieve a minimum of 90% compliance on all BHP Billiton Fatal Risk Control Protocol Elements.</td>
</tr>
<tr>
<td>Achieve a minimum of 80% compliance on the BHP Billiton Fatigue Management Score.</td>
</tr>
<tr>
<td>Achieve a safety observation ratio of greater than 8:1 for at risk behaviours to at risk conditions.</td>
</tr>
</tbody>
</table>
ENVIRONMENT
Worsley's aspiration is to achieve Zero Harm, consistent with the company's place as a world leader in alumina refining. Leadership, innovation, excellence, compliance and continuous improvement are the foundation of its environmental policies, standards and culture.

Key activities throughout the year included:

- Management of air quality and efficient use of resources such as energy, water and other raw materials;
- Enhancing biodiversity protection by assessing and considering ecological values and land-use aspects; and
- Developing partnerships that foster sustainable development of our host communities.

A range of research and development projects have been undertaken by Worsley's environmental team in collaboration with government, industry and community stakeholders. This work made particular contributions to improving rehabilitation programs and towards furthering understanding of the area's forest ecosystems.

Environmental Legislation

Worsley Alumina’s environmental performance is subject to a number of legislative instruments enacted by the State & Commonwealth Governments. Some of the more significant of these include:

- Alumina Refinery (Worsley) Agreement Act 1973 (as amended);
- Worsley Alumina Project Environmental Review and Management Program (ERMP) 2005;
- Ministerial statement number 719 issued 13th April 2006;
- Commonwealth Approval Instrument (EPBC 2004/1566) issued on 6th June 2006;
- Environmental Protection Act (EP Act) 1986; and
- Department of Environment and Conservation licences for the mine and refinery sites.

The Alumina Refinery (Worsley) Agreement Act 1973 - as amended requires Worsley to “comply with any requirement in connection with protection of the environment, pursuant to any legislation that may be in force at any time”.

On this basis, Worsley’s environmental management initiatives are dynamic; being influenced by changes in legislation and in social expectations as well as the company’s due diligence.

Worsley’s Environmental Management System has been certified with the International Quality Standard ISO 14001. Certification gives international recognition to the integrity and quality of the system that is in place at Worsley.

During the review period internal, and external surveillance ISO 14001 EMS audits were carried out. No minor or major non-conformities against the standard were identified during the external surveillance audits. ISO 14001 certification has been consistently maintained at Worsley since 2002.

MINING ACTIVITIES

Worsley's mining lease covers State forest and farmland along the eastern edge of the Darling Ranges near Boddington. The original lease covered 11,300 square kilometres.

Over the past 20 years, through negotiations with the State Government, Worsley has relinquished areas which are not considered suitable for bauxite mining. These relinquishments – which account for around 70 per cent of the original lease area – have allowed for the establishment by the State of key conservation areas and long-term forest management programs for the eastern Jarrah Forest region. Large areas of the remaining lease area are currently the subject of detailed flora, fauna and hydrological investigations.

Forest areas that have a high conservation value are excluded from mining plans. Other areas such as the foreshore areas along rivers and streams are also excluded to help retain environmental values.

Key environmental issues for management during current mining operations include:

- Conservation of significant vegetation communities and heritage areas;
- Sustainable use of groundwater resources;
- Protection of dieback free forest within the Mt Saddleback and Marradong Timber reserves;
- Management of noise and dust; and
- Energy efficiency.

Over the next few years, the primary mining area will move to include the Marradong Timber Reserve to the south of Boddington. The next two decades will see mining operations move north and south within the mining lease.

Final approval to mine these areas will be subject to the results of biodiversity investigations and approval of proposed mine and transport corridor plans.
ENVIRONMENT

NOISE CONTROL
Mining noise at the Boddington Bauxite Mine is managed to minimise the impact on neighbours through noise modelling, operational controls, mine planning and equipment modification.

Predictions of mining noise impact on noise surrounding locations are determined using the Environmental Noise Computer Model (ENM®). This is an essential part of daily operational planning to monitor compliance with the Environmental Protection (Noise) Regulations (1997).

The ENM model takes into account sound pressure levels of fixed and mobile equipment, capacity of fleet operating, pit location, topography and prevailing weather conditions to assess the noise impact. The most current meteorological data from the mine’s weather station is available to operators on line through the Worsley intranet.

Blast Noise
The management of blasting activities remains a key operations requirement. Worsley’s internal maximum noise level target is set below the statutory limit and any exceedence is investigated and corrected. The blast pattern, design and charge weight per delay and initiation are managed to comply with internal and legislative noise related requirements.

Consideration of weather conditions is crucial to the planning and scheduling of blast operations. Aspects such as prevailing winds, temperature, humidity and likely weather conditions are taken into account at the time of the blast to minimise the impact as much as possible.

Each air blast over pressure and vibration is monitored at the most noise sensitive premises, which has been determined by distance, topography meteorological factors and local knowledge. A total of 211 blasts were initiated and monitored during 2007-08.

Ongoing improvements in blast noise management include:
- Nonel signal tube continued to be used for all blasts, replacing detonation cord. This technique is designed to reduce noise generated by detonation cords by containing the energy generated by each blast hole;
- The blast timing was changed during the reporting period to use a faster initiation sequence to reduce the duration of blasts; and
- The initiation sequence ensures that no two holes are initiated at once.

Blasts have been routinely monitored for vibration analysis since April 2005 and during the last reporting period 183 blasts were monitored for vibration. Twenty-eight blasts were not monitored due to repair, interference or the use of a hand held noise monitor which does not record vibration.

Machinery Noise
The replacement of the mine’s mobile equipment fleet began during the reporting period. When purchasing new equipment Worsley has an internal target Sound Power level for all new mobile equipment of 107dB(A).

Ongoing improvements in noise mitigation have include:
- Modification of reversing buzzers on mobile equipment and light vehicles at the mine to reduce noise;
- Replacement of the ‘silent horn’ system for the excavator / loader to communicate with haul trucks;
- On-going noise monitoring by the night shift production supervisor at noise sensitive premises;
- No blasting between 6pm and 7am; and
- Continued formal reporting and investigation of noise reports from neighbours and electronic internal notification of noise reports;

DUST MANAGEMENT
The mine continued to implement the dust monitoring program during the past year. The two dust monitors, which have been in place since October 2006, remained at their existing locations adjacent to mining areas on the perimeters of the Mt Saddleback Timber Reserve.

A monitor north of the mine will be re-located during the next 12 months due to changes in land management and land use.

There has been an improvement in data collection over the last year with more consistent data recovery from the monitors. Annual calibration of dust monitoring results was undertaken using additional dust monitoring equipment during March/April 2008.

The weather station is an integral part of noise and dust management at the mine. An upgrade to the current weather station is planned for the next year.

Worsley continues to look for opportunities to improve dust suppression along haul roads every summer. During summer, crushed rock and chemical suppressants were used to improve the effectiveness of watering haul roads for dust suppression.

The combination of the different technologies was found to be effective in managing dust on haul roads and in helping Worsley to meet its internal water use targets. During the year, 288.385 ML of water was used for haul road dust suppression purposes, accounting for 97.6% of total water used at the mine.

Dust emissions resulting from the screening, crushing and reclaiming processes are minimised through the strategic location of watering points in the crushing plant and along the conveyor and dust containment mechanisms on the conveyor belts and transfer points.
REHABILITATION

Rehabilitation Strategy
The broad objective of mine rehabilitation in forest areas is to regenerate a stable forest ecosystem with flora characteristics compatible with the eastern jarrah forest. For the agricultural areas, the aim is to return a stable agricultural system to standards agreed with the landholder.

Worsley has established a wide range of collaborative research projects with universities, research agencies, other industries and government, aimed at improving the rate at which forest biodiversity is re-established.

Rehabilitation in the past year has taken place in 86.34ha of State Forest and 19.45ha of agricultural land.

Topsoil Management
Rapid return of topsoil is regarded as an important technique for re-introducing plant species to rehabilitation areas. The target is to direct return topsoil to 35 per cent of the rehabilitation footprint.

During 2007-08, topsoil was directly returned to 41.5 per cent of the rehabilitated forest area. Following topsoil return, the surface areas were scarified to a depth of 40cm at 1m spacing along the contour to minimise erosion scouring, enhance water infiltration provide soil conditions conducive for seed germination and root system development.

Between February and June 2008, all forest rehabilitation areas were broadcast with a diverse mix of seed from 174 native species of trees, legumes and other understorey plants, collected from the Mt Saddleback Timber Reserve local flora provenances.

Flora and Fauna
Worsley’s fauna conservation strategy aims to minimise impacts on flora and fauna populations through management measures, including:

- Detailed flora and fauna surveys before mining;
- Identification and protection of areas of high flora and fauna conservation significance;
- Establishment of wildlife corridors;
- Prompt rehabilitation of land and development of fauna habitats;
- Monitoring of vegetation diversity and fauna in rehabilitated areas;
- Support for research into recalcitrant plant propagation and increasing rehabilitation species diversity; and
- Workforce education and training.

Marradong Mining Area
Worsley is planning to expand its mining operations to the Marradong Timber Reserve, near Boddington in the future. Flora and fauna surveys have been undertaken in the Marradong Timber Reserve. On-going monitoring in the reserve will be aligned with the process in Mt Saddleback.

In addition to this, Worsley will complete the biodiversity-related investigations required by Ministerial Statement 719 for the proposed future expansion areas and submit a Biodiversity Investigations Report to Government. The report will document the key biodiversity values, zero disturbance areas, buffer zones, and other relevant aspects, identified from the investigations.

Fauna Habitats
As part of the on-going mine rehabilitation program, fauna habitats are routinely created at a density of approximately eight or nine habitats per hectare. Generally the habitats are constructed using logs, stumps, rocks, soil and forest debris which provides a variety of habitat refuges to encourage the return of various fauna species to rehabilitation areas.

Additional forest residue, where available, is also scattered throughout the rehabilitation areas to provide micro habitats and to form linkage corridors between the larger habitats and forest islands.

Fauna Monitoring
As part of Worsley’s ongoing rehabilitation monitoring, a fauna monitoring program report was developed to guide future vertebrate fauna monitoring in Mt Saddleback Timber Reserve.

Monitoring, to be done every three years, will focus on fauna in unmined forest areas, as well as fauna in different stages of rehabilitation growth over 15 years.

The monitoring program will cover three seasons and include systematic trap sampling and opportunistic sightings. The next fauna monitoring program will start in 2009-10.
ENVIRONMENT

REHABILITATION RESEARCH

Worsley has continued to support external research, which supplements in-house studies and contributes to continuous improvement in environmental management. Most of these programs are designed to enhance rehabilitation techniques and are coordinated through, or in conjunction with, Minerals and Energy Research Institute of Western Australia, Universities (The University of Western Australia, Curtin University of Technology, University of Queensland and Murdoch University) and Alcoa.

Seedling establishment

The broadcast seed mix is an integral component of the rehabilitation prescription for returning floristic diversity to the rehabilitation. A collaborative study with The Centre for Land Rehabilitation at the University of WA initiated in 2005 was progressed during the past year to examine processes involved in the establishment from seed of a range of species. A large field trial is examining the effect of time of seeding and topsoil (stockpile and direct return) on the sown seed of almost 40 species.

Seed studies

The reintroduction of many recalcitrant species to the rehabilitation is limited to various aspects of seed biology including poor seed quality and low germination. Worsley is collaborating with The University of WA, Alcoa, Kings Park Botanic Gardens, Australian Centre for Mining Environmental Research (ACMER) and the University of Queensland to improve the performance of broadcast seeding.

Worsley is collaborating with the University of Western Australia on student projects to look at the impact of seed burial and quality of topsoil coverage on emergence and to investigate dormancy alleviation and germination on three deeply dormant jarrah forest species.

A three year research project which started in 2005 with the ACMER into optimising storage, quality and germination of Australian native plant species was progressed. This is a collaborative project with the University of Queensland and Kings Park with support from Worsley and industry partners which has resulted in recommendations on dormancy breaking techniques for some species and the identification of further research possibilities for a number of other species.

The project titled ‘Enhancing native seed performance for mine site restoration and biodiversity conservation’ was also progressed. This is a collaborative project with Alcoa and the Botanic Gardens and Park Authority with support from the Australian Research Council (ARC).

Use of forest residues in rehabilitation

This project is being undertaken in collaboration with the Centre for Land Rehabilitation at The University of WA with support from the ARC. The study is investigating the potential use of mulched forest residues in rehabilitation that are currently not harvested or salvaged for fire wood or fauna habitats and is burnt.

This study is investigating the potential to apply the mulched residue to the rehabilitation to both provide increased organic matter and as a novel method of reducing the plant available nutrient, thereby reducing the rapid growth of the fertiliser responsive legume species.

Two student projects with the University of Western Australia supplementing this ARC linkage were also started. The projects aim to assess the effect of different treatments of soil preparation and management of organic residue on plant biomass of key vegetation species and provide additional information about soil microbial functional response with rehabilitation age.

Deep ripping

The Centre for Land Rehabilitation (CLR) at the University of WA reported on a study assessing the effectiveness of historical ripping practices at the bauxite mine.

Excavations in 10 sites of 8 to 16 year old rehabilitation areas found that although rip lines were not obvious there was root penetration throughout all profiles to the base of each pit. Pit excavations were all a minimum of 2.5m depth. There was a large diversity of pit floor materials.

Tree performance appeared to be correlated with the variation in pit floor material and water availability. The researchers concluded that the rehabilitated soils provide an adequate medium for plant growth although the poor water retention properties of very gravelly overburden materials will adversely affect establishment of all species and limit growth of shallow rooted species. This also occurs for some original soil profiles.

Root exploration of the lower soil profile (to 3m) consisting of in situ regolith was sufficient to enable plants to exploit water retained in the deeper subsoil.

Based on the finding of this investigation a study was initiated in collaboration with the CLR to evaluate the effects of ripping techniques on soil properties.

Ripping techniques

During 2007-08 further evaluations were progressed into the effects of ripping technique (straight tine, winged tine) on soil properties and associated root distribution and plant growth.

Preliminary evaluations of the soil profile immediately after ripping in 2005 indicated few differences between ripping techniques. Re-evaluation of the experimental areas was initiated during the review period.

This will be monitored over a number of years to assess the response of the vegetation to ripping techniques.

Somatic embryogenesis

Worsley continued supporting an ARC Project to develop the in-vitro propagation through somatic embryogenesis of rush and sedge species through Murdoch University and the Botanic Gardens and Parks Authority.

This project aims to develop high production techniques for propagation of some recalcitrant species which are extremely difficult to reintroduce from topsoil or seed by propagating seedlings by tissue culture. Tissue cultures were transferred from Kings Park to Marrinup nursery for propagation into seedlings for the rehabilitation program.

Cryopreservation

This study through Curtin University is a collaborative project with RMIT (Melbourne), University of Queensland, University of WA, Botanic Gardens and Parks Authority and Alcoa with support from the ARC and involves studies on cryopreservation of tissue cultures to provide alternative security methods.
Provenance study
This study was progressed through The University of WA and is a collaborative project with support from Kings Park, Alcoa and Worsley.

Fire study
This project is being carried out through the University of WA in collaboration with DEC and support from the ARC. The objective of this study is to investigate how fine-scale fuel patterns and fire characteristics evolve in rehabilitated forests and how these patterns affect subsequent fire behaviour and impacts.

Preliminary prescribed burns of forest and adjacent rehabilitated areas were carried out. Further assessment and monitoring of these burnt areas will be undertaken to assess the effects on rehabilitation.

Dieback Research
Worsley, in collaboration with Alcoa, DEC and Murdoch University, has supported the development of research projects investigating Phytophthora cinnamomi management and its control:

- ‘How does Phytophthora cinnamomi oversummer in soil?’ by Curtin University of Technology was completed. No Phytophthora cinnamomi was detected in any of the soil samples taken from the field. Phytophthora citricola was detected in one of the dieback sites at the mine. Recently some uncertainty over the identification of P. citricola has occurred. As a result of this the identification of the isolate found at the mine using molecular techniques was progressed; and
- “Susceptibility to Phytophthora cinnamomi and sensitivity to phosphate in native Australian plants: why are they linked” was progressed. This Project is being undertaken in collaboration between The University of WA and Murdoch University, Mineral Energy and Research Institute of Western Australia with support by Worsley and industry partners.
FUTURE MINING OPERATIONS

Environmental Review and Management Program and Approvals

Worsley Alumina prepared an Environmental Review and Management Program (ERMP) for the Worsley Expansion and Growth Project and submitted this to the Western Australian EPA in 2005, in accordance with the requirements of the Western Australian Environmental Protection Act 1986 and the bilateral agreement between the State and Commonwealth in relation to assessing environmental impact assessments under the Environment Protection and Biodiversity Conservation Act 1999.

Formal approval of the expansion proposal was granted by the State Minister for the Environment on 13th April 2006 (Ministerial Statement 719). An amendment to this approval allowing a slight increase in the rate of production was approved on 26th February 2007.

The ERMP was also reviewed by the (then) Commonwealth Department of Environment and Heritage and formal approval granted by the Commonwealth Minister, on 6th June 2007 (Approval Instrument EPBC 2004/1566).

The proposed expansion includes extension of mining activities into new mining areas outside of the existing Primary Bauxite Area (PBA), an increase in the rate of bauxite mining, an increase in alumina production from an approved 3.7 Mtpa to 4.7 Mtpa, and modifications, upgrades and expansions to transport and processing infrastructure to accommodate the increased production.

Biodiversity-related Investigations

The proposed expansion involves an increase in the footprint of mining activities into new areas outside of the existing Primary Bauxite Area (PBA) mainly to the north of existing mining operations that are currently centred around Saddleback near Boddington.

Given the scale of the proposed expanded mine footprint, and potentially significant biodiversity values that may occur within the footprint, a number of conditions have been included in the Ministerial Statement for the identification, management and protection of significant biodiversity values. In particular, Condition 8 of MS719 specifies a range of requirements, including:

- Preparation of a Scope of Biodiversity-related Investigations, for endorsement by the State Minister for the Environment, following a draft Scope for stakeholder review;
- Undertaking comprehensive biodiversity-related investigations, as agreed in the Scope of Biodiversity-related Investigations, primarily to identify the key biodiversity values in and around the areas proposed for mining-related activities; and
- Preparation of a Biodiversity-related Investigations Report (following completion of the investigations), for endorsement by the State Minister for the Environment, prior to mining, construction or any other ground-disturbing activities in the mine expansion areas.

Approvals will be required prior to mining and construction of the transport corridor. Plans for the mining operations and transport corridor will be developed taking into account the findings from the approved biodiversity investigations report.

A Biodiversity Investigations Working Group (BWG) was established in 2006, comprising Worsley personnel, project management consultants and specialist consultants in the disciplines of flora/vegetation, fauna and hydrology.

In 2008 a specialist Landscape Ecologist was added to ensure investigations provide data suitable for analysis and interpretation in relation to landscape modelling of key biodiversity values.

The BWG has been responsible for overseeing the preliminary consultations with key stakeholders early in the development of the draft Scope of Biodiversity-related Investigations, as well as overseeing the revised Scope of Biodiversity-related Investigations that was approved by the Minister.

The BWG has also engaged and consulted with a specialist Peer Review Panel, a government working group as a sub-group of the Environmental Management Liaison Group and comprising relevant government agencies and a broader stakeholder consultation group.

The draft Scope of Biodiversity-related Investigations was formally released in late March 2007 and distributed to approximately 60 recipients in late March and early April.

Feedback was received from a number of stakeholders in April and May, and was addressed in the Revised Scope of Biodiversity-related Investigations, that was submitted to the State Minister for the Environment in October 2007.

Ministerial approval of Worsley’s Scope of Biodiversity-related Investigations document was received in April 2008.

The Revised Scope was also submitted to the Commonwealth (as required under the Commonwealth approval instrument) and received endorsement in November 2007.

Other Approvals required for the mine expansion

On completion of the biodiversity investigations, and following State and Commonwealth endorsement of Worsley’s Biodiversity-related Investigations Report, Worsley will develop the relevant mine and transport corridor plans for the proposed expansion areas, taking into consideration the results of the Report, in accordance with the requirements of Ministerial Statement 719.

These mine and transport corridor plans will be submitted for review by a range of key stakeholders, before the relevant approvals. Approval to mine in the proposed expansion areas will be subject to the results of Worsley’s ongoing biodiversity investigations and the feedback received from key stakeholder consultations on the relevant development plans, as well as the State and Commonwealth Ministerial endorsements of the relevant reports and plans.

Relevant and important internationally-recognised guiding principles for environmental protection and ecological sustainability, are incorporated within the framework of Worsley’s approvals processes for the proposed mine expansion, including the following:

- The precautionary principle;
- Conservation of biological diversity and ecological integrity;
- Ecologically sustainable development; and
- Public participation.

FOREST MANAGEMENT

Forest Disease

Worsley’s management of forest disease at the bauxite mine has been developed and implemented in consultation with Department of Environment and Conservation (DEC). The key components are:

- Detection of forest disease prior to mining;
- Planning operations to minimise disease risks;
- Prevention of disease introduction and spread;
- Education of the workforce about forest disease;
- Rehabilitation of disease areas where required; and
- Research relevant to improving forest disease management.
During the year 170ha of Joint Venture and 775ha of the Mt Saddleback and Marradong Timber reserves were surveyed and interpreted for the presence of Phytophthora-related dieback forest disease.

The survey included areas to be cleared for mining within the next year, as well as areas in the parts of reserve that are to be cleared within the next three years.

The majority of the assessment area has been classified as being uninfested, with no visible disease symptoms within the vegetation. The remainder of the interpreted area was classified as unmappable.

**Weed Control**

Weed populations once again remained very low at the mine. Operational procedures maintain forest hygiene that prevents weeds being introduced to the Saddleback area by mining operations.

Worsley continues to manage both environmental and declared weeds on land under the company’s care and control, working in conjunction with neighbouring property land holders.

**Fire Control**

An inter-agency agreement between Worsley and the Department of Environment and Conservation (DEC) is in place for wildfire suppression. A memorandum of understanding was signed with FESA and incorporates Worsley’s refinery, overland conveyor, bauxite mine and other lands. This document is re-signed on an annual basis.

Over the last few years, Worsley and the DEC have worked in consultation to develop a three-year burn program for the Bauxite mining area, including a research burning program.

Two areas of Timber Reserve were successfully burnt under prescription by the DEC (Perth Hills District) during the year (440ha total). Further burning is planned for the next year, and the burn program is due to be reviewed annually.

Worsley also regularly reviews the burn plans around the refinery and has scheduled two regular meetings with DEC Wellington district to review its Master Burn Plan (MBP) for the coming seasons. Plans are in place to continue prescribed burning Worsley’s Joint Venture owned land in collaboration with DEC and local volunteer bush fire brigades.

Two areas of Joint Venture owned land near the Marradong Timber Reserve were also burnt under prescription during Spring 2007 and Autumn 2008.

**Forest Salvage**

The Forest Products Commission harvested timber in areas proposed for mining during the year. The high-grade timber was removed from site, while the firewood grade timber was stockpiled in a number of locations in the Mt Saddleback Timber Reserve.

The remainder of the forest residue generated during the year was used either for re-creating fauna habitats in rehabilitation areas, burnt on-site, or a small portion was diverted to a value-adding process off-site with approval of the FPC.

Worsley is keen to identify alternative uses for the forest residue remaining after harvesting, clearing and constructing fauna habitats. A high level Business Improvement Project was undertaken during the review period to identify opportunities to reduce the amount of forest residue burnt. The project identified a number of long term options to trial.

**Fox Control**

In late 2006, Worsley signed an agreement with the Department of Environment and Conservation to contribute $80,000 a year towards incorporating the Western Shield program across Joint Venture-owned land and other forest areas.

The increased area of land baited was 4600ha and the first baiting round started in December 2006. Subsequent baiting has occurred following prescribed burning operations. The Department has reported a significant uptake of baits.

**Indigenous Heritage**

No additional surveys for heritage sites were carried out during the reporting period.

Two surveys were completed about the occurrence and nature of Aboriginal heritage, an assessment was carried out into the proposed new mining areas detailed in the Worsley ERMP (April 2005) and an assessment of three Joint Venture owned properties located near the Worsley Refinery in Collie was finalised.

Archaeological locations identified as being potentially important have been registered with the WA Museum and the Department of Indigenous Affairs and are protected from disturbance.
THE OVERLAND CONVEYOR

Forest Management
Implementation of the Forest Hygiene Procedure for the Overland Bauxite Conveyor corridor has continued throughout the year. The procedure requires all vehicles travelling along the conveyor to use the wash-down facility at the refinery to prevent the introduction of potentially infected soil to dieback free areas.

The environmental induction program at the refinery, mine site and the conveyor educate staff and contractors about the precautions necessary to prevent jarrah dieback spreading through the adjacent forest.

The Forest Hygiene Procedure also requires that inspection, monitoring and demarcation of forest health adjacent to the OBC is undertaken to maintain accurate status of jarrah dieback infestations.

The OBC corridor was last assessed for the presence of Phytophthora cinnamomi in late summer of 2005 by Glevan Consulting, who is accredited by the DEC to provide this level of forest disease assessment.

Noise Control
A refinery-based environmental team meets regularly to discuss environmental management, including noise management strategies for the conveyor. The team also aims to make sure any new developments will not introduce new noise concerns.

Activities during the year included:
- Canvas covers fitted to Bridge 2 (mine end of conveyor);
- Use of the ‘Glide Seal’ mono-tyre pulley, initially introduced in 2003. Supply problems have been resolved and this is approximately 60 per cent complete. About 22,000 split rim type pulleys have been replaced within noise-sensitive areas;
- Installation of polyurethane inserts to reduce the bearing noise (steel on steel contact) has continued;
- A new type of conveyor cable rope called Taipan rope was trialled along a 1.5km section of the conveyor in November 2006. This rope did not meet Worsley’s expectations and a modified additional 1.0km trial length is planned for installation in November; and
- An ongoing program to reduce noise emissions from the conveyor bridges has continued. This program involves routine maintenance including replacing or tightening all nuts and bolts, replacing the running gear on the bridges and ensuring the conveyor cowling is secure.

In accordance with the State Agreement, monitoring of conveyor noise emissions continued through 2007-08 from the monitoring station located 900m from the conveyor to ensure compliance.
REFINERY OPERATIONS
The Worsley Alumina refinery is located in the Augustus River Catchment, about 15 km north-west of Collie.

Key environmental issues at the refinery are:
- Management of air quality;
- Reduction in greenhouse gas and other air emissions;
- Improvements in energy efficiency;
- Efficient use of water resources; and
- Management and rehabilitation of bauxite residue disposal areas.

Air Quality
Air quality management obligations include compliance with BHP Billiton’s Environmental Policy, licence conditions and with Ministerial conditions. Implementation is undertaken through Worsley’s Environmental Management System.

A significant study of air emissions impacts - the Air Emissions Impact Assessment (AEIA) project, was established in 2003.

A panel of employees and consultants, with high level expertise in the management of air emissions developed a comprehensive air emissions program that includes sampling and analysis, modelling, health risk assessment, community and employee consultation and environmental improvement plans.

Overseeing this work is an independent peer review panel and results are provided to a Government Coordination Group of specialist experts from the Departments of Health, Environment and Industry.

This project, which is still continuing, was instrumental in developing Worsley’s Air Quality Management Plan for the Efficiency and Growth Expansion Project.

The main activities during the year were:
- Continued Government and community engagement through the Environmental Management Liaison Group and the Refinery Community Liaison Committee;
- Comparison of different sampling methods for volatile organic compounds (VOCs);
- Sampling of odours and VOCs from secondary sources;
- Reporting of ambient monitoring trends;
- Following trials of dust suppressants for use on the Bauxite Residue Disposal Areas, implementation of hydromulch covering; and
- Preparation of a revised Health Risk Assessment based on dispersion modelling of the Version 2 Emissions Inventory using an improved model.

Air Emissions
Routine monitoring of air emissions is carried out to meet the requirements of the Worsley’s licence from the Department of Environment and Conservation. This includes monitoring of SO2, NOx, CO, PM10 (particulates with aerodynamic diameter of less than 10 micrometers), fluoride and a number of VOCs.

Electrostatic precipitators are fitted to all power station flues and calcination stacks to control particulate emissions. A baghouse is used to control particulate emissions from the liquor burner.

Regenerative Thermal Oxidisers (RTO) are used in digestion and liquor burning to destroy volatile organic compounds. These RTOs have a destruction efficiency as high as 99 per cent.

About 98 per cent of sulphur dioxide (SO2) emissions are due to coal combustion. The rest comes from the combustion of alternative fuels (for power generation) and miscellaneous sources.

The main contributor of NOx emissions is coal combustion (about 50 per cent) and natural gas combustion in the cogeneration plant (about 45 per cent).

The following tables summarise the measured emissions of SO2, NOx, and particulates over the last five financial years.

Emissions from year to year may be influenced by uncertainties in the stack testing measurements, unit on-line availabilities as well the performance of emissions control systems.
ENVIRONMENT

**Sulphur Dioxide**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulphur Dioxide (Tonnes)</td>
<td>9492</td>
<td>10379</td>
<td>10162</td>
<td>9442</td>
<td>7205</td>
</tr>
<tr>
<td>SO2/Unit Production (T/kT)</td>
<td>2.92</td>
<td>3.17</td>
<td>3.16</td>
<td>2.74</td>
<td>2.05</td>
</tr>
</tbody>
</table>

**Nitrogen Oxides - Measured as nitrogen dioxide**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen Oxides (Tonnes)</td>
<td>4162</td>
<td>4160</td>
<td>4180</td>
<td>6582</td>
<td>4201</td>
</tr>
<tr>
<td>NOx/Unit Production (T/kT)</td>
<td>1.28</td>
<td>1.27</td>
<td>1.30</td>
<td>1.92</td>
<td>1.19</td>
</tr>
</tbody>
</table>

**Particulates – Measured as PM10 (Powerhouse and Calcination)**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Particulates (Tonnes)</td>
<td>614</td>
<td>203</td>
<td>203</td>
<td>544</td>
<td>212</td>
</tr>
<tr>
<td>Particulates/Unit Production (T/kT)</td>
<td>0.189</td>
<td>0.062</td>
<td>0.063</td>
<td>0.163</td>
<td>0.060</td>
</tr>
<tr>
<td>Particulates reduction per unit production from 2006-07 baseline **</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-63</td>
</tr>
</tbody>
</table>

* The “Particulates - measured as PM10” reported values now only comprise powerhouse and calcination facilities and no longer include emissions from the Bauxite Residue Disposal Area. This change has been made to align with the 07/08 objective to reduce particulate emissions from the powerhouse and calcination facilities.

** National Pollutant Inventory**

Worsley reports gaseous emissions annually to the National Pollutant Inventory. The inventory is accessible to the public and records the amount of emissions and the way in which the emissions are measured.

Annual reports for the refinery and mine are submitted to the Department of Environment and Conservation in September each year.

**Greenhouse Emissions**

Worsley is continually developing and implementing measures aimed at achieving its greenhouse gas and energy efficiency improvement targets, as well as satisfying voluntary and regulatory commitments.

Since May 1997, Worsley Alumina has been involved in the Australian Government’s Greenhouse Gas Challenge Program. The agreement required Worsley to establish a greenhouse gas inventory and to develop an action plan aimed at reducing greenhouse gas emissions for each tonne of alumina produced. It aims to achieve this through:

- Improving energy efficiency;
- Preserving and developing greenhouse sinks; and
- Decreasing, where practicable the generation of greenhouse gases.

Energy efficiency is driven through the WAOS (Worsley Alumina Operating System). WAOS helps establish business focus, goal alignment and visual management of KPIs (including greenhouse and energy) across all levels of the business. Business Improvement (Six Sigma) tools are also used to ensure efficient delivery of improvements.

The Energy Efficiency Program uses the statutory Energy Efficiency Opportunities process and Worsley Business Excellence and WAOS processes, to identify improvement opportunities that can support a reduction in Worsley’s energy use and greenhouse gas emissions.

Project teams map energy flows and identify and implement projects that result in net energy efficiency benefits.

Projects are evaluated and progressed through an Energy Efficiency Project Pipeline that uses existing resource investment pipelines such as team fix, yellow, green and black belt Six Sigma business improvement processes and capital improvements.

Opportunities to improve energy efficiency are identified through the Efficiency and Growth Expansion Project, customers, suppliers and employees.

Significant reductions in energy used and greenhouse gas produced have been achieved during the financial year. Energy use reductions have been made through key projects including:

- Improvements to Digestion Train 2 resulting in a reduction in waste heat which is now being replicated in Train 1;
- Improved pump efficiency from increased mud flow to deep cone washers in clarification;
- The replacement of older style compressed air supply units; and
- Modifications to coal boiler primary air fans.
### Greenhouse Gas

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon dioxide equivalents (kilotonnes)</td>
<td>2461</td>
<td>2486</td>
<td>2495</td>
<td>2626</td>
<td>2640</td>
<td>2613</td>
</tr>
<tr>
<td>CO2e (kT/kT)</td>
<td>0.772</td>
<td>0.764</td>
<td>0.763</td>
<td>0.818</td>
<td>0.768</td>
<td>0.741</td>
</tr>
</tbody>
</table>

Note: values for 2006-07 & 2007-08 reporting years have been calculated using National Greenhouse Accounts Factors (January 2008).

Implementation of efficiency projects has contributed to reducing Greenhouse Gas Intensity by 3.5% per cent between 2006-07 and 2007-08.

### Energy Efficiency

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy consumed (TJ)</td>
<td>34,313</td>
<td>34,920</td>
<td>35,931</td>
<td>35,606</td>
<td>36,636</td>
<td>36,495</td>
</tr>
<tr>
<td>Energy/Unit Production (TJ/kT)</td>
<td>10.75</td>
<td>10.73</td>
<td>10.98</td>
<td>11.08</td>
<td>10.66</td>
<td>10.34</td>
</tr>
</tbody>
</table>

Note: values for 2007-08 reporting year have been calculated using National Greenhouse Accounts Factors (January 2008).
ENVIRONMENT

WATER CONSERVATION

Mining Operations
The mine continued a strong focus on water conservation and reducing the amount of water used for dust suppression by again implementing a dust control program. Crushed rock, a dust suppressant water additive (RT9) and a coating of Dustmag for dust suppression on the haul roads was used.

The water program began in November 2007 when crushed rock was laid down on the haulroads and treatment with the water additive (RT9) began shortly afterwards in December. RT9 assists in the penetration of water into the road and reducing flyaway dust by binding soil particles together. Dustmag was also applied in December 2007 to bind and compact the top surface layer of the haul roads so that less watering is required.

All water cart operators are trained in the correct application of the products onto the haul roads.

The mine’s Area Environmental Team carried out a trial to reduce evaporation through the use of an anti-evaporation product, Aquatain which is a silicone-based liquid which spreads across the water surface, forming a very thin film layer which reduces evaporation.

In December 2007 the product was applied to five of the six dams at a rate of 2L per hectare every fortnight and over a period of four months. A trial using evaporation pans indicated that Aquatain reduced surface evaporation from the dams by approximately 30%.

Refinery Operations
The refinery has a comprehensive water management system in place designed to contain, separate and re-use contaminated operations and process waters. This is achieved through:

- Containment facilities, made up of residue storage ponds managed in accordance with the red mud disposal plan, refinery collection system, Refinery Catchment Lake and Pipe Head Dams for contaminated waters and the refinery Fresh Water Lake for the containment of clean waters; and
- Groundwater underflow collection systems, which consist of a network of slotted and solid pipes, installed beneath the bauxite residue disposal areas (BRDAs) and Solar Evaporation Pond containment structures. These underflows are designed to intercept, collect and transport groundwater and depending on quality, discharge to the Pipe Head Dam for return to the process or, discharge to the Fresh Water Lake.
During the review period it was not necessary to recover or treat any groundwater.

A key aspect of the refinery water management is to minimise the use of freshwater and maximise the use and re-use of process liquors. This ensures sustainable management of fresh water at the refinery and mitigation of adverse risks to operational security from insufficient water availability or from excess water in the Refinery Catchment Lake. Initiatives implemented during the year included:

- Collaboration with the Department of Water to update the Refinery Surface Water licence, including the Ecological Water Requirements of the Augustus River;
- Continuation of trials into using condensate in cooling towers instead of fresh water;
- Completion of the Refinery Catchment Lake expansion reprofiling to accommodate future plant expansion, improve cooling of process liquor and adequacy in liquor storage under Peak Maximum Precipitation conditions;
- Following the success of dual flush toilets and “Desert Cubes” (waterless urinals) at the port to minimise the use of potable water, waterless urinals are now being rolled out across the refinery;
- Further investigations into longer term projects to collect moisture from Calcination stacks and alternatives to the use of water for powerhouse cooling and water jetting; and
- Detailed design and feasibility studies of the Fresh Water Lake capacity increase project were completed.

Water consumption at the refinery is highly dependent on rainfall. During 2007-08 there was high rainfall recorded so less water was required from the fresh water lake in the refinery.

<table>
<thead>
<tr>
<th>Bauxite Alumina Water Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Freshwater Consumption (ML)</td>
</tr>
<tr>
<td>2369  2042  2250  2289  3352  1945</td>
</tr>
<tr>
<td>Water consumption/unit of production (KL/T)</td>
</tr>
<tr>
<td>0.74  0.63  0.69  0.71  0.98  0.55</td>
</tr>
</tbody>
</table>

Note: The values represented above exclude water pumpback to the Refinery Catchment Lake (RCL). The pumpback to the RCL is completely dependent on rainfall over the year and therefore does not represent BWAPL’s performance.

Monitoring Water Quality

Monitoring of the ground and surface water quality is achieved by regular sampling and analysis of monitoring bores, underflows and water bodies and streams.

There are 119 monitoring bores across the refinery lease which have been drilled and designed to intersect specific aquifers to determine groundwater quality. The majority of these bores have been located down stream of containment facilities. Sampling is carried out every three months or more frequently if required.

There are 22 underflow systems which originate from beneath containment facilities. By analysing sampling and making comparisons to historic data, any changes can be tracked and appropriate action taken. Underflows are sampled and analysed weekly and quarterly.

Water bodies and streams include the refinery Fresh Water Lake and the Augustus River, both located downstream of the refinery process area and residue disposal containment facilities.

Sampling is continual for key potable parameters with weekly, monthly and quarterly sampling for complete analysis.

The monitoring schedule has been developed to identify changes in groundwater chemistry aimed at assessing and highlighting any adverse impact that may be attributed to refinery operations.

Key indicators used to detect potential anomalous chemistry are pH, electrical conductivity and sodium.

Since refinery operations started 24 years ago, the quality of ground and surface water collected and transported to the Fresh Water Lake has remained consistent with historical trends and seasonal fluctuations.
Theses targets can be achieved by finding lower impact sources of energy and reducing energy consumption intensity.

Worsley’s energy intensity (carbon-based energy per unit of production) performance was 10.34 gigajoules per tone of alumina, which represents a three per cent reduction from the previous year baseline value of 10.66GJ/T.

A high level Climate Change Steering Committee is developing a management plan to build on the achievement of the past year.

The Energy Excellence Champion role has been sustained over the current reporting period to coordinate efforts to find smarter ways to use energy.

Energy Excellence Teams set up in operational areas to implement improvement opportunities have been incorporated into existing environmental teams in the areas. Projects formally identified through workshops in each area are being progressed and a continuous stream of new ideas is also being recorded.

Other major initiatives identified or under investigation include:

- Water management efficiency improvements;
- Managing the impact of operations on biodiversity, including remnant bush preservation;
- Carbon sequestration, in which carbon is captured and disposed of safely in geological formations;
- Use of alternative fuel types for power and steam generation, including renewable energy; and
- Improving management of forest waste.

In addition to these major initiatives, employees are encouraged to change the way they approach their work and to challenge long established work practices within their operational areas.

As a foundation signatory in 1997, Worsley continued to be an active participant in the national Greenhouse Challenge Plus program run through Australia’s Greenhouse Office, which independently monitors and audits Worsley’s performance.
WASTE MANAGEMENT

At the Mine

The Bauxite Mine has recycling systems for liquid and solid wastes. Initiatives across site are to firstly reduce the amount of waste generated and reduce the total amount of waste disposed to landfill. Waste is also re-used on site, recycled, returned to the supplier or sent to an appropriate landfill or treatment facility.

Waste oil, lubricants, solvents and vehicle batteries are temporarily stored in a contained area before being removed by licensed contractors for either recycling or treatment offsite. Hydrocarbon waste is collected periodically from site by a licensed contractor and sent for recycling or treatment.

Consumable and recyclable materials such as scrap metal, oil filters and vehicle tyres are collected on site and removed by contractors, as required, to recycling facilities.

Domestic waste, including paper, cardboard, glass, aluminium cans and recyclable plastics are also collected for recycling. Septic tanks and leach drain systems are used for sewage treatment and are maintained in accordance with the requirement of the health regulatory authority.

A waste management meeting identified the need to align the Refinery, Port and mine bin standards in order to improve the way waste is disposed. The meeting resulted in ideas for numerous yellow belt projects to decrease the number of waste streams across site, having area specific waste streams and changes to some bin colours.

Over the past year the environmental team introduced a number of initiatives to support waste reduction at mine. These include:

- Introduction of under desk general waste/recycling bins issued to all office employees;
- Implementation of a green waste disposal system;
- Distribution of ceramic and thermal coffee mugs to phase out paper/plastic cups;
- Car litter bags were made available for all work and personal vehicles; and
- On-going collection of old mobile phones and accessories in conjunction with Mobile Muster and Landcare Australia;

Waste contractors Cleanaway carry out quarterly audits at the mine to examine the type of waste sent to landfill over a week period. The audit reports shows a breakdown of appropriate and inappropriate waste sent to landfill for each business section.

Results are reviewed and assessed by the Environmental Department and feedback is given to the workforce through presentations of results at environmental team meetings and posters around site.

Waste water generated through maintenance workshop activities (such as vehicle washdown and workshop floor cleaning) is collected in a storage bund and fed to the mine’s Anpress unit for treatment.

Once treated, the recycled water is re-used in the vehicle washdown facilities or released to a dam lined with plastic and mixed with bore water to be used for dust suppression on haul roads.

Hydrocarbon contaminated soil from spills is placed into the onsite mine soil treatment facility and remediated.

At the Refinery

Most waste products generated at the refinery are recycled, or re-used on site. This includes general office waste such as paper, glass, aluminium and plastics, printer cartridges, used uniforms, conveyor belt, scrap metal, wire rope, electrical cable, heater tubes, green and yellow PVC gloves, wooden pallets and other wood products, waste oil and lubricants, solvents and other chemicals, mercury, paints, batteries, and tyres.

Ancillary operations are managed so that drainage from all workshop areas is collected via sumps and treated by oil/water separation units. Waste oils, lubricants, oily solid refuse and oily waters are all exported offsite for recycling.

Over the last 12 months a number of new initiatives were implemented by the Refinery Waste Minimisation Team. These included:

- Implementation of recycling of fluorescent tubes;
- Installation of office recycling bins; and
- Removal of paper cups from all but one location on site.

Community Benefits

Cost savings achieved by recycling initiatives have a direct community benefit through the Ruggies Minerals Industry Recycling Scheme. Worsley donates 30 per cent of all recycling returns to the scheme, which are then passed on to Princess Margaret Hospital for Children and the Royal Flying Doctor Service.

Worsley donated $83,534.15 to the Scheme in 2007-08. The total amount provided to Princess Margaret Hospital by Worsley since the first donation in June 2000 is $347,246.15.

Domestic Waste to Landfill

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Refinery</td>
<td>1914.9</td>
<td>2899.3</td>
<td>2604.6</td>
<td>3485.8</td>
<td>1134.8</td>
<td>772.8</td>
</tr>
<tr>
<td>Mine</td>
<td>440</td>
<td>442.3</td>
<td>398</td>
<td>455</td>
<td>72.3</td>
<td>36.6</td>
</tr>
<tr>
<td>Total</td>
<td>2354.9</td>
<td>3341.6</td>
<td>3002.6</td>
<td>3940.8</td>
<td>1207.1</td>
<td>809.4</td>
</tr>
<tr>
<td>Domestic waste to landfill/ unit production (T/kT)</td>
<td>0.85</td>
<td>1.08</td>
<td>1.02</td>
<td>1.23</td>
<td>0.35</td>
<td>0.23</td>
</tr>
</tbody>
</table>

Note: Values consist of domestic waste sent to onsite sanitary landfill site only.

Note: The method of measuring waste to landfill changed in FY06 to exclude cover material of the landfill site.
ENVIRONMENTAL INCIDENTS

Worsley Alumina is required to report any incident that exceeds the conditions of the operating licence issued under the Environmental Protection Act, or has the potential to cause pollution.

Worsley recorded four licence target exceedances to the Department of Environment and Conservation (DEC). Details of the reportable incidents were:

Boiler 1, 2 & 3 Emissions
Routine sampling of the Powerhouse Station stacks in July 2007 showed an average concentration for PM10 of 87 mg/m³. This is greater than the target of 48 mg/m³ in the licence.

An investigation found that the 3rd zone collector inside ESP 2 was not operating. An analysis of compounds in coal ash and a review of the electrostatic precipitators suggested that poor quality coal may be a factor.

As a result of these findings further investigative studies into coal composition and its effect on ESP performance were carried out.

During routine monitoring of the Powerhouse facility in April 2008 average concentration results for PM10 from the Boiler Stacks 1, 2 and 3 were recorded as 122.5 mg/m³, 25.5 mg/m³ and 16.5 mg/m³ respectively with an overall average of 54.8 mg/m³ which is above the licence target of 48 mg/m³.

An investigation revealed that the high readings from the Boiler 1 stack were due to a failure in the ash vacuum system two weeks prior. The failure in the ash system caused a significant increase in dust within the ESP which led to dust bridging between two plates inside the ESP causing zone 3 to trip out.

As a result of the investigation, manual rapping of ESP 1, zone 3 was implemented to break the dust bridge that was causing it to trip and management of the ash vacuum system was improved by increasing the availability of spare parts.

The Ash Hoppers that are connected to the Ash Vacuum system will have level detectors fitted during the next major outage in November 2008, which will assist the central control room in managing dust levels during manual ashing of the ESPs. Data loggers will be connected to all zones of ESP 1 to monitor ESP performance automatically rather than the current manual mode.

This exceedance was the third instance where the average PM10 concentration of Power Station boiler stacks 1, 2 & 3 has exceeded the licence target of 48 mg/m³ in 12 consecutive calendar months, on 3 May (54.0 mg/m³), 26 July (87.0 mg/m³) and 4 April (54.8 mg/m³).

As required by the licence, Worsley completed a full management review of the environmental controls on the emission collection system of the Boiler Stacks 1, 2 & 3 and submitted the management review within 60 days.

Calciner 2 Emissions
Results during routine sampling of Calcination in August 2007 showed an average concentration for PM10 from Calciner 2 of 345 mg/m³. This is greater than the target of 148 mg/m³ in the licence condition for the Calciner stacks.

An investigation identified a broken rapper in the Electrostatic Precipitator (ESP) which is believed to be the cause of the high dust result. The broken rapper was repaired at the next scheduled shutdown.

Calciner 4 Emissions
In April 2008 Calciner stack 4 PM10 results were found to average 262 mg/m³. This concentration exceeds the licence target of 148 mg/m³.

An investigation revealed that the cause of the Calciner Stack 4 target exceedance was non-functioning rappers within the Electro Static Precipitator. A review of the on-line monitoring data showed that the night before the stack was sampled there was a step change increase in dust concentration.

A physical inspection of the ESP verified this data, both wire rappers were not functioning. It was suspected that broken shear pins were the cause of the malfunction.

Actions following the investigation included replacement of shear pins and a subsequent project to relocate the shear pins to an external location so as to enable replacement during calciner operation.
Community Complaints

There were 27 complaints received from the community during the year, which is equal to the number received the previous year. A summary of complaints is shown in the table right.

At the refinery, the number of complaints remained low as a result of emission control equipment installed in the liquor burning facility and digestion facility over the past three years.

Worsley’s ship loading facility at Bunbury Port received two complaints this year. This was six less than the previous year.

Nineteen complaints associated with mining activities near Boddington were received from residents. All except one were related to noise associated with mining activities and the other related to dust. All reports were investigated and in some instances mining operations in the area were temporarily shut down.

### Community Complaints

<table>
<thead>
<tr>
<th>Site</th>
<th>2006-07</th>
<th>Nature of Complaint</th>
<th>2007-08</th>
<th>Nature of Complaint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bauxite mine</td>
<td>17</td>
<td>Noise (17)</td>
<td>19</td>
<td>Noise (18), Dust (1)</td>
</tr>
<tr>
<td>Refinery</td>
<td>1</td>
<td>Odour (1)</td>
<td>2</td>
<td>Odour (1), Aesthetics (1)</td>
</tr>
<tr>
<td>Overland Conveyor</td>
<td>1</td>
<td>Noise (1)</td>
<td>4</td>
<td>Noise (4)</td>
</tr>
<tr>
<td>Bunbury Port</td>
<td>8</td>
<td>Dust (7), Smoke (1)</td>
<td>2</td>
<td>Dust (1), Noise (1)</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>Noise (18), Dust (7), Odour (1), Smoke (1)</td>
<td>27</td>
<td>Noise (23), Dust (2), Odour (1), Aesthetics (1)</td>
</tr>
</tbody>
</table>
**ENVIRONMENT**

**BAUXITE RESIDUE DISPOSAL**

During the digestion stage the alumina is dissolved into the liquor stream while other compounds form solid residues, more commonly known as red mud (bauxite residue). Large disposal areas have been specially constructed to store this residue. The bauxite residue disposal areas (BRDAs) are lined with clay and surrounded by batters or embankments.

Each disposal area is constructed with a network of pipes to maintain separation of water seeping from the bauxite residue and the natural groundwater system.

The groundwater drainage system collects clean water from under the clay liner and carries it to the Fresh Water Lake. The quality of the water from individual drainage pipes is monitored at least every quarter. A composite sample of the water entering the freshwater lake is collected every week for analysis.

Regular monitoring shows fresh water quality continues to reflect normal seasonal variations.

**Controlling Dust**

Dust is one of the main environmental issues to be managed in the disposal areas. Worsley’s strategy for dust mitigation and control is focused on alternate ploughing and deep ripping of the surface and changes in residue deposition. Ploughing the BRDAs increases surface roughness and lowers surface wind speed to below particle take-off velocity.

Amphirol machines continue to be used to improve dust reduction on the BRDAs during periods when other equipment and methods cannot be used due to restricted access.

The machines float on the surface of the residue, driven by two scroll shaped pontoons. They travel on the surface of the fresh residue creating troughs that help to release liquor and promote run-off, which helps the bauxite residue to dry and consolidate.

There are two high-volume air samplers located to the west and to the south-east of the refinery to measure Total Suspended Particulates. The samplers operate for 24 hours twice a week.

**Rehabilitation Planning**

Developing the BRDA rehabilitation approach involves addressing aspects of hydrogeology, geotechnical, geochemical, geomorphology, landscape design and rehabilitation. These aspects are integrated into an overall rehabilitation prescription for the BRDAs.

Historically, the development of the bauxite residue rehabilitation prescription identified two strategies. The initial focus of studies was on using the results from residue-amelioration and vegetation establishment trials.

The finding from hydro-geotechnical studies have progressively modified the rehabilitation concepts towards a capping design to meet the guiding principles for the final land use objectives for the Worsley Alumina Refinery Lease Area.

These principles address aspects of landform, water resource protection, environmental issues, maintaining the bauxite residue as a potential resource and addressing liability.

The rehabilitation design, developed for Worsley’s first residue disposal area was finalised in consultation with Government during the year. The design builds on the previous rehabilitation concept that has progressively been developed over the last 10 or so years. The rehabilitation concept has the following components:

- Vegetation of native species. Identification of the specific composition of the vegetation cover is progressing in consultation with Department of Environment and Conservation;
- Drainage system on the surface to enhance drainage and to reduce pooling of water and water logging of the soils;
- Upper erosions control layer;
- Moisture retention layer;
- Drainage layer;
- Infiltration and capillary barrier made up of two components
  - (a) Synthetic membrane liner
  - (b) Low permeability clay layer immediately beneath the synthetic layer; and
- Monitoring systems to monitor the efficacy of the capping.

A number of surface and soil profiles were modelled to optimise the soil moisture storage in the covering cap.

**Alternative Uses of Residue**

Determining alternative uses for bauxite residue requires fundamental knowledge of its physical, chemical, mineralogical, nutritional, biological and geotechnical properties. While Worsley continues to expand its knowledge base in these areas, containment and rehabilitation of the BRDAs remains the best option for managing Worsley’s bauxite residue.

While current research is focussed on progressing a rehabilitation and closure plans, Worsley continues to monitor national and international developments in alternative uses for bauxite residue, including soil amelioration, management of acid mine drainage and water treatment and as a potential construction material.

Worsley is a member of the International Aluminium Institute program that includes the investigation into residue management, including treatment and alternative uses.
Five year targets and 2007-08 progress

<table>
<thead>
<tr>
<th>Objective</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achieve a 10 per cent reduction in domestic landfill waste per unit production by June 2012 from a 2006-07 baseline.</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Achieve a 10 per cent reduction in average freshwater consumption per unit production, excluding make up water to the Refinery Catchment Lake, by June 2012 from a 2006-07 baseline.</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Contribute to the BHP Billiton target of a 6 per cent reduction in greenhouse gases per unit production by June 2012 from 2005-06 baseline.</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Achieve a 20 per cent reduction of particulate emissions, measured as PM10, from the powerhouse and calcination plant per unit production by June 2012 from a 2006-07 baseline.</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Maintain ISO 14001 EMS certification through six-monthly certification surveillance audits.</td>
<td>Ongoing</td>
</tr>
<tr>
<td>1 Uses a 2005-06 baseline consistent with the BHP Billiton Public HSEC Targets</td>
<td></td>
</tr>
</tbody>
</table>
COMMUNITY RELATIONS
COMMUNITY RELATIONS

Worsley aims to add value to the communities in which it operates by contributing to the social, economic and sustainable development of those communities.

Worsley is the largest employer in the South West and injects about $1 million a day into the region through wages, business contracts and community sponsorship.

For this reason, Worsley has an extensive program in place to consult with local communities to understand the impact of its operations and to learn about local issues and priorities.

The relationship with local communities is important for Worsley to maintain its ‘Social Licence to Operate’.

There are legislative and self regulatory limits in place to ensure social and environmental impacts are kept to a minimum during operations and that there are no long term effects.

Worsley’s key communities are Boddington, Collie and the Greater Bunbury area. These are where mining, refinery and port operations take place and where most employees live.

A Sustainable Environment
Preference is given to projects which demonstrate a commitment to sustainable development.

Worsley encourages its neighbouring communities to develop projects focussed on rehabilitation, preservation and management of a range of environmental issues. These include forest management, protection of biodiversity values, responsible water use, management of air quality, energy efficiency, waste management and closure planning.

Community Sponsorship
Worsley Alumina gets hundreds of requests every year for support from a wide range of community groups. In many cases, the company is able to help in some way.

Community sponsorship is provided for a range of projects from large infrastructure projects through to support for many community groups.

Worsley spent $1,065,720 on community sponsorship in 2007/08.

Worsley has a number of key focus areas for its sponsorship programs as well as general community support. These are:

- **Education and Training**
  Worsley supports education and training facilities which promote high education standards, develop industry skills programs and training opportunities and provide leadership development for people living in the South West.

  Worsley recognises the value of developing these programs and local skill base to enhance general community skills and to create a local skilled workforce for its long-term operational needs. Local people are encouraged to gain skills and apply for jobs.

  Developing leadership skills in the community is important because it helps people to make a contribution to their local area and provide long-term stability.

  As well as this, Worsley supports scientific endeavour and industry research.

  The sponsorship program includes support for local high schools, primary schools, colleges and universities. Worsley is also involved in recruitment forums, displays and events.

- **Indigenous Relations**
  Worsley’s sponsorship projects seek to improve the quality of life for indigenous people in the South West, respect the dignity of the traditional owners of the land and value cultural heritage.

  This is done through education programs at high schools and universities in the region and at employment forums. Worsley is a major sponsor of the annual Noongar arts exhibition and regional indigenous art workshops.

- **Local Business Support**
  Worsley wants to ensure that its neighbouring communities benefit from its operations by supporting and encouraging the development of competitive, industry aligned and locally-based contractors and suppliers.

  They are encouraged to develop skills in order to competitively bid for work at Worsley and with other industries, in operational, maintenance and construction work.
COMMUNITY RELATIONS

Business breakfasts were held in Bunbury and Collie when the Expansion Project was announced to brief local business people on planned works and potential contracts. A recruitment office was opened in Bunbury and Collie to assist potential employees to pre-qualify for work and register their interest in work opportunities.

Worsley also takes part in business exhibitions and conferences, supports industry and community business forums, supports training for business and promotes its health and safety standards.

Employee Support
The Matched Giving Program has been a big success story at Worsley. This year 103 employees took part in the program, clocking up 9066 volunteer hours and raising $164,116 which was matched by BHP Billiton.

Worsley was ranked the third highest site across all of the BHP Billiton assets in Australia for the number of hours employees volunteered in the community.

Some of the fundraising initiatives at Worsley during the year included 15 workers shaving their heads for the Leukaemia Foundation’s World’s Greatest Shave, raising $7386 and $1500 raised at The Cancer Council’s Relay for Life – all matched by BHP Billiton.

Money donated to the Boddington State Emergency Service hit $20,000 after volunteers who also work at the mine had their volunteer hours matched – BHP Billiton donates $10 for every hour worked.

Community consultation
Worsley has established community liaison committees at its refinery and mine to share information and opinions between the company and representatives of local community groups and government.

The committees generally meet every two months with managers and other employees from Worsley to discuss a wide range of issues.

At the mine, the committee has been concerned with housing and infrastructure issues, which have emerged with the development of a $2 billion plus gold mine project near the town. Road safety, especially on the highway between Pinjarra and Boddington, is also an important issue for the Boddington committee.

The refinery committee has been provided with information about the proposed refinery expansion project, climate change activities, land management and community sponsorship.

There is a Friends of Worsley group made of near neighbours who help to maintain the historic Worsley church. This group meets every quarter to also discuss local land management issues and projects.

During the past two years Worsley representatives have been talking to shire councillors throughout the SW region and with government agencies including the SW Development Commission. Much of this consultation has been to provide updates on the Efficiency and Growth Expansion project.

In addition, Worsley provides community information about mining, refining and shipping activities through displays, brochures, on the web and through the local media.

COMMUNITY SPONSORSHIP PROJECTS

Collie-Donnybrook Cycle Classic
Worsley Alumina has been a long time sponsor of the historic Collie-Donnybrook Cycle Classic. This year the company put its support behind increasing community participation in the event by sponsoring the “Fit For Life” community ride.

This aims to add another dimension to event by encouraging people of all ages and fitness to get involved in cycling by taking part in a community ride in conjunction with the professional race.

Vi Barnham award
Worsley has taken up sponsorship of the annual Vi Barham Award in the Narrogin Education District, which covers much of the company’s mining lease area.

The Award – in its 21st year – is given to the Year 7 student from the district who is considered the most outstanding student in all facets of school and community life.

Morrissey Homestead
Worsley Alumina is supporting the establishment of a new day care centre in Australind for people with physical disabilities.

The $1 million project will cater for a growing demand for this service in the Australind and Eaton region, where many Worsley employees live.

The centre is being sponsored by Morrissey Homestead, which began a similar service in Bunbury in 1984. Worsley’s sponsorship will pay for the fit out of the kitchen area in the new centre.

Regional sporting facilities
The South West region has always enjoyed a high profile in the sport of field hockey with many local players going on to represent Australia at the Olympic Games and other international tournaments.

The Bunbury and Districts Hockey Stadium has begun an ambitious fundraising program to replace its aging sand turf field. Worsley will contribute $20,000 to the appeal, which is targeting about $1 million in total.

Boddington High School
Worsley regularly sponsors a number of annual school awards, as well as incentives for students moving to upper school. The sponsorship agreement will also give the school library the opportunity to build its reading and study resources for upper school students.

Worsley Energy Challenge school launch
The Worsley Energy Challenge is a project which challenges four schools in the South West to cut their reliance on fossil fuels for energy by 20 per cent over the next five years.

The schools will do this by installing sources of renewable energy and by focusing on energy saving practices. Worsley has sponsored the installation of photovoltaic systems at each of the schools.

Western Shield
Worsley Alumina has joined other large businesses in WA to sponsor Western Shield – the world’s biggest wildlife recovery project.

Worsley this year paid its second of five instalments to the program which allows for ground and aerial baiting with 1080 poison, which is harmless to native animals but affects introduced species.

Worsley sponsorship has extended the area of the program, and also the amount of times the forest is baited each year.

Crooked Brook Forest Group
The Crooked Brook Forest Group is a community based group which has developed a forest education centre near Dardanup.

The forest project features walkways, signage and public facilities which are popular with school groups doing environmental studies.

The group is now building a lookout, which will provide a view to the Indian Ocean. Worsley is contributing $7000 to the project.
Riding for the Disabled
The South West Centre of Riding for the Disabled cares for 103 riders, 21 horses and operates three days a week with the help of volunteers. The riders are mostly children with mental or physical disabilities. Worsley donated $6000 to the centre to help build a shed to house vehicles and equipment.

Brunswick River partnership
A three-year partnership between Worsley Alumina and the Leschenault Catchment Council was launched at the Brunswick River foreshore in November. The partnership aims to improve river flow and water quality in the Brunswick River which has been targeted as the second most important river in the South West region for remedial action. Community groups, residents and local schools will be involved in the partnership.

Engineering scholarships
Worsley Alumina awarded six engineering scholarships to local students graduating from high school. The sponsorships of $20,000 each aim to give local students an incentive to study engineering at Curtin University and to take part in vacation programs at Worsley with a view to securing permanent employment.

Crop yield for bowling club
Worsley helped the Boddington Bowling club in its efforts to raise $145,000 to install a new synthetic turf by making some of its joint venture land available to raise a crop. Club members – many of them local farmers – donated time and machinery to sow and harvest the crop, which raised $26,000.

The Smith Family
Worsley continued its support to The Smith Family in Collie by contributing $20,000. The program runs throughout Australia, with the support of BHP Billiton, helping low-income families with education expenses. This year a case worker was employed to assist schools and families. The Collie service aims to have 200 scholarships available to the community by the next school year.

Ribbons of Blue
Worsley has renewed its sponsorship of the Ribbons of Blue project based in the Peel catchment. The key activity is an annual salinity snapshot which involves Catchment Council staff and volunteers sampling 100 sites in rivers around Boddington to measure the health of the river. The data collected is used in planning programs to reduce nutrient levels.

Youth services counsellor
Youth Focus is a community based organisation which provides counselling services to youth ‘at-risk’. With Worsley’s support, a counsellor has been based in the Collie-Bunbury district over the past year. Worsley will continue its annual contribution of $25,000 this year to support the continuation of the service.
2007-08 Community Performance

<table>
<thead>
<tr>
<th>Objective</th>
<th>Status</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review Worsley’s annual sponsorship strategy and community relations plan.</td>
<td>On track</td>
<td>A community relations plan and strategy was completed.</td>
</tr>
<tr>
<td>Participate in industry open days.</td>
<td>Completed</td>
<td>A Community Open Day was held in October 2007 in conjunction with the Chamber of Minerals &amp; Energy as part of the State-wide Resources Open Day.</td>
</tr>
<tr>
<td>Review and upgrade Worsley’s public web site.</td>
<td>Completed</td>
<td>The Worsley public web site has been incorporated into the BHP Billiton web site bhpbilliton.com/worsley.</td>
</tr>
<tr>
<td>Continue to develop relationships with local indigenous groups.</td>
<td>Ongoing</td>
<td>Relationships established with local indigenous groups and representatives.</td>
</tr>
<tr>
<td>Support trade and professional skills in local schools.</td>
<td>Ongoing</td>
<td>Engineering scholarships awarded in partnership with Curtin University. Collie SHS engineering trades partnership continued.</td>
</tr>
<tr>
<td>Encourage increased participation in the BHP Billiton Matched Giving Program.</td>
<td>On track</td>
<td>The employee participation rate for the program has increased from 4.8% to 8.24%.</td>
</tr>
</tbody>
</table>

2007-08 Community Objectives

<table>
<thead>
<tr>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Align Worsley’s Community Relations Plan with BHP Billiton Global standards.</td>
</tr>
<tr>
<td>Review the Community strategy to include feedback from community consultation activities.</td>
</tr>
<tr>
<td>Develop a plan to streamline and simplify the sponsorship application, tracking and reporting process.</td>
</tr>
<tr>
<td>Achieve a 10% employee participation rate in the Matched Giving program.</td>
</tr>
<tr>
<td>Publish the 2008-09 annual public HSEC report by December 2009.</td>
</tr>
<tr>
<td>Maintain bi-monthly meetings of the refinery and mine Community Liaison Committees.</td>
</tr>
</tbody>
</table>
The company actively promotes career opportunities and has been involved in a number of career expos. Worsley runs a number of programs to give prospective employees the opportunity to experience workplace conditions:

- **Work experience**
  Students in Years 11 or 12 at high school or students from TAFE and pre-apprentice course, experience on the job conditions for a week or two at a time. Worsley hosted 44 work experience students in the past year.

- **Apprenticeships**
  Eight new apprentices from the South West signed on at Worsley in early 2008. There are 53 apprentices at Worsley – 47 at the refinery and six at the bauxite mine.

- **Traineeships**
  Worsley’s traineeship program is focused on chemical plant processing power systems control and mining. At June 30, 2008, Worsley had 61 trainees in processing which includes four in raw materials. There are also eight trainees in power systems with another three at the bauxite mine, including one trainee in administration.

The traineeship program includes Worsley’ Indigenous Traineeship Program which aims to improve opportunities for indigenous people to gain general work skills or begin a career in the industry. Each year Worsley takes on at least three Indigenous trainees into the program.

- **Graduate intake**
  Graduates enter a two-year training program involving various aspects of their study. They also take part in the BHP Billiton Group Graduate Program. Intakes occur in January and careers include mechanical, electrical, chemical, civil, software and applications engineering, commerce and human resource management. There are currently 13 graduates working at Worsley.

- **Equal employment opportunities**
  A new committee has been formed to discuss equal employment opportunities, especially to encourage women into the workforce. The Diversity committee consists of a core group of employees, both male and female, who represent different areas across the mine and the refinery. The committee meets bi-monthly to discuss a large range of topics – from the attraction and retention of females at Worsley to uniforms.

**EMPLOYMENT**

Worsley Alumina is one of the biggest employers in the South West with 1304 employees at the refinery and 233 at the mine site on June 30, 2008. At the refinery there are 1185 men and 119 women. The total of 1537 includes 23 part-time or casual staff, 72 trainees and 13 graduates.

This graph shows the number of Worsley employees and the shires they live in.

*Includes Full-time, Part-time, and Casual Staff.*
8 May 2009

Mr J Matthys  
General Manager  
BHP Billiton Worsley Alumina Pty Ltd  
PO BOX 344  
COLLIE WA 6225  

Dear Sir  

**Independent Assurance Program for BHP Billiton Worsley Alumina Pty Ltd**  

The Health, Safety, Environment and Community Report 2008 (the Report) has been prepared by BHP Billiton Worsley Alumina Pty Ltd (Worsley) to provide information to stakeholders on activities and performance particularly for the period 1 July 2007 to 30 June 2008.

An independent assurance program on information and data contained in the Report was conducted during April 2009 by Sustainability staff who had not worked at Worsley in any other capacity. This letter represents an unedited statement of the scope and findings.

The work included:

- review of information and statements or assertions made, to test the accuracy and reliability against source documentation, on a sample basis;
- review of systems and procedures used for all stages of the reporting of information and data;
- interviews with personnel who are involved with the reporting of published information and data; and
- review of the final Report to assess consistency with the findings of the work completed.

Sustainability conducted the assurance program using guidance provided by the International Standard on Assurance Engagements (ISAE) 3000, ‘Assurance Engagements Other Than Audits or Reviews of Historical Financial Information’.

Based on the work, we report that nothing has come to our attention that causes us to believe that the information and data presented in the Report are not consistent with the source documentation.

Yours sincerely  

John Miraglotta  
Environment Manager
Worsley Alumina HSEC, Annual Report 2007-08

We appreciate feedback. Worsley Alumina welcomes your comments on the 2007-08 Health, Safety, Environment and Community Report. Your feedback will provide guidance to prepare future reports. Please complete this form, fold it, seal it and send it to the Reply Paid address below, or fax it to through to 08 9734 8413.

Please rate the report in relation to (tick the appropriate box):

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Not sure</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The information was useful to me</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The information is open and transparent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It is easy to understand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It is easy to follow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There is enough statistical data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Overall rating:**

<table>
<thead>
<tr>
<th></th>
<th>Very good</th>
<th>Good</th>
<th>Average / Not sure</th>
<th>Poor</th>
<th>Very poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>My overall rating of the report would be:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Which section(s) of the report did you find most useful?

Which section(s) of the report do you think can be improved?

Has this report changed your opinion of Worsley operations?  □ YES  □ NO

If yes, in what way has it changed?

Do you have any other comments to make?
SUSTAINABLE DEVELOPMENT POLICY

We aspire to Zero Harm to people, our host communities and the environment and strive to achieve leading industry practice. Sound principles to govern safety, business conduct, social, environmental and economic activities are integral to the way we do business.

Wherever we operate we will develop, implement and maintain management systems for sustainable development that drive continual improvement and ensure we:

- Do not compromise our safety values, and seek ways to promote and improve the health of our workforce and the community;
- Identify, assess and manage risks to employees, contractors, the environment and our host communities;
- Uphold ethical business practices and meet or, where less stringent than our standards, exceed applicable legal and other requirements;
- Respect, uphold and promote fundamental human rights within our sphere of influence, respecting the traditional rights of Indigenous peoples and valuing cultural heritage;
- Encourage a diverse workforce and provide a work environment in which everyone is treated fairly, with respect and can realise their full potential;
- Take action within our own businesses and work with governments, industry and other stakeholders to address the challenge of climate change;
- Set and achieve targets, including energy efficiency and greenhouse gas intensity, that promote efficient use of resources and include reducing and preventing pollution;
- Enhance biodiversity protection by assessing and considering ecological values and land-use aspects in investment, operational and closure activities;
- Engage regularly, openly and honestly with our host governments and people affected by our operations, and take their views and concerns into account in our decision-making;
- Develop partnerships that foster the sustainable development of our host communities, enhance economic benefits from our operations and contribute to poverty alleviation;
- Work with those involved through the lifecycles of our products and by-products to enhance environmental and social performance along the supply chain and promote their responsible use and management;
- Regularly review our performance and publicly report our progress.

In implementing this Policy, we will engage with and support our employees, contractors, suppliers, customers, business partners and host communities in sharing responsibility for meeting our requirements. We will be successful when we achieve our targets towards Zero Harm, are valued by our host communities, and provide lasting social, environmental and economic benefits to society.

HSEC MANAGEMENT STANDARDS

BHP Billiton owns and operates a diverse range of businesses in different countries and cultures around the world that, by their nature, may affect the health and safety of people, the environment or communities.

As stated in the BHP Billiton Charter, we have an overriding commitment to sustainable development and we pursue this through the effective management of HSEC. We aspire to Zero Harm and seek to ensure our business contributes lasting benefits to society through the consideration of health, safety, social, environmental, ethical and economic aspects in all Company decisions and activities.

These standards form the basis for the development and application of HSEC management systems at all levels in BHP Billiton.

During the 2008/09 financial year, BHP Billiton revised these standards and implemented a suite of Group Level Documents which included revised HSEC standards.