Executive Summary

ES 1 Background

The Gove alumina refinery is located in East-Arnhem Land, Northern Territory and commenced production in 1972. East Arnhem Land covers an area of 96,000 km^2 and accommodates a population of about 14,000 people, with about 3,800 living in Nhulunbuy and the balance in surrounding communities and homelands.

Alcan Gove currently produces about 2.0 million tonnes of alumina per annum for export and employs approximately 1,100 people (including contractors).

The Alcan Gove Expansion Project is a $1.5 billion expansion of the Gove alumina refinery to increase plant capacity to 3.5 million tonnes per annum by mid-2007 with the potential to reach 3.8 million tonnes through optimisation and continuous improvement. The project is also linked to the $500 million Blacktip Gas Project and the $500 million Trans Territory Pipeline Project, which are the subject of separate approvals.

This Environmental Impact Statement (EIS) has been prepared for submission to the Northern Territory Government as part of the environmental assessment process for the Alcan Gove Expansion Project. The EIS has been developed taking into account the Guidelines issued by the Department of Infrastructure, Planning and Environment.

In parallel to this EIS, a Definitive Feasibility Study (DFS) is being undertaken which will include a detailed examination of the design, implementation, risk assessment and cost evaluation of the expansion. The DFS and environmental approvals are expected to be completed by mid-2004 and will form the basis of Alcan's investment decision.

ES 2 About Alcan

The proponent for this project is Alcan Gove Pty Limited, the operator of the bauxite mine and alumina refinery at Gove. Alcan Gove Pty Limited is wholly owned by Alcan Inc (Alcan).

Alcan Inc is a multinational, market-driven company and global leader in aluminium packaging and aluminium recycling. Aluminium is often described as the 'sustainable metal' due to its light weight, high strength to weight ratio, resistance to corrosion and ease of recycling.

Alcan's recent acquisition of Pechiney reinforces Alcan's position as a world-leading aluminium company and a global leader in packaging. As one of the largest aluminium companies in the world, Alcan Inc operates in 63 countries and employs more than 88,000 people.

Australia forms an important part of Alcan's business where the focus is on bauxite mining, alumina refining and aluminium production. The following table summarises Alcan's Australian assets:

Asset	Total Capacity	% Shareholding
Gove and North Queensland bauxite resources	>900 million tonnes	100%
Gove alumina refinery	2.0 Mt alumina pa	100%
QAL alumina refinery	3.7 Mt alumina pa	41.4%
Tomago aluminium smelter	0.475 Mt aluminium pa	51.55%

In recent years, Alcan has strengthened its investment in Australia. This has included an increased shareholding in Gove, QAL and the Tomago smelter. Since 2000, the Australian operations have moved to be the major supplier of alumina to Alcan's downstream operation worldwide.

ES 3 Alcan's Environmental Commitment

Alcan's environmental management is governed by an overriding global focus on sustainability which includes:

- Improving performance
  - increasing the social and economic benefits, reducing the environmental impacts of activities, and becoming a more profitable and competitive organisation.
- Strengthening relationships and partnerships
  - recognising and working closely with stakeholders.
- Demonstrating integrity and commitment
  - maintaining high standards and values in day-to-day operations.

Alcan Gove has adopted a number of initiatives to support the global sustainability commitment. These are:

- An Environmental, Health and Safety (EHS) policy that advocates excellence in environmental performance through continuous improvement of awareness, understanding and performance. This policy is the cornerstone of Alcan's global EHS management system known as EHS First.
- Certification to ISO 14001, an internationally recognised standard for environmental management systems (currently awaiting official notification following a successful certification audit).
- Compliance with a company-wide initiative for reduction in greenhouse gas emissions (known as the TARGET program).
- Being a signatory to the Australian Government's Greenhouse Challenge Program and submission of annual reports to the Australian Greenhouse Office on performance against emission management targets.
- Continuous improvement principles rooted in process improvements and extend into the environmental area,
- Annual public reporting on the environmental, health and safety performance of its operations through its Environment, Health, Safety and Community Report.

ES 4 Project Objectives

The primary project objective is to maximise value of the Gove bauxite resource on an environmentally sustainable basis. This will be achieved within the framework of providing a significant contribution to the economic development of the Northern Territory and Australia.

Specific objectives include:

- Providing a timely response to market conditions and increasing global demand for alumina;
- Securing a competitive and sustainable future for the Gove operation through economies of scale;
- Improving the environmental performance of the Gove operation through increased efficiencies achieved by upgraded processing and operational practices; and

- Providing additional benefits to the community through business opportunities, direct and indirect employment and training, including actively developing sustainable indigenous business and investment.

ES 5 Planning Context

In accordance with the requirements of the *Environmental Assessment Act (1982*), Alcan Gove submitted a Notice of Intent (NOI) to advise the Northern Territory Government of its planning to undertake the expansion in March 2003. The Minister for the Environment determined that the project required the preparation of an EIS. Draft Guidelines were then advertised and made available for public comment. Following the public review period, the Office of Environment and Heritage (OEH) prepared the final EIS Guidelines which, after Ministerial approval, were issued to Alcan in May 2003.

The Draft EIS, prepared in accordance with the guidelines, has been released for review to enable the public and government agencies to comment on the Alcan Gove proposal. Location of display centres, submission procedures and purchasing details have been advertised in local newspapers.

Any submissions received by the close of the public review period will be addressed in an EIS Supplement. The Draft EIS together with the Supplement will constitute the Final EIS which will be reviewed by the OEH. Following this review, the Minister for Environment will make a recommendation to the Minister for Business, Industry and Resource Development regarding the project's environmental acceptability and its compliance with the requirements of the *Environmental Assessment Act (1982).* Because the project is a mining related activity, approval for the expansion is given by the Minister for Business, Industry and Resource Development under the requirements of the *Mining Management Act (2001).* All environmental controls required to effectively manage the expanded refinery will be incorporated into Alcan Gove's Mining Management Plan.

In accordance with the requirements of the Commonwealth Government's *Environmental Protection and Biodiversity Conservation Act (1999),* a referral for the project was submitted by Alcan Gove to Environment Australia in May 2003. In June 2003, Environment Australia advised that the project was not a controlled action under the Act. Consequently, final approval of the EIS is the sole responsibility of the Northern Territory Government.

The future planning and approval process that applies to this project is summarised below. Please note these are indicative dates only:

	2004				2005				2006				2007			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Alcan submits Draft EIS	■															
EIS review period	■															
Prepare EIS supplement		■														
Definitive Feasibility Study			■	■												
Ministerial decision			■													
Alcan investment decision			■	■												
Detailed engineering				■	■	■	■	■	■	■	■					
Procurement				■	■	■	■	■	■	■						
Construction				■	■	■	■	■	■	■	■	■	■			
Commissioning												■	■			
Plant start & ramp up														■	■	■

ES 6 Project Need and Benefits

The global long-term growth for aluminium demand is forecast to be about 3% per annum (average aluminium production growth per annum in the 10 years to 2002 was about 3.9%). For every one additional tonne of aluminium demand, an equivalent two tonnes' supply of alumina is required. From a global perspective, a 3% annual growth in aluminium equates to a requirement of an additional 1.35 Mt alumina capacity each year.

The aluminium industry is characterised by decreasing long term prices, tight operating margins and strong competition. Australia's comparative advantage in alumina is attributed to a combination of a skilled workforce, access to energy, and locally available bauxite. At Gove, the key advantage is access to a local bauxite resource. Nevertheless, global competition necessitates continual improvement in the Gove operation. The expansion will provide the opportunity to make a positive step change in competitiveness and therefore support the longer-term viability and sustainability of the operations.

ES 6.1 Economic Benefits

The expansion will deliver a number of economic benefits including:

- Increased exports from $560 million to $980 million per annum;
- Additional Gross State Product (GSP) to the Northern Territory economy of $90 million per annum during construction and $200 million per annum during the operational phase;
- Additional direct employment opportunities (about 1,200 peak construction and up to 120 operational phase);
- Additional government payments through taxes of about $60 million per annum; and
- Ongoing royalty payments.

ES 6.2 Social Benefits

Alcan Gove is a major partner in the local and regional community including the town of Nhulunbuy where a wide range of regional infrastructure and community services are maintained. The viability of the Gove operations is integral to maintaining and enhancing the quality of life of the region.

The company's relationship with local traditional owners, the Yolngu people, is built on trust and a shared vision for the future. An example of this partnership is the establishment of the successful YNOTS training school which promotes cultural understanding and equips young indigenous people with the skills necessary to join the workforce. The expansion will provide opportunities for the employment of YNOTS graduates.

Alcan Gove has an alliance contract with Yirrkala Business Enterprises (YBE), an Aboriginal owned and operated company, with an annual value in the order of $8 million. The proposed expansion will create new and additional opportunities for local indigenous enterprises.

As part of its commitment to both the Aboriginal and non-Aboriginal local communities, Alcan Gove will continue to sponsor and support many events, activities and groups within the local community.

ES 6.3 Environmental Benefits

The expansion will deliver a number of environmental benefits:

- Enhanced digestion technology will improve alumina extraction per tonne of bauxite by 10% and reduce residue produced per tonne of alumina by 25%;
- The liquor purification initiative will enable a 25% reduction in caustic consumption and a 75% reduction in soluble caustic waste per tonne of alumina;
- An overall reduction in energy consumption of 4% per tonne of alumina;
- The waste water inventory reduction project will reduce the inventory of stored water in the Residue Disposal Area, and enable safe runoff to the marine environment;
- Until gas supply is secured to the refinery, a new fuel oil switching strategy (low sulfur/high sulfur) will improve management of air quality during periods of unfavourable weather conditions; and
- The conversion from fuel oil to gas will deliver further air quality and greenhouse gas improvements.

Notwithstanding the above improvements in environmental efficiency, higher alumina production from the expansion will result in an overall increase in the consumption of raw materials and emission loads. Measures to effectively manage the impacts from these emissions will be incorporated into Alcan Gove's Mining Management Plan.

ES 7 Alternatives

ES 7.1 Business Alternatives

Alcan has considered three major alternatives to capture the market opportunities. These alternatives will be benchmarked against the preferred option of a Gove expansion following completion of the DFS:

1. Greenfield project

Alcan continues to investigate the feasibility of investing in greenfield alumina refineries. New opportunities have arisen through Alcan's acquisition of Pechiney in December 2003. The potential greenfield projects currently under consideration are less advanced than the Gove project.

2. Alternate brownfield expansion

Alcan fully owns, or has substantial shareholdings in another six alumina refineries worldwide. A brownfield expansion avoids the high capital cost of a greenfield development as well as providing an opportunity to increase the economies of scale of an existing refinery.

The most competitive alternative refinery for expansion is the Queensland Alumina Refinery, based in Gladstone, where the feasibility of an expansion to over 5Mtpa has been assessed. An incremental expansion of QAL is likely to be attractive, however Alcan's share (41.4%) of the increased production would only be about 600,000 tonnes, well short of the market opportunity. This opportunity is also less advanced than the Gove project.

3. Buy alumina from third parties

There are a number of alumina suppliers who could potentially underwrite further expansion of their facilities through a direct sale to Alcan. This is sub-optimal for Alcan given the cost of alumina per tonne from a Gove expansion is lower than the long-term price for alumina.

ES 7.2 Site Alternatives

The reasons for selecting Alcan Gove as the site for a brownfield expansion include the following:

- Alcan views Australia as an attractive location for growth in its bauxite and alumina business due to availability of a skilled workforce, access to energy, and locally available bauxite;
- There is adequate room available within the existing refinery footprint to accommodate the proposed expansion; and
- The existing production capacity of the Gove refinery is not sufficient to enable it to maintain its position in the future as a competitive low cost refinery. Production capacity must be increased to achieve improved economies of scale to safeguard viability in the future.

On the Gove Peninsula, there are no logical sites for locating the additional refinery facilities other than at the existing refinery site. Any other locations would result in the unnecessary disturbance of additional areas of land and would reduce the opportunities for economies of scale that occur in developing within the footprint of the existing refinery.

ES 7.3 Process Alternatives

Alcan has looked extensively into alternative production process options. However, there are no feasible alternatives to the Bayer process (which is used at Gove and in the majority of alumina refineries around the world) for the proposed expansion.

ES 7.4 Construction Alternatives

The use of pre-assembled modular construction for selected sections of the expansion is the preferred alternative to full on-site assembly. The benefits include a reduction in the number of on-site employees required and the associated demand for accommodation and services, less on-site congestion, improved construction safety, and reduced waste on-site.

ES 7.5 "No Go" Alternative

Ultimately the decision to proceed will be based on approval of the EIS by government and results from the DFS to be assessed by Alcan. The major impact of not expanding would be to reduce the long term viability and sustainability of the Gove operation and the lost economic, social and environmental benefits attached to the expansion project.

ES 8 Existing Alumina Refinery and Mine

The existing operations consist of the mine, the refinery, residue disposal, and the port.

ES 8.1 Mine

The bauxite mine is located on the eastern side of the Gove Peninsula. Bauxite ore from this deposit is mined using conventional open-pit mining techniques. On average, approximately 130 ha are mined each year with a similar area rehabilitated.

Since mining commenced in 1971, 2,296 ha of the mined area has been rehabilitated. The remaining area is currently used for active mining, roads, a crushing plant and support facilities and will be rehabilitated progressively or upon closure. Mining operations are undertaken 24 hours a day, 7 days per week. Current capacity of the mine is about 6.5 Mt/a.

ES 8.2 Refinery

The refinery uses the Bayer process to manufacture alumina. This involves dissolving the alumina component of the bauxite ore in sodium hydroxide (caustic soda) liquor and removing the undissolved component of the bauxite (residue) by settling and filtering. The residue is washed to recover caustic soda and this wash liquor is then evaporated so the caustic strength is increased for return to the digestion process. The evaporation process is cooled by seawater taken from Melville Bay. Alumina trihydrate (hydrate) precipitates out of the caustic soda liquor and is then calcined to produce alumina.

ES 8.3 Residue Disposal

The alumina refinery process produces two main residue streams. The major stream termed “bauxite residue” is a fine-grained material (fine silt and clay sizes) consisting of components such as iron oxide, titanium dioxide, alumina, silica, and sodium aluminosilicate. It is alkaline because of residual caustic soda from the refinery process. The minor stream, termed “residue sand”, is a coarse-grained material predominantly containing silica, iron and alumina.

Current management practice is to dispose of the residues in large purpose-built containment structures at the Residue Disposal Area (RDA). The RDA uses a “dry stacking” process which significantly reduces the land area required for residue storage as well as enhancing revegetation potential. The alkaline waters contained in the RDA are either returned to the refinery, stored in the RDA or neutralised before being discharged to the marine environment. Residue areas will be revegetated after use.

ES 8.4 Port

The Alcan Gove port is situated on each side of Dundas Point in Melville Bay. The bay area adjacent to these facilities is referred to as Gove Harbour. On the western side of Dundas Point there is the Bulk Cargo Wharf which consists of an alumina and bauxite export ship-loading terminal and a fuel and caustic soda tanker unloading terminal. On the eastern side of Dundas Point there is the General Cargo Wharf at which coastal vessels dock to unload bulk materials required for the refinery (eg limestone) and load hydrate for export.

Perkins Wharf is situated further into Gove Harbour and is used mainly by the supply barges as well as two to three fishing charter vessels and occasional commercial fishing boats. Perkins Wharf is also used to unload sulfuric acid, used in the refining process.

ES 9 Proposed Expansion

All new refinery plant and equipment will be located within the footprint of the existing operations. As a result of the expansion, there is no requirement to use any land outside the existing refinery lease areas for process plant and equipment.

The summary table at the end of this Executive Summary highlights the key changes to be introduced by the expansion.

ES 9.1 Bauxite Mining

While the existing mining rate will increase from 6.5 Mt/a to 8 Mt/a, no significant change in the mine plan is required to extract the increased tonnage. The existing mining procedure will continue and all mining will take place in accordance with existing approvals and within the existing mine lease.

ES 9.2 Bauxite Stockpiles

There will be no significant change to the size or method of operation of the bauxite stockpiles at either the mine or the refinery. However, there will be an increased turnover of the stockpiled bauxite to match the refinery's higher consumption rate.

ES 9.3 Grinding and Digestion

Bauxite is fed into a grinding mill together with caustic liquor recovered from the process to produce bauxite slurry. The ground bauxite slurry is then mixed with hot recycled caustic liquor and passed through a series of digesters to extract alumina.

The expansion will replace existing grinding mills with larger units and an extra slurry heating facility. The existing low temperature digestion process will be converted to a high temperature double digestion process for all refinery stages. This will result in a 10% improvement in alumina extraction and 25% less residue per tonne of alumina.

ES 9.4 Residue Separation, Filtration and Washing

Undissolved impurities such as sand and iron oxide are separated from the alumina rich caustic liquor (pregnant liquor).

The existing multi-stage thickeners, which are currently used for residue separation, will be converted to additional washers and Alcan high rate decanters will be used for residue separation.

This will minimise the current practice of the temporary storage of caustic material on the ground when the existing thickeners are descaled. The new high rate decanters are designed to prevent scale build up and will eliminate caustic contamination of ground around the thickening area.

ES 9.5 Precipitation

Pregnant liquor is cooled and seeded with alumina hydrate crystals to initiate the precipitation process.

Additional multiple precipitation tanks and another cooling tower will be installed to increase precipitation capacity.

ES 9.6 Classification and Filtration

Hydrate classification separates the precipitation slurry into three sizes as product, fine seed or coarse seed. Each hydrate fraction is filtered to remove liquor, which is recycled. The product hydrate is washed and filtered again to

remove any remaining caustic, and then conveyed to calcination. The fine and coarse seed is recycled back to precipitation.

Additional hydrocyclone classification and vacuum filtration systems will be installed to match the increased refinery capacity.

ES 9.7 Calcination

High temperature kilns drive off chemically bound water from hydrate to form alumina which is cooled and stored in silos prior to shipment.

Three new efficient stationary calciners will achieve a 16% improvement in energy efficiency. Dust emissions rates will reduce by over 95%.

Associated upgrades will include new hydrate conveyors, upgrading of the alumina transport systems, and a new alumina silo.

ES 9.8 Evaporation

The evaporation plant removes water from the recycled liquor to produce strong caustic liquor suitable for re-use in digestion area. The water evaporated from the liquor is condensed and re-used for washing in the process.

An additional multi-stage evaporation plant will be installed. Unlike the existing system which has a seawater cooling water discharge, the new evaporation facility will have a closed circuit cooling system. This means that for the new (Stage 3) evaporation plant there will be no potential for carryover of caustic to the marine environment.

ES 9.9 Liquor Purification

Liquor purification is a process designed to reduce the organic impurities in the residue to enable maximum recycling of caustic liquor.

Liquor purification, which is based on a new process, will result in 25% less caustic consumption and a 75% reduction in soluble caustic waste going to the RDA per tonne of alumina produced. Air emission and other tests undertaken at a pilot plant have confirmed the sound environmental and health performance of this process.

ES 9.10 Residue Disposal

Bauxite residue will continue to be dry stacked, an efficient means of disposal minimising the required area and maximising revegetation potential.

Whilst the improved digestion process installed during the expansion will generate less residue per tonne of alumina, there will be an increase in the amount of residue produced due to the refinery's increased production rate. The additional residue generation will result in the existing RDA storage ponds being filled earlier than originally planned. To minimise the requirement for new storage ponds, it is planned to reduce, and in time eliminate, the current waste water inventory at the RDA. This will be achieved by implementing the liquor purification process to maximise the amount of waste water to be recycled from the RDA back to the refinery, and the neutralisation process to initially enable the disposal of surplus waste water and ultimately to neutralise all residue streams. The

combination of these processes will enable the RDA storage areas currently used for the storage of alkaline waste water to ultimately become available for residue storage.

The neutralisation process produces a quantity of neutralised (saline) residue which needs to be kept separate from the alkaline storage areas to avoid re-contamination so as to maximise the recycling of the remaining alkaline waste water. In the medium term this will add some complexity to the operation of the RDA, however as the inventory of alkaline waste water is progressively reduced, the operation will be substantially simplified and the environmental issues associated with storage of large volumes of waste water progressively eliminated.

The current revision of the long range RDA plan will include the detailed sequencing necessary to effectively store alkaline residue, neutralised residue and waste waters. The plan will also include the rehabilitation and decommissioning strategy for the RDA. In the short term (up to 2011) it is expected all storage areas will be contained within existing lease areas. Any new storage ponds that may be required are not included in this EIS and will be the subject of separate environmental approvals. The timing of any additional storage dams will depend on the level of rainfall received (and hence storage volume needed) and the timing of the neutralisation project.

ES 9.11 Fuel Type

The refinery requires fuel for the operation of the power station and calciners.

The expansion design will incorporate sufficient flexibility for the refinery to use either fuel oil or natural gas. A Heads Of Agreement has been signed for natural gas supply to the plant. Fuel oil will continue to be used until natural gas becomes available, with strategies such as switching from high sulfur to low sulfur fuel oil when the wind is predicted to blow towards populated areas.

ES 9.12 Electricity and Steam

The refinery is supported by an efficient co-generation power station that produces steam and electricity for the process and supplies electricity to mining operations, Nhulunbuy town and nearby communities.

Currently there are three high-pressure boilers and turbines at the power station generating electricity and steam. An additional boiler is currently being installed. The increased steam and electricity demand from the expansion, township and communities will be met by the installation of a further boiler and turbines.

ES 9.13 Water Supply

The water supply for the refinery, mine and surrounding communities is sourced from bores located near the airport.

The expansion will increase the refinery's demand for water. Water demand management will be optimised to minimise the amount of water extracted from the bores. The preferred location of an additional bore field has been identified and approvals for its installation will be sought.

ES 9.14 Port Facilities

The port facilities established in Melville Bay are used for handling alumina, bauxite, hydrate, general cargo and bulk liquids. Oil, liquid caustic soda and petroleum products are pumped from vessels at the tanker jetty to their relevant storage tanks.

Ship movements will increase by about 25% as a result of the expansion. The existing bauxite ship traffic will cease prior to the commissioning of the expanded refinery and alumina ship movements will increase because of the higher alumina production rate. The average ship size will reduce as alumina ships are smaller than bauxite ships. Lime and caustic imports are likely to increase in line with increased production.

During construction, most large construction equipment and pre-assembled modules will be transported to Gove by barge or small ships. This will result in a temporary increase in shipping movements and will require upgrading of the existing wharf facilities owned and operated by Perkins shipping. Perkins are currently investigating options to expand the current wharf facilities within their existing lease to accommodate these requirements.

ES 9.15 Workforce

Alcan Gove currently employs approximately 1,100 people, including contractors.

The construction phase will extend for about 30 months. On average during this period, there will be an estimated 675 people (peak construction team of about 1,200 people). These workers will be accommodated in a serviced construction village to be developed on vacant land located on Arnhem Road adjacent to the Captain Cook Shopping Centre. This is the site of the construction camp used for the original development of the refinery at Gove.

The workforce will be determined during the project design phase but it is anticipated that up to 120 new jobs will be required for the expanded operation.

ES 10 Expansion Impacts

ES 10.1 Community Input

A social impact assessment has been undertaken to consider the social and community effects of the proposed refinery expansion. It included consideration of a wide range of social issues such as land use, residential communities, the demography of the area, the employment profile, training, community services and facilities, housing type and demand, health services, recreation and tourism. Community attitudes on impacts of the expansion were obtained via meetings and survey work.

Most feedback indicated that lifestyle, proximity to the coast and employment opportunities were the three aspects they enjoyed most about living in the area. The key perceived advantages of the project for the local communities were:

- Improved environmental performance;
- Less dust and air emissions into local environment;
- Adding value to ore taken from the area;
- Continued payments to Yolngu owners; and
- Expansion of local services due to an increased population.

The primary concerns expressed were:

- Cost and availability of accommodation with an increased population;
- Ability of the power supply system to cope with any additional demand caused by the expansion;

- Capacity of the current port facilities to accommodate all materials coming in / going out during construction and following expansion;
- Air emissions and dust increasing with expansion;
- Impacts on water quality in Gove Harbour;
- Social impact of increased population during construction;
- Increased bauxite residue production and waste disposal;
- Transportation method for workers from accommodation to the refinery site during construction phase;
- Risks associated with adopting liquor purification process; and
- Impacts on traditional fishing and marine gathering areas in Gove Harbour.

The most common issues for respondents were air emissions, marine water quality, and potential effects of the construction workforce on the local communities.

Environmental controls and management measures have been developed to ensure that potential impacts are minimised in the areas highlighted by the community. These include:

- Air pollution controls and testing on all major equipment, including liquor purification, to ensure satisfactory air quality;
- No additional discharge points to the marine environment;
- Adoption of new technology for calcining to improve energy efficiency and reduce dust emissions;
- A fully serviced accommodation village for construction workers, together with a code of conduct;
- Measures to maximise the life of the existing RDA through continued dry stacking and implementation of the waste water inventory reduction project;
- Expansion of the power station to accommodate additional operational and community demands; and
- Expansion of port facilities to enable equipment delivery during the construction period.

The closest community to the refinery is Galupa (located across the road from the refinery's front gate). Alcan Gove is currently working with the Galupa people to manage potential impacts from its operations and to explore suitable mitigation strategies.

ES 10.2 Cultural Heritage

Alcan Gove recognises the importance of Yolngu cultural heritage in the north-east Arnhem region. No significant sites will be affected by the expansion.

Alcan's approach to cultural heritage is based on respect for the Yolngu as traditional owners of this region and recognition of the importance of their cultural heritage.

Alcan Gove is committed to continue its involvement with Yolngu people through initiatives such as:

- Ongoing consultation on Alcan Gove operations and the proposed expansion;
- The YNOTS indigenous training program which is helping to strengthen Yolngu culture through education, training and employment. During 2004 and 2005, YNOTS will be focused on preparing trainees for job opportunities likely to arise from the proposed expansion.

- The Alcan Gove cross-cultural training workshop to increase employees' awareness of Yolngu culture and help build cross-cultural bridges.
- The Garma festival which is helping to preserve cultural heritage and stimulate debate about significant cultural issues.
- Support for organisations such as Dhimurru, Yirrkala Dhanbul Landcare, YBE and the Harmony Djamamirri Mala group.
- Support for the Community Reference Group.
- Working with Yolngu organisations to maximise employment opportunities and support the development of Aboriginal-owned businesses.
- Actively working with Yolngu organisations to ensure sites of cultural significance are not disturbed by the expansion.
- Cross cultural training for construction contractors.

ES 10.3 Waste Management

Alcan Gove will continue to comply with the NT *Waste Management and Pollution Control Act 1998* and the *Waste Management and Pollution Control (Administration) Regulations 2001* which cover waste such as tyres, containers that are contaminated with residues of a listed waste and hydrocarbon etc.

Previous waste audits have identified a range of process and commercial waste streams. Measures are in place to ensure proper disposal and recycling where facilities are available.

Alcan Gove will continue to manage solid and liquid wastes during construction and in the future operation of the expanded refinery in accordance with the principals of minimisation, reuse, recycling and finally disposal. This includes adopting waste-conscious design principles and planning prior to commencement of construction activities; incorporating waste management considerations in equipment specifications; reusing/recycling excess and waste materials; storing and disposing of waste materials in an appropriate manner; and instituting management controls for these programs.

ES 10.4 Air Quality

Alcan Gove is committed to sustainable improvements in air quality through efficient practices and leading technology. Air quality outcomes have been modelled for both energy fuel source options – fuel oil and gas.

Post-expansion air quality has been predicted through modelling and by comparing projected air quality directly against the 10-year goals set out in the National Environment Protection Measure (NEPM) for Ambient Air Quality, developed by The National Environment Protection Council in 1998.

An example of the predicted ground level concentrations at Gunyangara, an aboriginal community located 3 km south-east of the refinery, is given in the following table. The predicted concentrations, expressed as $\mu g/m^3$, represent the highest values expected to occur within the exceedences allowed by the NEPM goals.

Measure	NEPM Goal (to be met by 2008)	Current Refinery (2.0 Mtpa)	Expanded Refinery (3.8 Mtpa)	
			Fuel oil	Gas
Sulphur Dioxide	1 hr avg = 524	370	350	230
Dust – PM_{10}	1 day avg = 50	26	10	10

Measure	NEPM Goal (to be met by 2008)	Current Refinery (2.0 Mtpa)	Expanded Refinery (3.8 Mtpa)	
			Fuel oil	Gas
Carbon Monoxide	8 hr avg = 10,000	0.003	0.0007	0.0007
Nitrogen Dioxide	1 hr avg = 226	41	21	21
Lead	1 year avg = 0.5	0.00003	0.00002	0.00001

Note: Goals and results expressed as µg/m^3

The table shows that all the NEPM goals are met at Gunyangara. Modelling has shown that the NEPM goal will be met at all residential locations in the vicinity of the expanded refinery.

The refinery is the only significant industrial air emission source in the region and the major air quality impacts are from dust and sulfur dioxide emitted. Dry season bushfires are a significant non-industrial source of air emission.

Liquor purification emissions were assessed by pilot plant trials and were included in the modelling.

The current ambient air quality-monitoring program at Alcan Gove consists of hourly average measurements of sulfur dioxide at the front fence of the refinery and small dust particle measurement at sites within the refinery boundary and at the mine.

Metrological conditions can impact on the dispersion of emissions and a proactive fuel switching strategy will be implemented to manage these impacts.

The expansion will also incorporate a number of features that will result in improved air quality. For example, tall stacks on new equipment will aid dispersion, and dust controls on new calciners and other equipment will reduce particle emissions.

Emission estimation and dispersion modelling indicated that there is likely to be a slight increase in ground level odour concentrations at most of the nominated receptor locations from the expanded gas-fired refinery. However, the predicted percentage changes in odour concentration are generally small and any change in odour exposure is unlikely to be noticeable.

ES 10.5 Greenhouse Gases

Alcan is committed to a number of strategies to minimise greenhouse gas emissions including a company-wide program called TARGET (Targeting Climate Change), aluminium life cycle analysis, and Alcan Gove's involvement in the Commonwealth Government's Greenhouse Challenge Agreement.

The aluminium life cycle has significant benefits in terms of greenhouse gas emissions. For example, lightweight aluminium designs for vehicles improve vehicle performance by lowering fuel consumption. Every 10% reduction in vehicle mass provides a 6 to 8% improvement in fuel economy. Aluminium is 100% recyclable and every tonne of aluminium used in place of steel eliminates 20 tonnes of greenhouse gas emissions over the average life of a motor vehicle. Alcan is heavily involved in the development of lighter weight, energy efficient vehicles, having established a number of partnerships with major vehicle manufacturing companies around the world.

In 2001, the first year of the TARGET program, Alcan's global operations reduced greenhouse gas emissions by some 1.1 million tonnes of carbon dioxide (CO_2), or 5% from 1999 levels on a growth adjusted basis.

Alcan Gove has reduced specific emissions of CO_2 per tonne of alumina between 1990 and 2002 by more than 11%. At present, greenhouse gases per tonne of alumina at Alcan Gove are about 20% less than the world average.

Total greenhouse gas emissions will increase proportionally (85%) with increased production when using fuel oil. However when gas is available, the increase will be limited to 36% due to the significant reduction in emissions per unit of fuel consumed.

	Current refinery (2.0Mtpa)	Expanded refinery (3.8Mtpa)	
		Fuel oil	Gas
Total tonnes (millions)	1.6	3.0	2.2
Tonnes/tonne of alumina	0.8	0.8	0.6

To address the increase in greenhouse gas emissions, Alcan Gove is investigating the implementation of a number of greenhouse gas offset projects including several ongoing projects.

The performance of these projects will continue to be monitored, investigated and reviewed. The results will be reported in Alcan Gove's Greenhouse Challenge annual progress reports and in Alcan Gove's annual public review of environmental performance.

ES 10.6 Noise

At the existing refinery, the most dominant noise sources are hydrate filtration, calcination, cooling towers, conveyor start-up alarm and the steam power station. The vacuum pumps from the hydrate area emit low frequency noise which can travel significant distances particularly during calm nights.

Measured noise levels due to these sources are generally within the levels specified in the draft NT regulations. A noise model was constructed to assess the noise impacts of the fully operational expanded refinery. The noise model was validated against measured results.

After estimating noise emissions for the new equipment and then estimating noise levels at important receptors, the expanded refinery will have minimal impact on existing noise levels in the community. The increase in noise levels at all receivers is less than 1 dB(A). Normally a 3 dB(A) increase is required to be significant. A 1 dB(A) increase is expected to be undetectable by residents.

The model also addressed noise impacts during the construction period including building, alarms and traffic. It was concluded that increases in noise levels will be low except at Galupa where there could be some noise impact during construction. Construction activities will be managed to take account of potential noise impacts. Alcan Gove will work with the Galupa community on noise mitigation measures.

ES 10.7 Surface Water Management

Water management is an important aspect of normal and contingency operations at the refinery and RDA. Active water management at the refinery is undertaken to manage stormwater generated from rainfall onto the refinery catchments, and external water transfers into, and from the refinery catchment.

Stormwater collected in bunds around major storage tanks and process tanks is currently either returned to the production process or sent to the RDA. The expanded refinery will increase the proportion to be returned to the process as a result of increased storage capacity.

Stormwater falling outside bunded areas drains to the marine environment. Containment ponds to the west and south of the refinery allow for some settling of first flush stormwater, before discharge. A recent study has identified

actions that can be taken to improve stormwater management. These include separation of contaminated and clean catchments, the development of a new pond to the east of the refinery, improved management of the existing ponds, and flow of contaminated stormwater to the pond system. These improvements will be progressively implemented before the commissioning of the expanded refinery.

Improvement of ground sealing around tanks, supplemented by impervious drainage leading to upgraded secondary ponds will provide containment capacity consistent with the requirements of the relevant Australian standards.

At the RDA, the focus of surface water management is to ensure alkaline waste waters are contained in the existing pond system. Plans are in place to reduce waste water inventory by neutralisation with sea water and to implement improved operational controls.

ES 10.8 Groundwater

Previous groundwater investigations have indicated caustic-contaminated groundwater beneath the refinery. The groundwater and the discharge points along the Northern Beach are regularly sampled and the discharge shows no measurable effect on marine life.

Caustic contaminated groundwater also flows southward from the eastern half of the refinery. Most of the sources are liquor spillages outside of bunded areas, the temporary storage of caustic residue (during vessel cleaning) on road surfaces and clay overlying sandy, permeable soils.

A groundwater recovery system has been in operation since 1994 at the refinery. The results of groundwater pumping measurements indicate that the estimated average groundwater throughflow to the northern and southern beaches is being intercepted by the recovery system. As part of the expansion, improved management practices will be introduced to eliminate the placement of caustic contaminated materials on the ground, plans for improved bunding and containment, and the groundwater recovery program will result in ongoing improvement in groundwater quality.

At the RDA, monitoring indicates small areas of caustic contamination at some points around the fringes of the operation. These areas are managed through detailed investigations followed by preventative and/or ameliorative actions.

ES 10.9 Marine Water and Sediment Quality

Regular monitoring of marine water quality is undertaken by Alcan Gove at numerous sites around the shoreline of the western Gove Peninsula.

In conjunction with the results of this monitoring, marine water circulation modelling has been used to identify an area in Gove Harbour for the existing refinery where the current discharge has an influence.

Modelling shows the expanded refinery will cause little change to this area in the short term since the new equipment will create no significant change to current discharges. From 2005 onwards, the waste water inventory reduction project may result in higher discharge flows, but contaminant concentrations will remain low.

ES 10.10 Marine Habitats

The existing marine environment has been studied extensively and there is good knowledge of the marine flora and fauna around the shoreline of Melville Bay and in the waters near the refinery.

The discharge of wastewater from the refinery into Gove Harbour influences an area between 1% and 2% of the total area of habitat present in Melville Bay. Interpretation of data from physical, chemical and biological surveys has identified an impact on subtidal marine habitats over an area of approximately 120 ha of the seabed of northern Gove Harbour. This includes an area of approximately 70 ha where bottom dwelling species are not found as the habitat is unsuitable.

Little change to the existing zone of impact will result from the expanded refinery. An environmental management plan outlining strategies for the management and monitoring of marine habitats is in place. Ongoing investigations and improvements will be undertaken to progressively reduce the area of Gove Harbour seafloor affected by refinery discharges.

ES 10.11 Terrestrial Biology

Studies of flora in the vicinity of the refinery have identified and catalogued the species present. Species of significance to the local Rirratjinu people have been identified. Aside from the general disturbance that has resulted due to human and industrial activity, the refinery has had little impact on vegetation. There is a small affected area of mangroves at the RDA.

The expansion will result in the clearing of about 1.5 ha of regrowth within the refinery boundary to allow construction activities. The planned construction village will be developed in an area of regrowth where the previous construction village was located. The significant Banyan tree within the refinery boundary will not be affected by the expansion.

Fauna species have also been studied and catalogued and the species identified are typical of tropical Northern Australia. The proposed expansion will not result in significant loss or degradation of wildlife habitats around the refinery or RDA areas. Alcan will continue quarantine practices to minimise the risk of feral animal introduction and maintain current programs to control existing feral animals. Biting insects and mosquitos have been studied and control measures identified. These include minimisation of mosquito breeding areas and employee education programs.

ES 10.12 Terrain and Soils

The soils in the vicinity of the refinery have been studied and catalogued. Areas of existing or potential soil contamination are known and are to be assessed following EHS First principles. If any contamination presents a risk to the environment, a phased assessment will be undertaken. The expanded refinery is not expected to result in additional soil contamination.

ES 10.13 Aesthetics

Overall the proposed expansion is expected to have a low to moderate visual impact on the surrounding areas. Additional landscaping will be put in place in areas along Melville Bay Road.

ES 10.14 Lighting

The expansion of the refinery will result in an increased amount of lighting on the site.

To minimise any effects from this increase, particular attention will be paid to the new lights to be installed at the eastern and southern sides of the refinery to ensure that light spill effects towards Galupa are minimised.

The increased lighting effects at other surrounding residential areas such as Wallaby Beach and Gunyangara will be minor and are unlikely to result in any significant increase in glare.

ES 10.15 Hazard and Risk

To manage its environmental, health and safety risks, Alcan Gove uses a comprehensive risk management process. All activities, products and services, including contractor services, are identified for normal conditions of operation, start-up and shut-down conditions, abnormal situations and emergency situations.

All associated environmental aspects and occupational health and safety (OHS) hazards are identified for each activity. Environmental impacts are identified for each environmental aspect and all OHS risks are identified for each OHS hazard.

Twenty one potential serious events at the expanded refinery have been identified and analysed from a risk perspective. Controls required to avoid these events have also been identified and will be implemented. The study concludes that none of these events has a risk greater than acceptable standards of causing a fatality beyond the boundary of the refinery. Emergency plans are in place to deal with serious events.

ES 10.16 Rehabilitation and Decommissioning

Active rehabilitation at the mine site has occurred since mining began in 1971. The objective is to return a self-sustaining vegetation community comprised of local native species.

Extensive research has also been undertaken in developing effective strategies for rehabilitation at the RDA. Two decommissioned RDAs (Taylor's Pond and Northern Pond) have previously been revegetated. However, because these early disposal areas utilised a "wet disposal" technique they were more difficult to successfully revegetate compared to the current disposal areas which use a "dry stacking" technique. The revegetation of the decommissioned RDAs has not been completely effective and options to improve the standard of revegetation of these areas are being examined. The other residue disposal areas are still in use.

Alcan Gove has a closure plan aimed at identifying the preferred final land use and closure criteria for each of the following operations areas:

- Mine and conveyor corridor;
- Refinery and port;
- Residue disposal area; and
- Town (Nhulunbuy).

This closure plan has been submitted to the Northern Territory Department for Business, Industry and Resource Development (DBIRD) under the Mining Management Act and Regulations 2001 and has been approved in principle.

The closure plan is the basis for the eventual return of the mine, refinery and associated areas to the traditional owners.

ES 11 Environment Management Plans

For each identified area of impact, an environment management plan (EMP) has been developed consistent with Alcan Gove's existing EHS management systems and its commitment to continuous improvement. They are strategic and define a framework for environmental management, whilst at the same time identifying management structures and some specific monitoring, controlling and reporting actions to address potential areas of environmental impact.

ES 12 Community Consultation

Alcan Gove's community relations aims are to add value to the community and to ensure its net impact is positive and sustainable in terms of economic wealth generation, environmental, health and social benefits. Achieving these goals will contribute to greater sustainability for the business, its employees and the community.

The consultation and communication strategy for the proposed expansion began with a comprehensive community consultation program during the preparation of the EIS. The program has been conducted as an integral part of the project's socio-economic impact assessment to ensure issues raised by potentially affected communities are identified and given adequate consideration in the EIS process.

Communication will continue during the approval, construction and operational phases with regular reporting to the community and regulatory authorities concerning the activities, impacts, performance and other issues relating to the project.

Communication will include:

- Community meetings;
- Regular newsletters;
- Information on Alcan Gove website;
- Presentations to key stakeholders;
- Brief companion document to the EIS; and
- Public displays.

For further information, contact Community Affairs at Alcan Gove through the freecall number 1800 199 283 (business hours).

Formal responses to the Draft EIS may be directed:

Mr Rod Johnson
Assessment Officer
Northern Territory Office of Environment and Heritage
GPO Box 1680
Darwin
Northern Territory 0800

Summary of Expansion Components

Component	Existing Refinery	Expanded Refinery	Effect
Mine			
Production	Bauxite – 6.5 Mt/y, open pit (1.8 Mt/y is exported).	Bauxite – 8 Mt/y, open pit. Additional mobile equipment required and existing crushing and screening equipment upgraded.	No change to existing mining and rehabilitation practices. All bauxite consumed in expanded refinery. Bauxite exports cease.
Overland Conveyor	Conveyor from mine to refinery.	Conveyor to remain with slight increase in speed.	No significant change to conveyor operations.
Refinery			
Production	Alumina – 2.0 Mt/y.	Alumina – 3.5 Mt/y increasing to 3.8 Mt/y.	New equipment within existing footprint.
Digestion	Low temperature digestion.	High temperature double digestion (all stages).	10% improvement in alumina extraction and 25% less residue per tonne of alumina.
Mud Separation	Multi-stage thickeners.	Alcan high rate decanters plus conversion of existing thickeners to additional washers.	Two existing redundant washers available for storage of contaminated stormwater. Elimination of caustic to ground from thickener descaling.
Evaporation	Multi-stage evaporation plant with seawater cooling.	Additional multi-stage evaporation plant with closed circuit cooling (Stage 3 only).	No seawater discharge from Stage 3 evaporation process.
Precipitation	Multiple precipitation tanks with two stage cooling and cooling towers.	Additional multiple precipitation tanks and cooling tower.	Extension of existing precipitation operations.
Classification and Filtration	Hydrocyclone classification and vacuum filtration.	Additional hydrocyclone classification and vacuum filtration.	Extension of existing classification and filtration operations.
Calcining	Rotary calciners (4), stationary calciner (1).	Three new stationary calciners plus one existing. One existing rotary calciner on standby and others decommissioned. Stacks for stationary calciners to be 70 m compared to 32 m for rotary calciners.	Improved energy efficiency and dust control.
Alumina Handling	Alumina is stored in four silos and conveyed from silos to ships for export.	Existing alumina storage and shiploading conveyor facilities will remain. Alumina handling systems feeding the silos will be upgraded.	Improved dust control.
Lime Plant	Double shaft lime kiln and two silos.	Kiln capacity to be increased by 40% and additional silo installed.	Increased throughput. Improved stack emission control.

Component	Existing Refinery	Expanded Refinery	Effect
Impurities Removal	Organic impurities purged to residue disposal area.	Liquor purification (all stages).	Organic impurities destroyed in purification process resulting in greater recycling of liquor, 25% less caustic consumption per tonne of alumina, and 75% reduction in soluble caustic concentration in the residue.
Power Station	Three high pressure boilers and turbines with fourth high pressure boiler currently being installed.	Total of five high pressure boiler and turbine units.	Increased power generation capacity.
Fuel	22 PJ of 3.5% sulfur fuel oil.	43 PJ of natural gas (all stages). Eight days per year (approx) when gas supply may be interrupted and 1% sulfur fuel oil will be used.	Reduced sulfur and particulate emission rates and reduced greenhouse emissions per tonne of alumina.
		If gas supply delayed, continue with 3.5% sulfur fuel oil until gas available with SO_2 control by switching to 1.5% sulfur fuel oil with unfavourable winds.	Switching strategy to minimise emission effects.
Residue Disposal Area (RDA)			
Residue and Waste Water Storage	Dry stacking of alkaline residue in containment structures.	Dry stacking of residue to continue. Progressive reduction of waste water inventory through operational controls and neutralisation with seawater.	Prior to capacity of the existing RDA being reached, a new containment area will be required. Investigations and separate approvals for new containment pond locations to be sought.
Air Emissions			
Combustion Emissions	Combustion of fuel oil generates SO_2, NO_x, particulate and greenhouse emissions.	When natural gas supply is secured, new and existing combustion sources converted to natural gas which will reduce emission rates. Additional emission control equipment to be used.	Reduced sulfur and particulate emission rates, and reduced greenhouse emissions per tonne of alumina.
		If gas supply delayed, continue with 3.5% sulfur fuel oil until gas available with SO_2 control by switching to 1.5% sulfur fuel oil with unfavourable winds.	Switching strategy to minimise emission effects.
Fugitive Emissions	Fugitive dust sources include stockpiles, conveyors, roads and shiploader.	No significant additional fugitive dust sources. New dust control measures to be implemented for existing sources.	Overall reduction in fugitive dust emissions.
Liquor Purification	No equivalent technology currently in place.	Emissions from liquor purification plant controlled by scrubber.	No significant air quality effects.

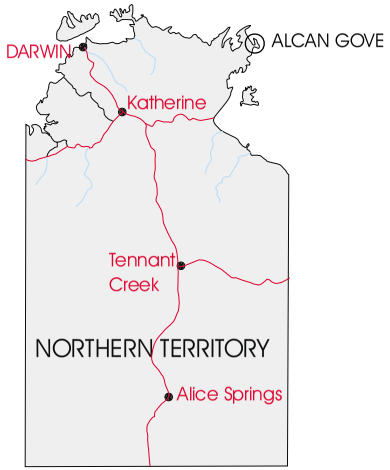
Component	Existing Refinery	Expanded Refinery	Effect
Water			
Bunding and Containment	Most storage and containment areas compliant with Australian Standards.	All new storage and containment areas to be compliant with Australian Standards and existing areas to be upgraded as necessary.	Compliance with bunding and containment standards.
Caustic to Ground	Thickener cleaning and other practices can result in caustic material placed on ground.	Existing thickeners converted to red mud washers and no caustic to ground from thickener operations (all stages).	Significantly reduces the potential for caustic contamination of soil and groundwater.
Marine Discharge	Discharge to Melville Bay of cooling water from the evaporation process (with occasional carry-over events forming precipitate on discharge), some neutralised waste water from RDA, stormwater from the refinery and other minor waste streams.	Discharges to Melville Bay to continue. Evaporation cooling water for Stage 3 will be closed circuit to prevent carry-over events and precipitate formation. Progressively all of the waste water from the RDA will be neutralised and discharged. Stormwater and other minor waste streams will be controlled. Opportunities to improve Stages 1 and 2 discharges to be investigated.	No significant increase in discharge volume or contaminant load.
Water Supply	Wellfield extraction rates within existing permit conditions.	Increased water demand to be met by expanded wellfield. Water demand management programs to be implemented.	New water extraction permit to be sought. Improved efficiency in water use.
Shipping			
Ship Movements	Export of bauxite, alumina and hydrate. Import of fuel oil, limestone and caustic soda.	Bauxite export will cease. Alumina exports will increase. Once gas supply secured, fuel oil imports will cease (apart from occasional delivery of backup supplies). If gas is delayed, fuel oil shipments will increase from 8 to 14 per year.	Ship movements will increase from 113 per year to 143 per year (with gas) or 156 per year (with oil).
Workforce			
Workforce Numbers	Existing workforce is 1,100.	Average construction workforce is 675 and will peak at approximately 1,200. Up to 120 additional positions for ongoing operations.	Construction workers' village to be provided in Nhulunbuy. Operational workers to be accommodated in Nhulunbuy.

URS

ALCAN

SOURCE: ALCAN ENGINEERING PTY LTD.

LOCATION MAP



0 1 2 3 4 5Km

SCALE - 1 : 125 000

ALCAN GOVE REFINERY EXPANSION ENVIRONMENTAL IMPACT STUDY

REGIONAL LOCATION

Project No. 12373-021-559

CAD File No. -g-073.cdr

Date 30-01-04

Rev. A

A4