

## Rio Tinto Borax's Initiative on Sustainable Development in Mining Operations

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**ABSTRACT:** Sustainable Development is defined as "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs." In late 1998, Rio Tinto joined with a number of the world's largest mining companies to develop the Global Mining Initiative to ensure that the mining, metals, and minerals industry addressed global needs and challenges. Early in 2000, Rio Tinto Borax was selected as the pilot project within Rio Tinto to develop and test the concepts of sustainable development. As a result, Rio Tinto Borax embarked on a major project with a mission to ensure that the company's operations and products contribute to the three pillars of Sustainable Development: economic, environmental, and social. A global team has developed live primary objectives to support the project mission, and each objective is further supported by indicators, metrics and targets. Examples will be taken from Rio Tinto Borax's global operations as well as from its world class mine and processing facility in Boron, California, USA.

### 1 BACKGROUND AND INTRODUCTION

Early in 2000, Rio Tinto Borax embarked on a major initiative with a mission to ensure that its operations and products contribute to sustainable development. Borax was selected as the pilot company to carry out a case study of the role of sustainable development in the daily operations of one of Rio Tinto's major business units. The outcome of this pioneering case study would then be a valuable guide to other Rio Tinto business units also launching sustainable development projects. Rio Tinto is one of the leaders in the group of the world's largest mining companies who in 1998 joined together in the Global Mining Initiative (GMI) to ensure that the mining, metals, and minerals industry faced global needs and challenges. The GMI was formed to address the question: how best can the mining and minerals industry contribute to the transition to sustainable development? The GMI has been successfully concluded at the global conference in Toronto on 15 May 2002 with structures and relationships in place to help answer this question ([www.ulobalmining.com](http://www.ulobalmining.com), see also, [www.icmm.com](http://www.icmm.com)).

Sustainable development is defined in the Brundtland report as "development that meets the needs of the present generation without compromising the ability of future generations to meet their needs." The Borax team developed a definition of sustainable development, which applies to the day-

to-day decision making of Borax management. It includes an integrated consideration of economic performance, environmental management, and social responsibility. This is underpinned by ethical, transparent, and accountable business practices. In practical terms, it means that all business decisions involve trade-offs in which the three pillars of sustainable development, economic, environmental, and social, must be considered. Under the leadership of Dr. Elaine Dorward-King, Borax's Global Executive Environment, Health and Safety, a cross-functional and multi-cultural team developed the mission, objectives, measurements, and initial projects to drive Borax to achieve tangible results in sustainable development in 2001 (Rio Tinto Borax 2001 Social and Environmental Report). Dr. Dorward-King is now Head of Health, Safety and Environment for Rio Tinto Ltd, London, and leadership of Borax sustainable development teams has been continued by the Borax Chief Executive, Preston Chiaro, and the Borax Executive Team. In 2003, as sustainable development is transitioning to full integration into day-to-day Borax operations, leadership of the initiative has been assigned to an Executive triumvirate representing the three pillars of sustainable development-Jeff Olsen, Chief Financial Officer, Jim Qin, Chief Health, Safety, and Environmental Officer, and Alexis Fernandez, Chief Communications Officer (also responsible for community relations).

## 2 BENEFITS TO BORAX

Early in the initiative, it was recognized that the business benefits of sustainable development had to be identified and understood. Thus a concerted effort was undertaken to quantify these benefits, which were termed "success factors" in recognition of their importance. The success factors emerged during the numerous projects that were undertaken as the indicators of progress toward reaching the objectives of sustainable development. Overall, it was recognized the sustainable development program differentiated Borax in the mining industry as an innovator and leader in the marketplace by managing risk, improving efficiency, stimulating innovation, bringing value to customers, and by managing reputation. The latter is critical to the success of any natural resource company, where the agreement of the outside community and appointed regulators is necessary for continued operations (effectively a license to operate).

## 3 OBJECTIVES

Rather than dealing only with abstract concepts, the Borax sustainable development effort has evolved through the completion of numerous projects, headed by team members with assistance from employees. This process can best be illustrated by the *measurement pyramid*, shown in Figure I. The pyramid illustrates with an example from the health and safety objective how the Borax sustainable development mission-"Rio Tinto Borax Operations and Products Contribute to Sustainable Development"-is supported by objectives, indicators or suc-

cess factors, metrics for measurement, targets, and supporting projects. Since 2000, over 80 projects have been carried out by Borax teams in support of Borax's objectives in sustainable development. Details of the 2002 projects are available in the "2002 Progress Report, Borax and Sustainable Development," a copy of which can be obtained by contacting Borax through its web site at [www.borax.com](http://www.borax.com). Borax's objectives cover each of the key areas of sustainable development and are listed below:

- To protect the safety and health of employees, contractors, neighboring communities, and the public.
- To enhance the human potential and well-being of communities and employees.
- To maximize efficient utilization of resources while minimizing environmental impacts of our operations.
- To optimize our economic contribution to society.
- To expand how our products contribute to sustainable development.

## 4 HEALTH AND SAFETY

Safety is the top priority at Borax, and very early in the program the sustainable development team recognized "number of injuries" as a key success factor. There were no fatal accidents in 2001 and 2002. Borax also achieved an 83 percent decrease in serious injuries, as measured by Lost Time Injuries (LTI's) and LTI Frequency Rate, and the All Injury Rate, which includes minor injuries, decreased by 25%. A summary of the results is shown in the following Table 1.

Table 1 A. summary of results

<i>(a) Injury Measure</i>	<b>2001</b>	<b>2002</b>	<b>% Change</b>	<b>2002 Goal</b>
Fatalities	<b>0</b>	<b>0</b>	<b>0</b>	0
Lost Time Injuries	<b>18</b>	<b>3</b>	-83.3	-50%
Medical Treatment Cases	<b>20</b>	24	20.0	
LTI Frequency Rate	0.92	0.16	-82.6	-50%
Total Injuries	<b>18</b>	<b>27</b>	-28.9	
All Injury Rate	<b>1.94</b>	<b>1.45</b>	-25.3	
Severity (Shifts Lost)	502	278	-44.6	
Severity Rate	<b>25.6</b>	<b>15</b>	-41.4	

The excellent performance-the best in Borax's history and the best among Rio Tinto operating companies-confirms the effectiveness of Borax's safety program which emphasizes preventing injuries by focusing on unsafe behaviors and conditions, identified by the implementation of Safety Management Audit Training (SMAT) at all sites including offices. Another important initiative towards the goal of reducing injuries is the near miss reporting system.

started in January 2001. In a near miss, the injury or equipment damage is averted but other risks are in place that could result in an accident. Near misses are investigated including a root cause determination just like actual accidents, and thus near misses are valuable learning tools to prevent an actual related accident from occurring. In 2001, 54 near misses were reported, and 64 in 2002, for a combined ratio of reported near misses to all injuries of 4:1. The

target in 2003 is a reported near misses to all injuries ratio of 7:1, which is felt to be a level where significant impacts on reducing accidents will be seen. This target is to include increased emphasis on analysis of "recovery actions" that employees took to prevent an actual accident from occurring.

## 5 COMMUNICATION AND COMMUNITIES

The key focus of Objective 2, the human potential and communities objective, was to increase internal and external consultation and mutual understanding of sustainable development principles. Results of a 2000 survey of employees and external opinion leaders showed they knew little about sustainable development, but they wanted to know more. In response to these results, information about sustainable development was provided to employees in a number of forms including a series of workshops held in 2002 at most global sites. Opinion leaders received the 2001 Social and Environmental Report and throughout the year Borax representatives presented the sustainable development project to external audiences which included colleagues in the mining industry, community leaders, customers, trade associations, governmental officials and NGO's. In addition, a community needs assessment (CNA) was carried out in the community immediately adjacent to our Boron operation. The CNA, which was conducted in partnership with local government and the community, identified drug and alcohol abuse, attracting new business, youth activities, and unemployment as the four critical issues facing the community. Working groups have been organized to address these issues and move ahead with solutions in 2003. As a follow up to this action plan, the Borax Communities Department has set a target for 2003 of aligning 75% of the Borax-supported community programs with needs identified in the CNA.

## 6 MINING, REFINING, AND ENVIRONMENTAL PERFORMANCE

Efficiency in mining, refining, and environmental performance is a key objective of sustainable development and the benefits are multiple-economic through high efficiency and low risk operations and social in the public's expectation that mining businesses operate in a way that doesn't harm the environment or people. Projects geared towards improving performance at Borax's operating sites in operating and environmental efficiency fall into the following categories: mining efficiency, refining ef-

ficiency, global supply chain, and environmental improvements.

### 6.1 Mining Efficiency

2002 Borax set aggressive targets for improving its energy, water, and fuel use. While in 2001 a significant reduction in water usage in the mine was seen, 2002 water usage (used for dust control on haul roads) was not improved due primarily to changes in hauling patterns. Fuel usage was almost flat from 2001 to 2002 as part of the haul truck fleet was put on standby. Two areas where efficiency targets were exceeded were in fuel usage by auxiliary equipment such as graders and in the amount of blasting powder used.

### 6.2 Refining Efficiency

In our Boron operation. Borax met the recovery target in the primary process (sodium borate) plant and reduced effluents to the ponds by nine percent from 2001, however water usage increased. The boric acid plant did not meet recovery or water usage targets, however production was at record levels with longer intervals between equipment maintenance. Condensate return and plant availability were below target in the primary process, and the cogeneration plant exceeded the plant on-stream target. Overall refinery scheduled and predictive maintenance performance was slightly below target. The Coudekerque plant (France) met targets to reduce waste and improve efficiency in the borax decahydrate plant, and in Borax Argentina, both process plants were on target for recovery. At the Wilmington plant in the Los Angeles harbor, throughput targets for zinc borate and spray dry were not met and improvement projects will continue, however the plant set aggressive targets to reduce water usage and volume of waste to the sewer system, and both targets were achieved (Figures 2 and 3).

### 6.3 New Primary Crusher

At Boron, the Jeffrey impact primary ore crusher, which had been in service since 1960, was replaced in 2000 by a new crushing system employing MMD toothed double roll sizers in two reduction stages. Benefits included an increase in processing rate, improved particle size distribution with less fines and surges of coarse lumps, and reduced maintenance-all part of sustainable development (Mineral Processing on the Verge of the 21<sup>st</sup> Century, Ozbayoglu, et al., eds, 2000 Balkema. Rotterdam, ISBN 90 5809 172 4).

Table 2

MINE EFFICIENCY FACTOR	2001 Performance	2002 Target	2002 Performance
Fresh water use in Boion mine	38% reduction	Additional 28% reduction from 2001	3% increase from 2001
Fuel use for haul tickets	0.0152 gallons/mile/avg. truckload	Maintain 2001 levels	0.0159 gallons/mile/average truckload
Blasting efficiency (powder factor)	0.35 lbs of ammonium nitrate/ton	0.33 lbs/ton	0.30 lbs/ton
REFINING/PROCESSING EFFICIENCY FACTOR	2001 Performance	2002 Target	2002 Performance
Water use in Primary Process and Boric Acid Plant (Boion)	4% reduction from 2000 - PP 17% reduction from 2000 - BAP	11% reduction from 2001 - PP 7% reduction from 2001 - BAP	12% over target - PP 13% over target - BAP
Effluent to Primary Process R-Ponds (Boion)	17% reduction from 2000 - PP	8% reduction from 2001 - PP	9% reduction from target - PP
Recovery in Primary Process and Boric Acid Plant (Boron)	1.1% dec. from 2000 - PP 1.6% dec. from 2000 - BAP	New target set - PP 4.6% inc. over 2001 - BAP	On target! - PP 4% under target - BAP
Condensate return and plant availability (Boron refinery and cogeneration plant)	Target set - PP 76% on-stream - PP	11% over 2001 target - PP 85% on-stream - PP 93.4% on-stream - cogen	Same as 2001 performance - PP 82.3% on-stream - PP 96.1% on-stream - cogen
% scheduled & predictive maintenance compliance (Boron)	Target set in 2002	Scheduled: 65% Predictive: 85%	Scheduled: 63% Predictive: 82%
Throughput efficiency (Wilmington - ZB, spray dry)	Target set in 2002	Target set - ZB Target set - SD	18% under target - ZB 7.5% under target - SD
Wilmington plant water usage and wastewater discharge to sewer	Program initiated in 2002	Baselines measured and water usage and wastewater discharge to sewer reduction initiated	35% reduction in water usage and 55% reduction in wastewater discharged to sewer
Recovery, water and natural gas usage (Argentina)	13% dec. from 2000 - H;0 3% dec. from 2000 - gas	Target set - TI recov. Target set - CQ recov. 17% reduction from 2001 - H <sub>2</sub> O 2.0% reduction from 2001 - gas	1% under target - TI recov. On target - CQ recov. 2.5% over target - H;0 2.2% under target - gas

#### 6.4 Environmental Improvements

An extensive plant dust reduction program was undertaken at Borax's Rotterdam bulk terminal port facility. The project included replacement of old product-handling equipment such as open conveyors with chain conveyors and installation of a pneumatic product transfer system and vacuum clean-up systems for product spillage. The result was a dramatic decrease in dust emissions (< 10 mg/m<sup>3</sup> at each filter

outlet), reduced product spillage, and an improvement in the attitude of management and employees towards plant housekeeping. A similar effort is underway at the Boron refinery in an area where old equipment results in excessive product spillage. At Coudekerque, improved cooling systems resulted in a 50% reduction in boron discharged to the nearby canal, well below permit requirements. Remediation of the Coudekerque gypsum waste pile is well underway, and at Boron, with help from local horti-

culture students, rehabilitation of mining waste overburden piles increased to 60 acres per year, which puts it on track to reach a target of rehabilitating 100 acres per year by 2007. At Borax Argentina, water usage was flat from 2001 to 2002, but gas reduction targets have been achieved for two years in a row. There were zero environmental incidents of any significance in 2002 across all Borax global sites.

#### 6.5 Oil Recycling

Oil recycling units are in place on Boron's fleet of haul trucks. The units, which burn used oil in the fuel, reduce engine maintenance, extend engine life, reduce deterioration of the crankcase oil in service, and eliminate the generation of waste oil. Additionally, these units allow the trucks to increase production hours, as they are not taken out of service for oil changes. Over the life of a truck, use of the fuel recycling units significantly reduces costs and eliminates the requirement to haul waste oil to off-site treatment facilities.

### 7 BORAX PRODUCTS AND SUSTAINABLE DEVELOPMENT

Borax produces five major refined products at its facility near Boron, California: Borax Decahydrate ( $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$ ), Borax Pentahydrate (*Neobor*®,  $\text{Na}_2\text{B}_4\text{O}_7 \cdot 5\text{H}_2\text{O}$ ), Anhydrous Borax (*Dehxbor*®,  $\text{Na}_2\text{B}_4\text{O}_7$ ), Boric Acid (*Optibor*®,  $\text{H}_3\text{BO}_3$ ), and Boric Oxide ( $\text{B}_2\text{O}_3$ ). Smaller volume specialty products are produced at its refineries in Wilmington, California and in Coudekerque, France. Borax ensures that people and the environment are protected from any significant exposure risks through its product stewardship policy. In 2001, Borax revised the policy to incorporate all aspects of sustainable development, and in 2002 communicate that policy to customers and employees. This communication effort will continue in 2003. The five major products produced at Boron were subjected to cradle to gate life cycle assessments (LCAs) in 2002. These LCAs measure the amount of energy and natural resources used, the amount of waste produced, and all environmental impacts in making each product. LCAs will be completed for Wilmington specialty products in 2003. Sustainable development principles are incorporated in the "stage gate process" as one of the hurdles new applications and products for the market must pass through. A sustainable development

checklist ensures that all new applications and products are consistent with Borax's sustainable development principles and objectives. A "leading edge" project underway in collaboration with business, academic, and government partners is the development of long-term replacement of fossil fuel energy sources with hydrogen-powered fuel cells for vehicular and stationary applications. The objective is to utilize the hydrogen storage capabilities of sodium borohydride and related hydroborates as safe and environmentally benign sources of hydrogen to power fuel cells. This is a long-term development process with enormous potential to benefit society.

### 8 WHAT'S NEXT FOR BORAX

In 2003, Borax is progressing in the completion of its goal to integrate the principles of sustainable development into daily decision-making at every level and in every department within Borax. A number of cross-cutting projects were completed in 2002 to achieve this goal. These included incorporation of sustainable development principles into the capital expenditure approval process, application of the principles to procurement decisions from vendors and suppliers, and increased partnerships with customers in key areas with sustainable development components, for example, recycling and re-use of borate feedstocks, and control of borates in wastewater. A logistics and distribution team has been set up to consider applications of sustainable development principles to the Borax global supply chain. The target is to model alternative transportation scenarios, which could potentially reduce emissions and increase transport efficiencies. Employee workshops were held in 2002 and in 2003 to increase employee awareness of the principles and benefits of sustainable development. Projects undertaken by employees were highlighted in these workshops. In 2003, the core sustainable development teams, which have been a mainstay of the project since 2000, have been replaced by a "transition team" lead by an executive triumvirate, consisting of the Chief Financial Officer, the Chief Communications Officer, and the Chief Health, Safety and Environment Officer. Under this new team, Borax is expecting to complete the transition to fully integrating the principles of sustainable development in every aspect of its business and operations (Borax and Sustainable Development. 2002 Progress Report).

