Alcan Gove Alumina Refinery Expansion Project

ENVIRONMENTAL IMPACT STATEMENT

SUPPLEMENT

May 2004

URS

ALCAN

Introduction

A Draft Environmental Impact Statement (EIS) has been prepared for the Alcan Gove Alumina Refinery Expansion Project.

The Draft EIS was made available for public comment and review from 11 February 2004 to 2 April 2004. In response to this, 17 written submissions were received (6 of which were in a combined NT Government submission). Alcan Gove appreciates the contributions from those who provided submissions. Copies of all these submissions are attached in Appendix A.

Some of the submissions received mentioned the same or similar issues. Over one hundred and forty different topics were raised and these have been listed in Table 1. The table shows which of these topics were commented on by each of the 17 respondents.

This EIS Supplement contains responses to all of the submissions received. It has been divided into sections corresponding to the relevant sections of the Draft EIS. This will facilitate reference back to the Draft EIS to enable responses to be read in context.

In addition to the written submissions, a meeting was held with NT Government agencies to discuss the Draft EIS. Questions raised at this meeting have also been addressed in this Supplement.

Alcan Gove received additional communications from stakeholders after the close of the submission period and has included responses to these in the Supplement.

The numbers in parenthesis after the heading of each section indicate which respondent made submissions on that topic. The numbers relate to the respondent numbers given in the submission summary table (Table 1).

Table 1 - Respondent Matrix

Respondent	Glossary of Terms & Acronyms	ES 8.3 Residue Disposal	ES8.4 Port	ES9.10 Residue Disposal	ES10.4 Air Quality	1.5 Project Schedule	1.7 Planning Issues and Statutory Requirements	3.4.4 Crushing & Screening	3.6 Residue Disposal	3.6.4 Pond Design & Management	4.3.4 Residue Separation, Filtration & Washing	4.3.12 Refinery Inputs	4.4 Liquid Purification	4.5 Waste Water Inventory Reduction	4.6 Residue Disposal	4.7 Port	4.9.4 Construction Workforce	4.9.6 Construction EHS EMP	4.10 Gas Conversion	5.1 Water Supply	5.1.3 Current Water Usage	5.1.7 Wellfield Demand	5.1.8 Wellfield Modelling	5.1.9 Well Field Management & Monitoring	5.2 Energy	5.4 Sewerage	5.5.2 Roads	5.5.3 Shipping	6.4.2 Fuel Alternatives	6.6.5 Air Pollution & Control Technologies	7.2 Waste Management Standards	7.3 Current Waste Management Practices	7.3.1 Solid Wastes
1. Department of Business Industry and Resource Development		■	■	■	■			■		■	■		■									■									■		■
2. Department of the Chief Minister (DCM)											■					■				■														
3. Northern Land Council (NLC)	■																■			■												■	■
4. Department of Health and Community Services (DHCS)							■										■			■						■							■
5. Department of Infrastructure Planning and Environment (DIPE)									■								■			■					■	■	■						
6.Office of Environment and Heritage (OEH)												■		■									■	■	■	■	■	■		■			■
7. Dhimurru Land Management Aboriginal Corporation (DLMAC)																	■																
8. Yirrkala Dhanbul Community (YDC)																		■		■	■		■										
9. Sean Carroll																				■		■	■										
10. Justin Tutty																													■				
11. Museums and Art Galleries of the Northern Territory (MAG)																																	
12. Noel Wright																																	
13. Aboriginal Areas Protection Authority (AAPA)																																	
14. The Environmental Centre Northern Territory (ECNT)						■									■				■				■										■
15. Gove Combined Unionsn (GCU)																																	
16. Gove Amateur Astronomers																																	
17. Northern Territory Police																																	

Table 1- Respondent Matrix (continued)

Respondent	7.4.2 Construction Waste	7.5 Waste Management Strategy	8.5.1 Existing Emission Controls	8.5.3 Emission Control	8.7 Results of Air Dispersion Modelling	8.8 Health Risk Assessment	8.9 Odour	8.11 Air Quality Management	9.1 Alcan's Greenhouse Strategies	9.3 Greenhouse Gas Effects of Refinery Expansion	9.4 Management of Greenhouse Gas Emissions	10.3 Existing Noise Levels	10.5.1 Refinery Noise	10.6.1 Refinery Construction - Noise	10.7 Noise Management	11.3.1 Current Surfacewater Management - Refinery	11.3.2 Residue Disposal Area	11.4 Water Quality Monitoring Program	11.7.2 Seawater Cooling Discharge	11.9.2 Refinery Discharge Quality	11.9.4 Water Quality Monitoring & Impact Mitigation	12.1.3 Groundwater Standards	12.1.4 Existing Environment - Refinery	12.2.4 Existing Environment - RDA	12.2.5 RDA Groundwater Impacts from Expansion	13.2 Monitoring and Investigation Program	13.3.1 Water Quality	13.4.2 Gove Harbour Water Quality	13.4.3 Drimmie Arm Water Quality	13.5.1 Gove Harbour Sediment Quality	13.5.2 Drimmie Arm Sediment Quality
1. Department of Business Industry and Resource Development (DBIRD)			■													■	■	■	■		■	■									
2. Department of the Chief Minister (DCM)										■						■															
3. Northern Land Council (NLC)	■	■				■		■				■	■	■	■							■	■	■	■	■	■	■	■	■	■
4. Department of Health and Community Services (DHCS)																															
5. Department of Infrastructure Planning and Environment (DIPE)				■												■							■				■				
6.Office of Environment and Heritage (OEH)	■			■	■		■	■		■	■			■		■				■			■							■	
7. Dhimurru Land Management Aboriginal Corporation (DLMAC)																															
8. Yirrkala Dhanbul Community (YDC)																	■							■							
9. Sean Carroll																															
10. Justin Tutty									■																						
11. Museums and Art Galleries of the Northern Territory (MAG)																					■		■	■		■	■			■	
12. Noel Wright																															
13. Aboriginal Areas Protection Authority (AAPA)																															
14. The Environmental Centre Northern Territory (ECNT)					■					■																					
15. Gove Combined Unionsn (GCU)																															
16. Gove Amateur Astronomers																															
17. Northern Territory Police																															

Table 1 - Respondent Matrix (continued)

Respondent	13.6 Refinery Expansion Marine Impacts	13.7.1 Refinery Outfall Discharge	13.7.2 Changed Shipping Movements	13.8 Marine Management	14.2.1 Refinery Outfall	14.2.2 Northern Beach	14.2.3 Drimmie Arm	14.3.1 Regional Influences & Marine Biogeography	14.3.2 Southern Melville Bay	14.3.3 Fishing	14.4 Marine Standards	14.5.1 Shipping	14.5.2 Benthic Macrofauna	14.5.3 Turtles	15.2.2 Data Sources – Terrestrial Biology	15.2.5 Regional Context	15.2.6 Flora Survey	15.2.7 Project Effects	15.2.8 Flora Management	15.3.5 Survey Results	15.3.6 Significant Fauna Species & Habitats	15.3.7 Impact Assessment	15.4.1 Previous Studies of Biting Insects	15.4.4 Impact Assessment	16.4.5 Soil Erosion	16.5.1 Earthquake History	17.8.2 Refinery – Visual Impact	18.6 Expansion Impacts - Lighting	19.2 Rehabilitation & Closure Standards	19.3.1 Mine Rehabilitation	19.3.2 Mine Closure Criteria
1. Department of Business Industry and Resource Development (DBIRD)	■																														
2. Department of the Chief Minister (DCM)	■		■	■			■																								
3. Northern Land Council (NLC)		■	■	■	■	■	■	■	■	■	■	■	■			■	■	■	■	■	■	■								■	■
4. Department of Health and Community Services (DHCS)																		■		■			■	■							
5. Department of Infrastructure Planning and Environment (DIPE)																											■				
6.Office of Environment and Heritage (OEH)			■						■		■					■		■													
7. Dhimurru Land Management Aboriginal Corporation (DLMAC)																			■		■								■		
8. Yirrkala Dhanbul Community (YDC)									■						■	■		■	■						■	■			■	■	■
9. Sean Carroll																															
10. Justin Tutty																															
11. Museums and Art Galleries of the Northern Territory (MAG)	■		■	■			■	■	■				■							■											
12. Noel Wright																															
13. Aboriginal Areas Protection Authority (AAPA)																															
14. The Environmental Centre Northern Territory (ECNT)		■							■			■		■							■										
15. Gove Combined Unionsn (GCU)																															
16. Gove Amateur Astronomers																												■			
17. Northern Territory Police																															

Table 1- Respondent Matrix (continued)

Respondent	19.4.1 Refinery Rehabilitation	19.5 Residue Disposal Area - Rehabilitation	19.5.1 RDA Rehabilitation	20.1 Introduction	20.2 Historical Context	20.5 Cross Cultural Relationships	20.6.1 Register of the National Estate	20.6.2 Archaeological & Heritage Place & Objects	20.6.3 Indigenous Sites of Significance	20.8.1 Impact of Alcan Gove Expansion	21.3.1 Nhulumbuy	21.4.2 Demography - Yirrkala	21.4.9 Harmony Djamamirri Mala Group	21.4.11 Tourism	21.5 Social Impact of Existing Alcan Gove Presence	21.7 Social & Community Impacts	21.7.3 Community Facilities	21.8.7 Off-Site Construction	22.4 Economic Effects of Expanded Operations	23.5 Consultation Formats	24.2.3 Consequence Analysis	24.4.4 Emergency Response Plans	25.4.3 Draft Construction Environment Mganagement Plan
1. Department of Business Industry and Resource Development																							■
2. Department of the Chief Minister (DCM)																■							
3. Northern Land Council (NLC)	■	■	■	■		■	■	■	■	■					■	■					■		■
4. Department of Health and Community Services (DHCS)																■	■						
5. Department of Infrastructure Planning and Environment (DIPE)											■		■					■					
6.Office of Environment and Heritage (OEH)			■		■		■	■	■													■	
7. Dhimurru Land Management Aboriginal Corporation (DLMAC)																■	■			■			■
8. Yirrkala Dhanbul Community (YDC)			■						■			■											
9. Sean Carroll																							
10. Justin Tutty																■							
11. Museums and Art Galleries of the Northern Territory (MAG)																							
12. Noel Wright														■									
13. Aboriginal Areas Protection Authority (AAPA)									■														
14. The Environmental Centre Northern Territory (ECNT)					■										■					■			
15. Gove Combined Unions (GCU)																■	■		■	■			
16. Gove Amateur Astronomers																							
17. Northern Territory Police																■							

ES 8.3 Residue Disposal (1)

RDA Rehabilitation (1)

A query was received regarding whether sufficient work has been undertaken to determine a final rehabilitation strategy or if additional research is proposed.

Studies by Alcan Gove and others including Queensland University have identified successful rehabilitation techniques and these have been incorporated into the overall rehabilitation strategy. The rehabilitation strategy is part of the RDA Closure Plan.

Industrial Waste Disposal (1)

A respondent commented that the industrial waste disposal at the RDA be improved in terms of location designation and documentation.

Apart from residue, the three waste streams disposed of at the RDA are industrial waste, process waste (caustic contaminated), and materials containing asbestos. They are managed as follows:

- Industrial waste and caustic contaminated process waste are placed in the RDA scale dump. The scale dump is a well-defined location on the mud farm area, which is contained within the confines of a clay-sealed pond.
- Disposal of waste materials containing asbestos complies with all requirements and accepted techniques

Waste management will be improved in future so that non-contaminated industrial waste will be disposed of at the community landfill. Caustic contaminated industrial waste will continue to be disposed of at the RDA. This will make it easier to reclaim refinery residue should it become a resource in the future. Waste disposal locations at the RDA are documented in the site's GIS.

ES 8.4 Port (1)

A respondent has noted that an increased level of material handling, especially at the shiploader, is likely to generate more dust unless significant improvements are warranted. More details on the shiploader upgrade are sought.

The effectiveness of the current shiploader's dust control is limited because of the need to export both bauxite and alumina on the same system. Once bauxite exports have ceased in 2005, the upgrade can be implemented with more effective dust controls. The detailed design of the dust control system is currently being developed to achieve a dust reduction target of 95% of existing alumina dust loads. Details of the design will be provided to the respondent through the mining management plan process. By the end of 2007 the shiploader will be upgraded.

ES 9.7 Calcination

Section ES 9.7 of the Executive Summary refers to "a new alumina silo". This reference to a new alumina silo is an error. As stated in Section 4.3.8 of the Draft EIS, "no changes to the alumina storage silos will be undertaken as part of the expansion."

ES 9.10 Residue Disposal (1)

Alternative Wastewater Use (1)

A respondent has commented that alternative use of alkaline waste water from the RDA is a desirable option for future residue disposal.

Alcan Gove's overall objective is to reduce the volume of alkaline waste water by a combination of process improvement, treatment and reuse.

Approximately 100 m^3/hr of the alkaline waste water at the RDA is currently returned to the refinery for reuse. An additional 50 m^3/hr is neutralised and discharged via the refinery outfall. The volume of waster water treatment will increase to 350 m^3/hr. This will neutralise the waste water making it suitable for discharge.

Options for alternative uses for the remaining alkaline waste water include:

- Removal of filter cake in security filtration
- General cleaning and hosing in the ferrosilt area
- Gland water for pumps

Currently these activities are undertaken using potable water.

RDA Storage Capacity (1)

A respondent has asked how the capacity of the RDA storage matches the increased residue production rate.

As part of its ongoing management of the RDA, Alcan Gove has prepared a long range plan to indicate how the RDA will be developed to ensure that it can provide secure storage for residue over the life of the refinery. This plan is updated at regular intervals in response to changing circumstances. The plan is currently being updated to reflect the increased residue storage requirements resulting from the refinery expansion. The RDA's long range plan is a component of Alcan Gove's Mining Management Plan which is approved annually by the NT Government.

A key objective of the long range plan is to ensure that the RDA has adequate storage capacity to match the expected residue production rate. The effects of the refinery expansion and the waste water reduction project will be taken into account.

ES 10.4 Air Quality (1)

A respondent has asked if it is proposed to use only one source of energy at any particular time and that two types of energy wouldn't be used simultaneously?

Generally, only one source of energy will be used at a time. This will be fuel oil until gas supply is obtained. When gas becomes available, it will be the energy source except for the infrequent occasions when gas supplies may be interrupted at which time fuel oil will be used. Small or infrequent energy users, the lime kiln and the standby rotary kiln, will remain oil fired.

In addition, a fall back oil firing capability will be maintained in the event of interruption to gas supply.

ES – Summary of Expansion Components

In the section on Liquor Purification in the summary table in the Executive Summary of the Draft EIS, reference is made to the use of a scrubber to control emission from the liquor purification plant. This is incorrect. It is not proposed to use a scrubber because tests have proven the acceptable performance of the proposed ceramic filters.

As discussed in Section 4.4.4.1 of the Draft EIS, organic emissions from the liquor purification plant will be controlled by an efficient incineration process which destroys all organic compounds. Particulates from the liquor purification process will be controlled by an extremely efficient air filter comprised of porous ceramic tubes (Section 4.4.4.2). Testing of the ceramic tubes has shown negligible levels of particulate emissions will be achieved.

1.5 Project Schedule (14)

A respondent has expressed concern that the environmental approvals are being sought before the Definitive Feasibility Study (DFS) is completed.

The EIS and the DFS have been undertaken in parallel as is normal practice for major projects. The DFS provides engineering information intended to estimate project costs. Project operational criteria are already sufficiently well defined by the preliminary engineering phases. More detailed design components being

developed by the DFS have been incorporated into the EIS and the environmental management strategies developed for the EIS have been incorporated into the design.

1.7 Planning Issues and Statutory Requirements (4)

A respondent noted that in addition to the legislation listed in Section 1.7 of the Draft EIS, other relevant legislation includes the Public Health Act and the Food Act.

The applicability of these Acts is noted and Alcan Gove will comply with them. They are currently being taken into account during the integration of the site's occupational health and safety management system (OHSAS 18001).

3.4.4 Crushing and Screening (1)

A respondent has noted that the added dust load in the crushing plant may need some effective dust minimising approach and control measures.

Alcan Gove has upgraded dust control at the primary crusher. Further upgrades to the existing system are scheduled in 2004-2005. These include:

- Upgrading of duct work
- Automation of scrubbing system
- Upgrading of slurry disposal

3.6 Residue Disposal (5)

A respondent has commented that there is a risk of a pollution incident occurring in Melville Bay resulting from failure of one or more of the embankments at the RDA.

Ponds are designed to internationally accepted standards and routinely monitored including recertification to confirm stability and low risk of overtopping. The long-term strategy is to eliminate stored water inventory and this will further enhance integrity and reduce risk of environmental damage.

The operational and maintenance controls are managed through the ISO14001 certified environmental management systems covering:

- Monitoring and inspections which include:
  - Daily physical inspections by operators.
  - Biannual inspections by independent civil engineers
  - Fortnightly water pressure measured in dam walls by piezometers, bores and standpipes
  - Monthly physical movement of the wall measured by independent surveyor using fixed monuments
  - Monthly analysis of water pressure and physical movement data by independent civil engineers
- Maintenance and remedial works which include:
  - Defects from inspections and monitoring logged in a defect register
  - Maintenance completed using YBE service contract
  - Completed maintenance logged and tracked using a punch list system
  - For common defects such as rat-holes, there are detailed maintenance procedures
  - For complex repairs independent civil engineers are used for specialised advice
- Emergency Response Plan which includes:
  - ERP developed in conjunction with independent civil engineers
  - Summarised on an easy access wall chart
  - Details the early warning signs of pond failure, which are also combined in the monitoring procedures
  - Details information on chain of command, risks and potential impacts and resources
  - Describes remedial actions to take to rectify typical faults that could lead to pond failure

– Crisis management actions, covering all necessary communications to local and other communities

3.6.4 Pond Design and Management (1)

Pond Seepage (1)

A respondent has commented that the statement in Section 3.6.4.1 of the Draft EIS that says "no seepage has been observed to date" may not be technically correct or is a very strong claim. It was suggested that it would be more appropriate to state that there are no significant seepages so far. It suggests that a few areas (down stream of Ponds 5 and 6) of suspected seepage need detailed investigation to design action plan/remedial works to minimise the impact.

A geophysics investigation combined with bore data have indicated no significant seepage to date at the RDA. The details of these investigations are reported in Section 12.2.4.2 of the Draft EIS.

Two sites for further investigation are:

- A position near the south-west corner of Pond 5 has been previously investigated and minor seepage suspected. Alcan Gove is developing remediation strategies which may include the installation of an interception and treatment system. A vegetation replanting program will also be implemented.
- A site near the intersection of Pond 5 and Pond 6. Any seepage will be contained by the installation of an interception and treatment system.

Geotechnical Report (1)

A respondent has noted that a geotechnical report on the RDA is expected to be submitted. This report would be an annual dam review report as per Australian National Committee on Large Dams guideline.

A geotechnical report is submitted as part of the annual submission of the Mining Management Plan.

4.3.4 Residue Separation, Filtration and Washing (1,2)

It has been noted that when the existing thickeners are converted to red mud washers, there is a chance of caustic to ground incidents. They would like an explanation as to how it is planned to minimise/eliminate caustic to ground in this situation.

Since the Draft EIS was completed, the design has been improved and there is no longer a need to convert the thickeners to washers. Instead, the 32 existing thickeners and washers will be replaced by 9 new high rate thickeners and washers (Figure 2). Some of the redundant tanks will be removed. The remainder will be retained to provide additional storage capacity for contaminated stormwater and various process liquids prior to reuse.

Alcan Gove and the construction contractor will have a dedicated "tie in" manager and team to ensure that all connections to existing plant and equipment will have appropriate environment health and safety controls. These controls will include Hazard and Operability Assessments, documented procedures and instructions, and system and compliance audits.

Redundant tanks (washers and/or thickeners) will be cleaned of mud and caustic prior. Caustic to ground impacts will be prevented during this process in accordance with the current procedures and environmental controls.

4.3.12 Refinery Inputs (6)

A respondent has asked for more information (including a mass balance flow diagram) for the caustic inputs and outputs.

Most of the caustic is recycled in the process. It continuously recycles, digesting bauxite, being separated from red mud, precipitating alumina then being concentrated up to enter the digestion process again. However some of it is removed from the recycling process as it is bound in with the residue and is stored in the RDA. In addition a small amount is exported with the hydrate.

Fresh caustic is fed to the process purely to compensate for the caustic that remains with the exported product or that is lost to the RDA. Since caustic is an expensive commodity, Alcan Gove maximises all opportunities to recover and reuse it. The reduction in caustic consumption between the existing refinery and the expanded refinery is largely due to the implementation of the following processes:

- Liquor purification
- High temperature digestion

Specific details of the caustic balance in the refinery are proprietary information. However, Alcan Gove will provide the respondent with a simplified mass balance flow diagram.

4.4 Liquor Purification (1)

A respondent has asked for more information on the Liquor Purification process particularly the emissions from the SLC split out from the rest of the data would make it easier to understand i.e.

1. *What volumes of organics will be dealt with?*
2. *What potential compounds would be created from the combustion process?*
3. *What are the emissions from this process in isolation?*
4. *What are the localised effects?*
5. *What are the consequences of facility malfunction?*
6. *Is there an OHS hazard from this?*
7. *What happens to the impurities removed from the liquor purification process?*

The response to the above questions are:

1. The liquor purification process is designed to deal with 0.68 tonnes of organic carbon per hour.
2. The combustion process is designed to convert the organic impurities to carbon dioxide and water vapour. The pilot plant trials described in Section 8.5.2.2 of the Draft EIS indicated that the plant will be highly efficient in achieving this. However there is expected to be some very small amounts of organic compounds that are emitted to atmosphere. Pages 68 to 73 of Appendix B (Volume 2 of the Draft EIS) show the compounds and estimated emission quantities. Where an emission is expected, the amount is shown in the right most column (SLC Liquor Purification).
3. The total emissions from the liquor purification process are given in Appendix B of the air quality modelling report which is in Appendix B of Volume 2 of the Draft EIS.
4. There are not expected to be any localised effects. Emissions to air will be via a 70 m tall stack which is designed to ensure good dispersion and low ground level concentrations. The pilot plant tests included odour assessment and the outcome was that odour from the process is expected to be low, generally milder than most smells around the refinery. This is discussed in more detail below.
5. The liquor purification process will be designed to incorporate all the appropriate process monitors, alarms and interlocks to prevent malfunctions from having an impact on environment health and safety. Should a malfunction occur, the most likely outcome is automatic process shutdown until rectification has occurred.
6. Any dry material within the liquor purification process will be captured in the ceramic filters and will be caustic. Therefore the same or similar safety precautions will need to be taken as for caustic in the main sections of the refinery. During maintenance and repairs, personal protective equipment will need to be worn to prevent inhalation of dust particles and/or skin irritation.
7. Section 4.4 of the Draft EIS describes the liquor purification process. It explains that there are sections of the plant designed to remove both inorganic and organic impurities. The inorganic impurities are causticised (converted to insoluble calcium salts) and recombined with red mud before disposal in the red mud area. This is described in Section 4.4.2 of the Draft EIS. The organic impurities are converted

principally to carbon dioxide and water vapour through combustion at high temperature in the solid liquid calciner described in section 4.4.3 of the Draft EIS.

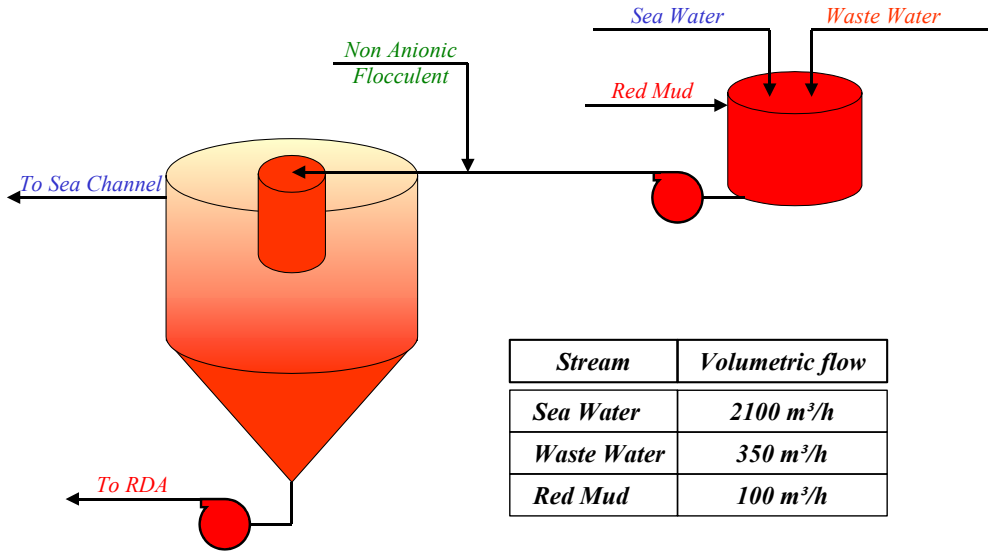
4.5 Waste Water Inventory Reduction (6)

Process Explanation (6)

A respondent considers that it is not clear whether all waste water and residue passes through the neutralisation plant before being transferred to the RDA. They have requested that the waste water neutralisation process be explained in more logical terms or illustrated in a diagram.

The clear neutralised overflow from the neutralisation plant will be discharged directly via the seawater channel to the refinery outfall.

The operation of the waste water neutralisation plant is given the diagram below.



Stream	Volumetric flow
Sea Water	2100 m^3/h
Waste Water	350 m^3/h
Red Mud	100 m^3/h

The neutralised residue underflow will discharge to the RDA. It will be stored in a separate area that will be kept separate from the balance of the RDA which, at least initially, will contain un-neutralised residue as discussed in Section 4.6 of the Draft EIS. Waste water from un-neutralised residue will flow to the labyrinth, and then it will be pumped to the refinery outfall for discharge to Melville Bay.

Neutralisation Plant Overflow (6)

Section 4.5.4.2 states that the overflow from the neutralisation plant will return to the discharge channel via the labyrinth. A respondent has noted that is not the case and requests that the statement be amended.

See section above.

Shortfall in Washer Water (6)

Once the full-scale neutralisation process reduces the inventory of alkaline water in the RDA, water will no longer be available for use in the washer train. A respondent has asked how this shortfall will be addressed.

Present refinery operations uses an average of 70 to 100 m^3/h of water from the RDA. The refinery expansion will limit the return of RDA waters initially to approximately 50 m^3/h. However the expansion will enable the reuse of increased water volumes from within the refinery process that presently report to the RDA. The reuse volume will be higher than the reduction in available RDA water and the net result should be a faster RDA water inventory depletion. When full scale neutralisation is introduced, the saline waters produced will not be able to be reused in the refinery process. However there will still be significant volumes of caustic water in the RDA

that will continue to be recovered back to the refinery. The rate of use of the RDA water will increase as its caustic soda concentrations decrease. When the RDA water inventory is depleted, process water from within the refinery will still be available for reuse.

The future elimination of return process water from the RDA has been incorporated into the refinery's water demand.

Management of Neutralised and Non-neutralised Waters (6)

A respondent has asked how will the waste water inventory reduction system partially work in the short term given that there will be a mixture of neutralised and non-neutralised material being transferred to the RDA at any one time.

Separate pipelines and separate disposal areas will be used for both the neutralised and non-neutralised residues.

4.6 Residue Disposal (14)

A respondent considers that it is not sufficient to say that separate environmental approvals will be sought if additional residue storage areas will be required in the future.

Plans for residue storage up to 2011are given in Section ES 9.10 of this EIS Supplement.

Plans for the long-term storage of residue are currently under development. Environmental studies and community consultation cannot be undertaken until the preferred options have been developed. The preferred option for residue disposal beyond 2011 will be presented in the 2007 Mining Management Plan to initiate the environmental approval process.

4.7 Port (2)

A respondent has noted an error in Table 4.7.1 of the Draft EIS as it contains insufficient ship movements/ship size for fuel oil premised upon the base case addressed within the EIS.

The error relates to the average shipment size for fuel oil tankers for the expanded refinery. This size should be 77,000 t and not 30,000 t. The number of oil tanker movements remains as in the table.

4.9 Pre-Assembly Modules

At a meeting with NT Government agencies a question was asked about where the Pre-Assembly Modules (PAMs) will come from and who will manage environmental issues at the PAM site.

The PAM location is currently being investigated. Options now under consideration include Northern Territory, Queensland, China, Malaysia, Thailand and Indonesia. The PAM site's environmental management capability will be one of the criteria used to determine the preferred site.

The construction contractor (LSL) will be responsible for ensuring a high level of environmental management at the PAM site (including quarantine issues). LSL is currently preparing a detailed construction environmental management plan including monitoring and auditing of the offshore construction work.

4.9.4 Construction Workforce (3,4,5,7)

Contractor Employee Management (3,7)

A number of respondents have asked for information about the management strategies proposed for the construction workforce.

The detailed construction management plan currently in preparation will include contractor employee management. The Code of Conduct will be an important component of this. The Code of Conduct is currently undergoing review to ensure it meets industrial relations requirements. As soon as the review is completed and signed off by the relevant parties, it will be copied to all stakeholders who have requested it.

Infrastructure Requirements (5)

The Draft EIS states that all necessary infrastructure will be installed in accordance with local government requirements. In the absence of local government in the town, a respondent has asked if this is taken to mean the Northern Territory Government's requirements.

All necessary infrastructure will be installed in accordance with the relevant requirements of the Northern Territory Government.

Sewage Treatment Capacity (4)

The construction workers will increase the volume of waste water required to be treated at the waste water stabilisation ponds. A respondent has asked if the current sewage treatment facility will be able to adequately process this additional volume.

Nhulunbuy Corporation has advised that there is adequate capacity in the existing Nhulunbuy sewerage system to cater for the additional demand from the construction workforce accommodation village.

Effluent Standards for Golf Course Irrigation (4)

A respondent has asked if there is compliance with the National Water Quality Management Strategy Guidelines for Sewerage Systems – Use of Reclaimed Water November 2000, in regard to use of sewerage plant effluent to irrigate the golf course.

The Nhulunbuy Corporation is responsible for the management of the town's sewerage system and holds a licence under the Waste Management and Pollution Control Act for management of the system. The Corporation has advised that they are reviewing the National Water Quality Management Strategy Guidelines for Sewerage Systems and will take any necessary action required to meet these requirements in consultation with DHCS.

4.9.6 Construction EHS Environmental Management Plan (8)

A respondent has asked for a discussion of the fire regimes and prescribed burning practices in the area.

The expansion of the refinery has no impact upon the fire regime at the mine. Regardless, a mine site fire management strategy has been implemented to protect rehabilitated areas and to ensure the safety of mine employees and equipment. This includes an annual assessment of back burning requirements and the clearing of fire breaks.

Numerous fire trials in selected mine rehabilitation areas have been undertaken over the past 10 years. The results of these trials are being used to prepare a long-term fire management plan. Discussions will be held with local stakeholders on this long-term management plan.

4.10 Gas Conversion (14)

A respondent has stated that the impact assessment of the expanded refinery cannot be assessed unless the impacts of the gas pipeline are included.

The refinery project is not dependent on the supply of gas. The impacts presented in the Draft EIS include the effects of the expansion both with and without gas. The supply of gas is a separate project and subject to a separate EIS.

5.1 Water Supply (2,3,4,5,8,9)

Water Quality (4)

Due to the groundwater being utilised for potable use, a respondent has asked for additional detail in relation chemical, radiological and microbiological parameters. They have noted that the appropriate reference document is the National Water Quality Management Strategy Australian Drinking Water Guidelines 1996.

The quality of potable water has not been affected by the existing operations nor will it be affected by the expansion. Available quality data are given in the following table.

Potable Water Quality

Month	Mar-01	Apr-01	May-01	Jun-01	Aug-01	Oct-01	Dec-01	Jan-02	Mar-02	Sep-02
Groundwater Quality Before Aerator										
pH	5.2	5.3	4.9	4.8	5.1	5.1	4.8	5.4	5.8	4.9
Temp	31.0	30.0	31.0	32.0	30.5	30.5	30.6	30.2	31.0	30.0
Tot Alk	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.0	0.0	0.0
Bicard Alk	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.0	0.0	0.0
Dohrman	28.0	28.5	28.0	24.4	28.1	10.0	19.1	24.0	13.0	18.9
Total CO2	28.0	28.5	28.0	24.4	28.1	15.1	19.1	24.0	13.0	18.9
Groundwater Quality After Aerator										
pH	6.4	6.2	6.3	6.0	6.2	6.0	5.8	6.2	6.2	6.0
Temp	31.0	30.0	32.0	30.0	30.0	30.0	30.5	30.2	31.0	29.9
Tot Alk	1.3	1.4	1.4	1.4	1.6	7.0	1.4	1.5	1.4	1.9
Bicarb Alk	1.3	1.4	1.4	1.4	1.6	7.0	1.4	1.5	1.4	1.9
Dohrmann	3.9	3.5	3.0	3.0	3.3	3.0	3.9	4.0	3.0	2.3
Total CO2	5.2	4.9	4.4	4.4	4.9	10.0	5.3	5.5	4.7	4.3

Environmental Flows (2,3,5)

Some respondents have stated that the work reported on in the Draft EIS does not adequately address environmental water requirements. They consider that the groundwater model utilised for scenario predictions does not appropriately represent the current level of knowledge of the aquifer and the ecosystems it maintain.

The Draft EIS indicated that the refinery expansion would require an increase in the capacity of the water supply system from 12,000 ML/year to 14,000 ML/year. However, as part of more detailed review of water requirements and management practices, the required capacity has been reduced to 13,000 ML/year. As a result of this change and based on comments received on the Draft EIS, a review of the location of the proposed new water supply bores has been undertaken.

The groundwater model reported in the Draft EIS assessed the effect of a line of new production bores to the east of the airport. Following discussions with DIPE and concerns expressed in other submissions over the potential effects on Yirrkala Creek and Shady Gum Creek, it was decided to move the new bores to a location to the west of the airport and closer to the Latram River (Figure 5).

This effect of the bores at this new location is being assessed using the groundwater model. The model is being modified and tested to take into account DIPE's suggestions about the structure of the aquifer. It will be used in addition to a field investigation to provide assurance that not only will the impact at Yirrkala Creek be acceptable, but also that flow and wetland conditions in other areas affected by the aquifer discharge will not be adversely affected. The model assumptions and results are under currently discussion with DIPE and once the preferred borefield arrangements have been determined, the necessary approvals will be sought.

To confirm the aquifer assumptions used in the model, it is proposed to undertake a field program of drilling and testing at the location of the new borefield. The scope of this field program will be developed in consultation with the DIPE.

Surface Runoff From Mine (9)

One respondent has voiced concerns about the mining occurring north of the Yirrkala access road and, with no vegetation cover and a modified hydrology through mining. They are concerned about the potential impact on water run off from the mining areas to the Gunyipinya Lagoon and Yirrkala Creek.

The quality of the surface water runoff from the mine will not be affected by the expansion.

Protection of the Gunyipinya Lagoon and Yirrkala Creek from surface water runoff is a priority in the environmental management of mining activities north of Yirrkala Road. Flow structures and sediment traps will be constructed and maintained to minimise the potential of sediment flow to the Lagoon.

Visual observation over previous heavy wet seasons and storm events have shown that there are no impacts from similar mining areas close to the area under discussion.

Water Demand (8)

A respondent has expressed that they would like to see accurate projections of future trends for water usage and the known capacity of the groundwater resource.

The projections of future water demand given in Table 5.1.1 of the Draft EIS are as accurate as possible at present. The existing demand is based on water use records and is considered to be accurate. The future demand is based on increasing the existing accurate figure on a pro-rata basis to allow for the expansion as well as incorporating design water demand specifications for new refinery equipment items. Since publication of the draft EIS the proposed maximum water demand has been revised down from 14,000ML per year to 13,000 ML per year. The capability of the aquifer to supply is being assessed as outlined in the response on environmental flows above.

5.1.3 Current Water Usage (8)

A respondent considers that there is some ambiguity about the extent of the capacity of the groundwater resource. They consider that there is little or no information about changing habits regarding water use to assist in water conservation and that a water management strategy should be implemented.

Alcan Gove is committed to sustainable resource use, including continuous improvement in water conservation measures and minimising the impact of water extraction from the aquifer. As part of more detailed review of water requirements and management practices, it is intended to reduce the maximum rate of extraction from the aquifer from 14,000 ML per annum (as indicated in the Draft EIS) to 13,000 ML per annum, compared to the current limit of 12,000 ML per annum. In addition, a water conservation and management strategy will be developed for the operational areas as well as for Alcan Gove managed properties in the town of Nhulunbuy. Alcan Gove has been monitoring water levels in the aquifer for 30 years and has been reporting them to government triennially. Annual water demand reduction targets will be established for each location and performance against them reported publicly each year in Alcan Gove's annual EHSC report and directly to the NT Government through the Mining Management Plan.

5.1.7 Wellfield Demand (1,9)

Approval Procedure (1)

A respondent has noted that the current water extraction licence is issued by the Controller of Waters under Water Act. The increased extraction of water will be approved under the Mining Management Act, after appropriate consultation with the Controller of Waters.

Alcan Gove will comply with this procedure.

Demand Management Options (9)

A respondent has asked if demand management is not adequate to manage water supply, what are the other options and how soon can they be identified and made public.

While the current wellfield has a licence limit of 12,000 ML/year, the average extraction rate is approximately 9,200 ML /year.

It is expected that the water demand for the expanded refinery could be managed within the existing licence limit of 12,000 ML/year. Water demand management strategies will be implemented to minimise the increase in water demand. However, to allow for periods when demand is at is maximum it will be necessary to increase the licence extraction limit to 13,000 ML/year. Note that ongoing design improvements have reduced this limit from the 14,000 ML/year given in the Draft EIS.

To minimise the overall increase, Alcan Gove plans to introduce a number of water demand management strategies. These strategies will include the following:

- The expanded refinery will be designed to minimise the requirement for fresh water in plant maintenance.
- Greater use will be made of wastewater rather than fresh water in the expanded refinery. For example, two 5,000m^3 capacity washer tanks will become redundant and will be made available to collect spills and rainwater from the bunds in the ferrosilt area (digestion, washing and thickening). This will significantly increase the capacity of the containment system and allow greater capacity to hold waste waters for use in the process stream as a substitute for fresh potable water.
- Options for use of recycled process water include:
  - removal of filter cake in security filtration.
  - general cleaning and hosing in the ferrosilt area.
  - gland water for pumps.
- Freshwater use targets will be defined for each operational area within the refinery. This program will be implemented through the continual improvement commitment required by the refinery's ISO 14001-accredited Environmental Management System. To assist in this program, meters will be installed at appropriate locations within the refinery to measure on-line the real-time water use.
- Alcan Gove, through the Nhulunbuy Corporation, will investigate additional measures to control the use of water in the town. Options to be considered include provision of wood chips for lawn replacement for all town residents. For Alcan Gove housing, subsidised timers and trickle irrigation for home gardens, increased paved areas, dual flush toilets, and water efficient shower roses will be considered.
- Water restrictions will be maintained during the dry season and reviewed on an annual basis.
- In addition YDC has asked to be included in ongoing discussions regarding the water demand management program. Alcan Gove will ensure that YDC remains informed about the program.

License Limit (9)

A respondent has asked if Alcan will be instructed to remain within the supply capacity of the licence limit for the existing borefield.

Alcan Gove is applying to increase the licence limit from 12,000 ML/year to 13,000 ML/year. Note that ongoing design improvements have reduced this limit from the 14,000 ML/year given in the Draft EIS

5.1.8 Wellfield Modelling (6,8,9,14)

Yirrkala Bore (6)

A respondent has stated that the available drawdown at the Yirrkala bore could potentially be reduced to a level where users of this bore are affected and have asked that mitigative measures be developed to address this issue.

Refer to Section 5.1, Environmental Flows above for response.

Yirrkala Lagoon (8)

A respondent has asked that the following points be noted in assessing the groundwater effects on Yirrkala Lagoon;

- *The social impacts on supply, hunting for food and impacts upon the vegetation structure surrounding Yirrkala Lagoon and Creek; and*
- *The cultural impact on a site registered with AAPA for its cultural values and sensitivity.*

The above values for Yirrkala Lagoon are recognised. Any potential effects to date on these values have been protected by maintaining a flow rate through the lagoon of 50 L/s. The modelling in the Draft EIS has shown that even with the increased extraction rate this minimum flow will be maintained. Consequently no detrimental effects on the above values are expected.

Yirrkala Creek (14)

A respondent has asked for more information on the impact of the additional groundwater abstraction on Yirrkala Creek.

Refer to Section 5.1, Environmental Flows above for response.

Yirrkala Water Supply (9)

A respondent has asked if water extraction exceeds the current licence limits, has the effect on Yirrkala's water supply been considered.

Refer to Section 5.1, Environmental Flows above for response.

5.1.9 Wellfield Management and Monitoring (6)

A respondent has asked for more information on the location of observation bores, and the program to monitor the aquifer performance and stream flows of surface water systems.

Monitoring will be undertaken across the wellfield to ensure that sufficient data are collected to allow effective management. It will include the following:

- Monitor groundwater extraction volumes and water levels in all production bores on a monthly basis.
- Monitor the water level in all observation wells on a monthly basis.
- Monthly specific capacity testing of all production bores.
- Analyse groundwater samples for the following parameters:
  - pH
  - Total Dissolved Solids
  - Carbon Dioxide
  - Total Alkalinity
- Record rainfall totals on a monthly basis.
- Record stream flow volumes in Yirrkala Lagoon (Bellmouth Weir) and Latram River.
- Conduct a detailed review of the monitoring data every three years. The objective of the review will be to evaluate of the performance of the aquifer, the wellfield, and associated surface water systems. It will also include recalibration of the model against observed measurements from the previous three years, and prediction of performance for the next three years with respect to the aquifer, wellfield and Yirrkala Creek and the Latram River.

5.2 Energy (5,6)

Strategies if Fuel Oil Use Continued (6)

A respondent has said that more detailed discussion is required on the continued use of fuel oil if a gas supply is not secured in the short or medium term. This should account for oil spill potential through increased shipping, control of air emissions and strategies to offset increased greenhouse gas production.

Management strategies for the control of oil spills, air emissions and greenhouse gas in the event of a delay in the supply of natural gas, are discussed in the following sections of the Draft EIS and the EIS Supplement.

Issue	Draft EIS	EIS Supplement
Oil Spills	13.7.2.2, 13.7.2.4, 14.5.1.2, 24.4.4.2	14.5.1
Air Emission Controls	8.5.2.1, 8.5.3, 8.5.4	8.5.3
Greenhouse Offsets	9.4	9.4

Further discussions will be held with relevant government agencies on this topic and outcomes reflected in the annual Mining Management Plan.

Capacity of Energy Generation System (5)

A respondent has said "The EIS indicates that the energy generation system is capable of handling the construction phase of the refinery (page 5-8). This is may not be correct, if the town, Ski Beach and Yirrkala supplies are to be fully secured and backup reserves fully established. Whilst Alcan are commencing a program of up-grading sub-stations in the network distribution options will be required. This will be best undertaken by a collaborative arrangement between Alcan and the Northern Territory Government."

The current and planned increases in generating capacity of the power station has been phased to ensure that adequate supplies of power will be available for the construction phase of the refinery as well as for the demands of the town, Ski Beach and Yirrkala.

Alcan Gove will work with the Northern Territory Government regarding network distribution.

5.3 Fuel

Necessity for Gas

A question was asked at a meeting with government departments if the expansion was dependent on the supply of natural gas.

The expansion is not dependent on the supply of natural gas to the refinery. The expanded refinery will be able to operate on either natural gas or fuel oil. However, for environmental reasons and for long-term reliability of supply, natural gas is being actively pursued.

Use of Low Sulfur Fuel Oil

A question was asked at a meeting with government departments if Alcan Gove would consider using low sulfur fuel oil only if gas is not available.

In the event that a supply of natural gas is not secured, it is proposed to use a predictive fuel switching strategy to use low sulfur fuel oil when there is potential to impact either employees or local residents and high sulfur fuel oil at other times.

Modelling has shown that it is not necessary to use low sulphur fuel oil continuously to achieve compliance with the NEPM and other health guidelines.

Decommissioning of Harbour Fuel Tanks

A question was asked at a meeting with government departments as to whether any of the tanks at the harbour fuel tank farm will be decommissioned when gas arrives.

Once the gas supply is secured there will be less use for the fuel tanks in the harbour fuel tank farm. However, none of these tanks will be decommissioned.

Some tanks will still be required to store the fuel oil that will be required in the event that gas supplies are interrupted. It is estimated that gas supplies may not be available for up to eight days per year due to maintenance requirements on the gas pipeline and gas production facility. Other tanks may be put to alternative uses including the storage of caustic.

5.4 Sewerage (4,5,6)

Effluent Disposal (4)

A respondent has stated that increased effluent disposal should not occur at the Nhulunbuy Golf Course unless provisions are made to prevent increased nutrient runoff into Nhulunbuy Lagoon and to ensure there is no ponding of water in the intertidal overflow area to prevent mosquito breeding.

The Nhulunbuy Corporation is responsible for the operation of the sewerage system at Nhulunbuy and has advised the following:

The town's sewage treatment facility is located to the north of the town. The treatment system comprises a smaller primary pond and two large secondary oxidation ponds, connected in series. The oxidation pond system is currently operating at approximately 50% of its design capacity.

Treated effluent from this pond system can be pumped to one of two disposal/discharge sites as follows:

- A significant proportion of treated effluent is pumped to the town's golf course, located approximately one kilometre to the south-west, where it is used as irrigation water for fairways and greens. The relevant pump is operated by the golf course on a 'demand' basis, using a combination of manual and timer control. No increase is expected as a result of the expansion.
- Any treated effluent that is excess to the requirements of the golf course is pumped to an evaporation/infiltration/overflow pond located within the coastal sand dunes to the north of the sewage treatment facility. An overflow pipeline from this pond has been constructed. In the event that the pond is filled to its capacity, the overflow line would discharge effluent to an outfall to the Arafura Sea. However, in the thirty years' operation of the sewerage scheme, discharge to the sea has never occurred as evaporation and infiltration losses have always exceeded the inflow to the pond.

The discharge of effluent to the evaporation/infiltration/overflow pond and the contingency provision of the sea outfall have been licensed by the Department of Infrastructure, Planning and the Environment (DIPE).

During the dry season all effluent from the oxidation ponds is pumped to the golf course for irrigation purposes. Discharge of effluent to the evaporation/infiltration/overflow pond only occurs during the wet season.

Nhulunbuy Corporation has advised that there has been no direct discharge from the sewerage ponds to the intertidal zone. Nhulunbuy Corporation has also advised that an investigation has been undertaken into the water quality guidelines for irrigating the golf course and will be following up the matter with the Department of Health and Community Services.

Refinery Sewage Treatment (5,6)

Two respondents have stated that Alcan Gove should have reference to acceptable standards for sewage effluent discharge to the refinery outfall particularly during the construction phase when the load is to double. Furthermore, a respondent has asked for more details required about the proposed upgrade of the sewage treatment plant at the refinery – treatment process and monitoring program.

The sewerage system will be upgraded for the construction workforce at the refinery by adding separate reticulation and package sewage treatment plants. The discharge from these plants will meet all relevant water quality requirements.

5.5.2 Roads (5,6)

Katherine to Gove Road (6)

A respondent has asked that further consideration be given to site access via the Katherine to Gove Road. They have also asked that if the potential impacts of the upgrade and use of this road for the Alcan Gove expansion are to be assessed in the Trans Territory Pipeline EIS process then this should be clearly stated.

Minimal use will be made of the road from Katherine to Gove to transport construction materials to the site. As discussed in the Draft EIS, virtually all construction loads will be imported by barge. It is possible that small urgent construction items could be trucked to the site but this would only be on the infrequent occasions that the equipment could not be delivered by sea in time. This would only be possible during the dry season as the road is not passable by large trucks during the wet season.

Unaccompanied construction workers will not have vehicle removal entitlements. Travel of all construction workers to and from site will be by air.

The Trans Territory Pipeline EIS will address the use of the road for pipeline construction and operations purposes.

Road Network (5)

A respondent has noted that the project will have little impact on the NT road network based on the Draft EIS. However the respondent has noted that any variations to the proposals for materials delivery (eg road access of materials) outlined in the Draft EIS will need to be notified to the Road Network Division.

Transport via road will only occur in consultation with the relevant authorities. Risk management process will confirm anticipated risk associated with road transport. If road transport is necessary, the Road Network Division will be notified and the contractor will be required to comply with their requirements.

Perkins Wharf (6)

A respondent has asked if Alcan Gove is closely involved and supporting Perkins in the development of the NOI and monitoring programs for their wharf expansion.

Perkins Shipping will submit a Notice of Intent to the NT Government for the extension of an existing wharf facility adjacent to the Alcan Gove refinery. The extended wharf will enable the berthing and unloading of the large barges required for transportation of the Pre-Assembled Modules (PAM's) that make up a significant portion of equipment required for the refinery expansion. Alcan Gove supports Perkins in the wharf development since the wharf is a critical piece of infrastructure for the successful unloading of PAMs and other construction materials. Alcan Gove has reviewed Perkins NOI and made comments in order to ensure any potential inconsistencies are avoided.

5.5.3 Shipping (6)

A respondent has sought assurance that potential impacts associated with the barged transport of the pre-assembly modules (PAMs) are being addressed by Alcan Gove or by the contractors. These assurances need to be included in the EMP.

The PAM yard, transport contractors and installation contractors will all be required to comply with the environmental requirements of the project, as specified in the Draft EIS. The requirements will be incorporated in the contract terms and conditions. Management of environmental issues will be monitored with strict pre-emptive performance indicators to monitor the contractors' performance.

PAMs shipped from overseas will be subject to quarantine requirements in accordance with Australian Quarantine Inspection Service requirements.

6.4.2 Fuel Alternatives (10)

Sources of Gas (10)

A respondent has asked for further discussion of alternative sources of gas.

Alcan Gove has a heads of agreement to source gas from the Bonaparte Basin with the primary source being the Blacktip filed. The Blacktip joint venturers intend to progressively develop adjacent gas reserves.

Alternative sources considered include Sunrise Gas, Bayu Undan and gas from PNG to Alcan Gove. None of these alternatives are currently available.

Sources of Coal (10)

A respondent has stated that if coal is to be a realistic alternative fuel, it is necessary to demonstrate where it may come from, and to discuss the prospects of such an alternative in the current regulatory, policy and economic environments.

Coal was only considered in the broad initial assessments. Detailed investigations were not progressed further due to the disadvantages identified in the Draft EIS.

Gas Pipeline (10)

A respondent has stated that an offshore gas pipeline from Mataranka to Borroloola to Alyangula to Nhulunbuy, powering all three large mines along the way, should be considered.

An offshore pipeline of this distance would be prohibitively expensive and involve numerous environmental impacts. The provision of gas supplies to various mine in the Northern Territory is a matter between the mine operators and the gas suppliers.

6.6.5 Air Pollution Control Technologies (6)

A respondent has asked for more information about the advantages and disadvantages of alternative air emission controls that were considered.

The advantages associated with the air emission control technologies considered are discussed below.

Stack Height

Increasing the height of a stack can reduce the ground level concentrations of the stack emissions. The main factors that determine stack height include:

- Operational size of the plant
- Height and proximity of adjacent buildings
- Nature of surrounding terrain
- Local meteorological conditions
- Sensitivity of potential receptors

The purpose of taller stacks is to dilute the plume concentrations to acceptable levels before the emissions reach the ground. This is achieved by the release of the plume into the atmosphere at a height which gives sufficient time for the dilution and dispersion of the plume matter. Therefore, a tall stack will release the plume higher into the atmosphere, which allows the plume to disperse more before it reaches ground level. Tall stacks do not reduce the amount of material emitted.

Electrostatic Precipitators

An electrostatic precipitator (ESP) is a particulate control device that uses electrical forces to move small particles (particulates) out of a flowing gas stream onto collector plates. The electrical field that forces the charged particles on to the plates comes from the electrodes maintained at high voltage in the centre of the flow path. Particles collected on the plates, they are removed mechanically without re-entraining into the gas stream. ESPs have proven more effective when large volumes of hot wet gas are treated such as in calcination.

Advantages	Disadvantages
Extremely high particulate matter (coarse and fine) collection efficiencies can be attained (at a relatively low expenditure of energy)	Sensitive to fluctuations in gas stream conditions (in particular, flow rates, temperatures, particulate and gas composition and particulate loadings)
Dry collection and disposal	Relatively large space requirements required for installation
Low pressure drop	Certain particulates are difficult to collect due to extremely high or low resistive characteristics
Designed for continuous operation with minimum maintenance requirements	Special precautions required to safeguard personnel from the high voltage
Capable of operation under high pressure or vacuum conditions	Explosion hazard when treating combustible gases and/or collection combustible particulates
Capable of operating at high temperatures	Ozone can be produced by the negatively charged electrode during gas ionization
Relatively large gas flow rates can be effectively handled	

Baghouses (Fabric Filter Systems)

Fabric filter systems are an alternative to electrostatic precipitators as a means of particulate control. They are frequently referred to as "baghouses" since the fabric is usually configured in cylindrical bags. Baghouses remove dust from a gas stream by passing the stream through a porous fabric. Dust particles form a porous cake on the surface fabric. It is normally this cake that performs the filtration. Baghouses are generally considered to be effective for the treatment of relatively low volumes of cool dry gas.

Advantages	Disadvantages
High collection efficiency on both coarse and fine (submicron) particulates	Relatively high operation and maintenance costs
Relatively insensitive to gas stream fluctuation.	Certain dusts may require fabric treatments to reduce dust seeping or, in other cases, assist in the removal of the collected dust
No problems with liquid waste disposal, water pollution or liquid freezing	Concentrations of some dusts in the collector may represent a fire or explosion hazard if a spark or flame is admitted by accident. Fabrics can burn if readily oxidisable dust is being collected.
Corrosion and rusting of components are usually not problems	Temperatures much in excess of 200°C require special refractory mineral or metallic fabrics that can be expensive
There is no hazard of high voltage, simplifying maintenance and repair and permitting collection of flammable dusts	Fabric life may be shortened at elevated temperatures or by the presence of acid or alkaline particulate or gas constituents
Use of selected fibrous or granular filter aids (pre-coating) permits the high-efficiency collection of submicron smokes and gaseous contaminants	Hygroscopic materials, condensation of moisture, or tarry adhesive components may cause crusty caking or plugging of the fabric or require special adhesives
Relatively simple operation	Replacement of fabric may require respiratory protection for maintenance personnel.

Preferred Emission Control

Alcan Gove's preference for emission control is to use a combination of tall stacks, electrostatic precipitators and where appropriate, baghouses.

Tall stacks will be used for the power station and calciners to limit ground level concentrations of gaseous emissions.

Electrostatic precipitators are preferred for particulate control in large volume hot gas applications such as calciners. The site already has experience in operating and maintaining this type of equipment to meet the emission standard of 50 mg/m^3. Baghouses will continue to be used for specific small materials handling operations.

7.2 Waste Management Standards (1)

A respondent has noted that Alcan Gove is not directly required to comply with the Waste Management and Pollution Control Act. Section 6 of the Act excludes mining and petroleum activities authorised under the relevant mining or petroleum legislation.

It is noted that while the Act does not directly apply to on lease activities, it is relevant for any off-lease waste disposal activities.

7.3 Current Waste Management Practices (3)

Waste Impacts (3)

A respondent has stated that there is little information provided about the current impacts from waste management practices particularly with respect to the RDA and the community landfill. They are seeking information about wastes being disposed, impacts, site suitability and impact of expansion.

The community landfill is the responsibility of the Nhulunbuy Corporation which has established this new operation in accordance with all current relevant Government approvals. The wastes to be deposited, impacts, site suitability and impact of expansion were all taken into consideration in seeking and obtaining these approvals and the lease arranged through the NLC.

The RDA will continue to be used for the disposal of process wastes which are compatible with the main purpose of the facility. The impacts of this disposal are very low due to the isolation of the RDA from other activities and the very low permeability and depth of the residue stored at the RDA which prevents leaching of any waste constituents.

Wastemaster Audit (3)

A respondent has asked for the results and recommendations of Wastemaster audit to be provided. They have asked for them to be used to extrapolate the future waste generation and management.

The Wastemaster audit took place over a three day period in June 2003. The results and recommendations of the audit will be made available to the respondent.

The report found about 100 m^3 of non-process waste on site at the time of the survey and noted that on average there are 156 bin services per month. Each bin has a volume of 4 m^3 and hence the estimated waste generation rate would be approximately 620 m^3 per month. By extrapolation, approximately 1,200 m^3 per month would be generated by the expanded refinery.

7.3.1 Solid Wastes (1,3,4,6,14)

Fate of Wastes (6)

A respondent has asked for information on the fate of wastes removed from the site to ensure that the end uses or disposal of these wastes are appropriate.

- Steel – recycled in Asia by Darwin based recycling company.
- Batteries - recycled in Australia by Darwin based recycling company.
- Grease - burnt in kilns in Port Hedland by an oil recycling company.
- Oil filters - recycled in Asia by Darwin based recycling company.
- Coolant - recycled in Darwin for glycol recovery.
- Mercury – sold to Australian market by Sydney based contractor.
- Electrical components and transformer oil containing PCBs – chemically destroyed prior to disposal. Certificates of destruction are obtained from the waste contractor.
- Tyres – retreaded in Darwin for semi-tipper trucks.
- Other hazardous materials – treated by accredited recycling contractors in Darwin.
- Computer monitors – recycled in southern states for rare earth and precious and transition metals recovery.

Scale (1)

A respondent has asked for information on the nature of scale, where is it from, what is it composed of, does it breakdown and release contaminants.

When bauxite is dissolved in hot caustic liquor alumina , silica, organics and various trace elements also dissolve into the process liquor. At various stages in the process operation these substances may come out of solution to form scale on tank, vessel and piping walls.

Depending on its type, scale is removed by either mechanical means or by dissolving in strong caustic solution, hot water or acid.

Scales that are removed from process vessels are either re-dissolved and recycled to the process, or disposed of in the RDA with the residue.

Scales that are disposed of at the RDA are permanently contained in the RDA structure. No scale is either removed off site or otherwise released to the environment.

The major scales encountered are listed below.

Hydrate Alumina Scale

Alumina scale is the product alumina that has precipitated on tank walls instead of becoming part of the product. These scales are typically redissolved and returned to the process. Some alumina scale is mechanically removed and unless pure is disposed of at the RDA.

Silicate Scale

Silicate scale is a hard inert scale, which forms on process equipment at higher temperatures.

The bauxite digestion reaction dissolves alumina. The bauxite also contains silica rich clay, which reacts and saturates the process liquor with silica. As the liquor silica saturation point is exceeded, reaction with the caustic soda and dissolved alumina in the liquor then form a silicate precipitate. This coats vessel and tank walls and also precipitates from the liquor onto heat exchanger tubes in the digestion and evaporation and hydrate areas. Higher temperature heaters, particularly live steam heaters in digestion and evaporation, are most affected.

Oxalate Scale

Oxalate is an impurity within the alumina precipitation circuit.

Typically in the first half of the refining process and particularly in precipitation, the oxalate has reached a solubility limit in the liquor, which causes co-precipitation of sodium oxalate with alumina hydrate. In areas such as caustification where lime slurry is added to liquor, a calcium oxalate scale may form.

Boehmitic Alumina Hydrate Scale

Boehmitic alumina hydrate scale occurs in the digestion and thickening areas where elevated temperatures and process liquors saturated with alumina occur. It is typically a minor component. .

Calcium and Lime Scales

Calcium normally forms relatively insoluble scales. This means chemical removal of these scales can be difficult. Removal of calcium and lime scales is by mechanical descale or hydroblasting. They occur in areas where a lime slurry has been used.

Vanadate, Phosphate and Fluoride Scales

Vanadate fluoride and phosphate scales form where the liquor is concentrated and cool. These scales typically occur on vessel walls at the cold end of the evaporation circuits, or in the concentrated liquor storage tanks which are cooler than most process liquor areas.

Hydrate Spillage (1,14)

Two respondents have asked what was the hydrate spillage rate before the conveyor modifications reduced the spillage rate by 2,500 t/y.

Before the hydrate conveyor was modified the spillage rate was 4,500 t/y. The modification actually enabled the recovery of 3,600 t/y not 2,500 t/y.

Waste Tyres (4)

A respondent has stated that waste tyres that are provided to local community organisations should be holed to prevent water from ponding and subsequent mosquito breeding.

Any tyres given to local community groups will be holed.

Scrap Metal

At a meeting of NT Government agencies a question was asked about what happens to the scrap metal sent to Darwin for recycling.

The metal is checked for contamination before it leaves Gove and is then shipped to Darwin. From Darwin it is either exported or trucked south for recycling. Records are kept of the fate of the scrap metal sent off-site.

Location of RDA Landfill

At a meeting of NT Government agencies a question was asked about the location of the landfill at the RDA.

The landfill at the RDA is located in the south-east corner of Pond 4.

Biological and Corrosion Inhibitors (6)

A respondent has asked for a discussion of the nature and fate of biological and corrosion inhibitors from cooling water pipes.

Biocide and corrosion inhibitor concentrations are matched to the demand to counter the corrosion potential and biological activity in the cooling water circuit leaving negligible residual amounts in the bleed water. Under normal operating conditions there is no discharge of bleed water from cooling towers. To prevent impurity build-up, the cooling water is bled intermittently from each tower and discharged to the refinery outfall. Residual biocides and corrosion inhibitors are also bled prior to the cleaning of the cooling towers (every 6 to 12 months) to enhance efficiency and to protect against Legionnaires bacteria. The biological and corrosion inhibitors used on site are listed in the table below.

Chemical Product	Where Used	Monitoring
Corrostop L (active ingredients: Zinc sulphate, Maleic acid copolymer)	Diesel cooling towers Main cooling towers Town cooling towers	Monitored through water electrical conductivity Zinc and phosphate species
Corrostop K active ingredients: Sodium nitrite)	Diesel power station Cooling jackets Air conditioning chillers	Water electrical conductivity and nitrite concentration
Biocide G (active ingredient: Glutaraldehyde	ISC cooling towers	Effectiveness on total bacteria counts No monitoring of active ingredient - glutaraldehyde
Biocide Q active ingredient: Sodium hypochlorite	Diesel cooling towers Main cooling towers Town cooling towers	Effectiveness on total bacteria counts and free chlorine
Biocide E74 active ingredient: Sodium hypochlorite	Diesel cooling towers Main cooling towers Town cooling towers	Effectiveness on total bacteria counts and free chlorine

Waste Streams (3)

A respondent has stated that there is insufficient information on waste streams and quantities for current, construction and operation.

Information on construction waste is given below in Section 7.4.2.

Community Landfill (3)

A respondent has asked for an estimate of the quantity of waste to go to landfill and impacts of disposal on noise, odour, amenity.

The community landfill is the responsibility of the Nhulunbuy Corporation which has established this new operation in accordance with all current relevant Government approvals. The wastes to be deposited, impacts, site suitability and impact of expansion were all taken into consideration in seeking and obtaining these approvals and the lease arranged through the NLC.

7.4.2 Construction Waste (3,6)

Community Landfill (3)

A respondent has asked that additional attention be paid to the impact of construction wastes on the new community landfill which was assessed as being necessary for the community and not to service Alcan Gove.

The new community landfill at Gove is used for some non-contaminated waste from Alcan Gove. This includes domestic waste generated by the during the construction period. Initiatives will be investigated for the recycling of glass, paper and plastics to reduce the amounts of domestic waste from the construction period that will be taken to the landfill.

Refuse tip management under the direction of the Nhulunbuy Corporation Limited will monitor the impact of Alcan Gove waste on tip capacity and operations.

It is intended to recycle all wood waste although there is a possibility that a small amount of wood that cannot be recycled during construction will be disposed of at the landfill.

Scrap steel and other metals following clean up to remove any residual caustic from the production process will continue to be recycled.

Targets for recycling of untreated wood and non-contaminated steel used in the construction have been set at 100% (treated wood that cannot be recycled).

Based on a recent aluminium smelter construction project, the following are estimates of total waste generation during the construction period:

- General waste (domestic) 13,000 m^3
- Wood 12,000 m^3
- Scrap steel & other metals 2,000 m^3

PAM Site Wastes (6)

OEH has asked who is responsible for the construction waste generated at the PAM site. If Alcan Gove is responsible, OEH would like details of how this will be managed.

The PAM constructor is responsible for compliance with their local waste management requirements. Alcan through its construction contractor will monitor its PAM contractors in accordance with the construction EMP including relevant waste management requirements in line with its sustainability strategies.

7.5 Waste Management Strategy (3)

A respondent has stated that the EIS fails to mention any quantitative targets for waste streams.

The targets of the waste management strategy are to achieve:

- 30% reduction in non-process waste generation rate per tonne of alumina produced by 2009
- 25% reduction in process waste generation rate per tonne of alumina produced by 2009

8.5.1 Existing Emission Controls (1)

A respondent has noted that Alcan Gove plans to seal existing unsealed roads and would like to know:

- *When will this take place*
- *How much of the construction traffic will be passing over unsealed roads near air-sensitive receivers*
- *Will the contractor be asked to use a wheel washing facility*

The majority of refinery roads are sealed. Upcoming sealing includes:

- The precipitation road
- Upgrade of the calcination road

- Completion of the materials handling road as far as Melville Bay Road
- Scaffold yard
- Plant services compound

Further sealing will occur during containment improvements planned during period 2005 to 2009.

All high use construction roads will be hard faced and water sprayed to minimise dust generation.

A full vehicle (including wheel washing) facility will be available for all vehicles initially arriving at the Alcan Gove Site. A wheel washing facility will be available for dirty vehicles but there is not an expectation that all vehicles will require this washing.

8.5.3 Emission Control (5,6)

Stack Heights (6)

A respondent have asked for an explanation as to how increasing the stack height helps to reduce ground level concentrations.

An explanation is given in Section 6.6.5 of this Supplement.

Shiploader (5)

A respondent has asked for details of the proposed upgrade to the dust controls at the shiploader.

The effectiveness of the current shiploader's dust control is limited because of the need to export both bauxite and alumina on the same system. Once bauxite exports have ceased in 2005, the upgrade can be implemented with more effective dust controls. The detailed design of the dust control system is currently being developed to achieve a dust reduction target of 95% of existing alumina dust loads. Details of the design will be provided to the respondent through the mining management plan process. The shiploader will be upgraded by December 2007.

8.5.4 Emission Rates

Information was sought at a meeting with Government agencies on the extent of any monitoring data from the lime kiln.

A stack testing program was undertaken for a number of air emission sources at the refinery in May 2003. This included testing of the Lime Plant Shaft 1 Stack. Emissions were analysed for total particulates, PM_{10}, and hydrogen sulfide. Details of the testing results for the lime plant are given in Appendix B.

8.7 Results of Air Dispersion Modelling (6,14)

Organic Carbon (6)

A respondent has asked for an assessment of organic carbon to be included in the results of the air dispersion modelling.

It has been assumed that the reference above to organic carbon should read volatile organic compounds (VOCs). Organic compounds enter the alumina refining process due to the presence of material such as tree roots and leaves in the bauxite. When this material is processed at the high temperatures that are characteristic of the refining process a small portion forms volatile organic compounds, collectively known as VOCs, which are emitted to atmosphere through process vessel vents at low concentrations. VOCs can also be emitted from the combustion of oil and gas.

Depending on the bauxite source, VOCs can be odorous and at high enough concentrations they can cause irritation and other health concerns. These compounds were included in the health risk assessment documented in Section 8.8 of the Draft EIS, which concluded that there is little likelihood of adverse health effects or irritation.

VOC emissions will vary significantly depending on the bauxite source, the fuel type and the process conditions. Alcan Gove has tested its refining process in order to reliably estimate emissions from the existing and proposed expanded refinery. These test results were combined with sampling from the liquor purification trials described in Section 8.5.2.2 of the Draft EIS and with other emission estimates to develop an overall picture of VOC emission rates.

The potential number of organic compounds is high. In Section 8.8 Health Risk Assessment in the Draft EIS it was noted that the health effects of between 60 and 98 compounds were assessed. The majority of those compounds were VOCs.

Appendix B of the of the air quality modelling report (given in Appendix B of the Draft EIS) shows details of VOC emission estimates from the sections of existing refinery where they were detected. Similar tables were constructed for the expanded refinery under each of the fuel burning scenarios described in Section 8.8 of the Draft EIS. Ground level VOC concentrations at residential communities were calculated using the air dispersion model described in Section 8.6, and these results were then used in the health risk assessment described in Section 8.8 of the Draft EIS and in the next section of this Supplement. The other compounds identified in Section 8.7 of the Draft EIS, and known metals emissions, were also part of the health risk assessment.

Galupa (14)

A respondent has expressed concern that sulfur dioxide concentrations will increase under fuel oil scenario and will affect Galupa. Carbon monoxide will also increase.

Modelling has shown that under the fuel oil scenario for the expansion, concentrations at Galupa do not exceed the relevant air quality standards and no detrimental effects are expected. The concentrations of carbon monoxide are well within NEPM air quality goals.

Under the fuel oil scenario it is proposed to use a predictive fuel switching strategy to use low sulfur fuel oil when there is potential to impact either employees or local residents and high sulfur fuel oil at other times.

8.8 Health Risk Assessment (3)

A respondent asked for more information about the modelling conducted for the health risk assessment.

Section 8.8 of the Draft EIS gives a broad outline of the health risk assessment due to air exposures. The risk assessment process involved:

- Calculating emissions of a wide range of compounds for several current and future operational scenarios;
- Using the emission calculations and known meteorological data in an air dispersion model to calculate ground level concentrations at residential areas; and
- Analysing the ground level concentrations in relation to known standards for health protection.

As mentioned in Section 8.8, the assessment takes a conservative (ie. safe) approach and it concludes that there is little likelihood of adverse health effects or irritation. The assessment was carried out by a recognised expert consultancy, Toxikos Ltd.

The health risk assessment report provides background and a description of the techniques used. The following extracts from the report focus on the outcomes of the various analyses performed by the expert consultant.

The scenarios assessed were:

- E = Existing refinery
- S1 = Expanded refinery burning gas and including liquor purification
- S2 = Expanded refinery burning gas and excluding liquor purification
- S3 = Expanded refinery including liquor purification burning 1% S fuel oil on one of the approximately eight days per year that the gas supply may be interrupted
- S4 = Expanded refinery including liquor purification burning a 3.5% S fuel oil and using a fuel switching strategy (1.5% S) when winds are blowing in the direction of the surrounding communities.

Acute and Chronic Risks

The non-carcinogenic health risks were separated into acute and chronic risks according to time frame of exposure to which the health based ambient air reference value pertains. For this risk assessment an acute exposure is regarded as one that is less than 14 days while chronic is regarded as being equal to or greater than 365 days. These acute and chronic exposure times are the same as those used by the Agency for Toxic Substances and Disease Registry (ATSDR) of the US for creating minimum risk levels for protection of public health. Acute and chronic health guidelines were found for up to 98 compounds, depending on the scenario being assessed.

Chronic Hazard Indices

The chronic hazard indices are all markedly less than unity indicating the likelihood of health effects from chronic exposure to the refinery emissions is unlikely.

Acute Hazard Indices

For all locations, the predicted ground level concentrations are compared with health guidelines considered protective of public health and the hazard index calculated based on both the highest and 95th percentile 1 hour average modelled ground level concentration (GLC).

It was concluded that although the acute hazard indices calculated for some of the operational scenarios of the future plant are a little greater than unity, there is nonetheless little likelihood of an acute adverse health effect occurring in the surrounding community areas because:

- The exceedances above unity are not large. The hazard indices based on the highest one hour ground level concentration that will be achieved just once during the year for scenarios 1 & 2 are only 1.07 – 2.97, with maximum being approximately 5 for scenario 4. Importantly for the area where there is the highest density of residents, i.e. Nhulunbuy, all hazard indices are less than unity.
- The highest concentrations are modelled from worst case emission assumptions and they will be rarely achieved.
- For areas outside of the refinery, the 95th percentile acute hazard indices are substantially below unity and at least 240 times less than hazard indices based on the highest modelled 1 hour ground level concentration, thereby supporting the notion that the latter will be rarely achieved.
- The hazard index calculation assumes an additive interaction between emission components. However there is low likelihood of a health interaction between the major contributors (PM_{10}, caustic and NO_2) of the hazard index calculated for the future plant scenarios.

Under NEPM guidelines, 5 exceedances per year are allowed for $PM_{10.}$ Therefore the acute hazard quotient for PM_{10} was also calculated using the sixth highest modelled PM_{10} value. The hazard quotient for PM_{10} at Galupa (a location on the edge of the refinery boundary) for scenario 4 was marginally above unity. At all other locations, but especially at the township of Nhulunbuy, and for all operational scenarios evaluated the hazard quotient for PM_{10} based on the sixth highest 1 hour average GLC was well below unity indicating compliance with the NEPM PM_{10} air standard.

Although using the sixth highest PM_{10} ground level concentration resulted in a marked reduction in the hazard index, at some locations the hazard index remained a little greater than unity.

As discussed in Section 8.5.1, Alcan Gove has an ongoing program of sealing exposed surfaces for dust reduction to be implemented between 2005 to 2009. In addition, the third stage footprint allows for large areas of currently unsealed areas to be sealed including the precipitation, power station, digestion, evaporation and liquor purification areas.

Irritation

The ability of a chemical to cause sensory irritation after an acute exposure to an emission can be assessed by comparison of the emitted concentration to an 'irritation threshold'.

The value of the irritation index was consistently below 1, indicating there is little likelihood that the emissions will cause sensory irritation to individuals who may be exposed.

Polyaromatic Hydrocarbons (PAHs)

PAHs are genotoxic carcinogens and are assessed in this report by calculating the carcinogenic risk associated with the summed congeners using the range of benzo[α]pyrene equivalents for each congener as published by the WHO (1998). It should be noted that this is a conservative approach as there is information to indicate that co-exposure to mixtures of PAHs often decreases the carcinogenic potency of the most potent PAH (usually benzo[α]pyrene) in the mixture (WHO 1998).

The cancer risk calculated by applying the benzo[α]pyrene unit risk factor to the total benzo[α]pyrene equivalents of the PAHs emitted at the receptors in is presented in the following table. The carcinogenic risks from airborne PAHs at all receptor locations and for all scenarios are within or below the acceptable carcinogenic risk band of 1 $x10^{-5}$ to 1 x 10^{-6}.

Carcinogenic Emissions Other Than PAH

Carcinogenic risks due to individual emission components and the sum of carcinogenic risks are within or less than the acceptable risk band of 1 $x10^{-5}$ to 1 $x10^{-6}$.

It is concluded the risks associated with exposure to components of refinery emissions that are considered to be carcinogenic are within the bounds of risks usually considered as being acceptable by overseas regulatory authorities.

Dioxins

It was calculated that the dioxin dose from direct inhalation is 0.002% of background intake and is therefore a negligible contributor to total dioxin intake. It is concluded emissions from the existing or future refinery operations is quite unlikely to result in increased health effects due to exposure to dioxins.

8.9 Odour (6)

A respondent have asked for an assessment of the risk of odour from Volatile Organic Carbons from the liquor purification process.*

The odour assessment referred to in Section 8.9 of the Draft EIS took into account VOC odours from the liquor purification process. Expected odour emissions from all significant sources of the expanded refinery, including liquor purification, are shown in the last row of the table of emissions on page 73 of Appendix B in Volume 2 of the Draft EIS.

The liquor purification odour emission estimates were based on pilot trials conducted over several days and analysed by the Danish analytical company DK-Teknik. The table on page 73 of the noted Appendix shows that liquor purification is not expected to be a significant contributor to odour at the expanded refinery. This is supported by the operating experience of a similar full scale liquor purification process in the San Ciprián alumina refinery in Spain (operating since 1998).

* Assumed Volatile Organic Carbons should read Volatile Organic Compounds

8.11 Air Quality Management (3,6)

Liquor Purification Emissions Monitoring (6)

A respondent have asked that a monitoring program be undertaken to ensure that the relevant environmental and health standards for air emissions from the liquor purification process are met.

The liquor purification stack gases will be continually monitored for hydrocarbons and particulates and the results will be used as part of the online process control and monitoring procedures. This will be part of a wider program of atmospheric monitoring aimed at ensuring air quality is within relevant guidelines.

Air Quality Monitoring Program (3)

A respondent have recommended that a comprehensive ambient air quality monitoring program be put in place to prove the modelling results for the scenarios proposed.

An air quality-monitoring program for the expanded refinery will be implemented. A framework of the proposed air quality-monitoring program is given below.

Component	Without Gas	With Gas
Ambient Monitoring	Continuous SO_2 monitoring at Gunyangara. Continuous particulate monitoring at the refinery and offsite local communities. Total non-methane hydrocarbon monitoring. On-line NO_x	Continuous particulate monitoring at the refinery and offsite local communities. Total non-methane hydrocarbon monitoring. On-line NO_x
Stack Monitoring	On-line particulate metering and periodic in-stack sampling at calcination, power station, lime kiln and liquor purification. To be used as an indicator of control equipment efficiency. Continuous hydrocarbon monitoring of liquor purification stack.	On-line particulate metering and periodic in-stack sampling at calcination, power station, lime kiln and liquor purification. To be used as an indicator of control equipment efficiency. Continuous hydrocarbon monitoring of liquor purification stack.
Emission Estimation	SO_2 emissions to be estimated on a monthly basis. Greenhouse gases to be calculated on a monthly basis.	Greenhouse gases to be calculated on a monthly basis.

The air quality modelling results given in the Draft EIS demonstrate that Nhulunbuy will not experience any significant air quality impacts from the refinery operations and that the predicted ground level concentrations are well below the NEPM goals. Use of the air quality model, which has been calibrated against air monitoring results from a site much closer to the refinery, is a more effective way of determining air quality impacts at Nhulunbuy. Furthermore, the model can be used to indicate air quality at any required location at Nhulunbuy whereas a monitoring station can only be used for a single location.

9.1 Alcan's Greenhouse Strategies (10)

Renewable Energy Sources (10)

A respondent has stated that within the context of Alcan's business activities, it would be necessary to see a long term plan for migration from polluting fuels to renewables.

Alcan has considered renewable options such as tidal, wind and solar power. None of these is viable at present. Alcan will continue to investigate options for renewable energy.

Existing Fuel (10)

A respondent has stated that because of the greenhouse benefits of gas it would be unacceptable to pursue the expansion with the existing fuel type.

Alcan Gove recognises the greenhouse benefits of gas and this is one of the reasons that it is planning to convert from fuel oil to natural gas.

9.3 Greenhouse Gas Effects of Refinery Expansion (2,6,14)

Greenhouse Gas Emissions Estimates (2,6)

Two respondents have sought clarification on the estimates of greenhouse gas emissions given in the draft EIS.

Tables 9.3.3, 9.3.2 and 9.3.5 of the Draft EIS provide the estimated greenhouse gas emission from the existing and expanded refinery (including mine and town operations). There were minor errors in some of the numbers given in these tables. The correct emissions information is given in the following revised tables. Note that Table

9.3.4 is unchanged from the Draft EIS. The emissions for the existing refinery are based on a production of 2,000,000 tonnes of alumina per year. The emissions for the expanded refinery are based on a production of 3,800,000 tonnes per year.

Revised Table 9.3.3
Existing Refinery Greenhouse Gas Emissions

Greenhouse Gases	GWP1	Greenhouse Gas Emissions – CO2e (tonnes/year)					
		Steam Power Station	Digestion 2	Calcination	Lime Plant	Onsite Transport (diesel use)	Total for Existing Refinery
Carbon Dioxide	1	1,034,669	-8,195	553,766	14,573	24,620	1,619,432
Methane	21	236	0	158	4	1	400
Nitrous Oxide	310	2,615	0	1,399	37	0	4052
Total		1,037,520	-8,195	555,323	14,614	24,621	1,623,883

1. Global Warming Potential, a number developed to compare the ability of each greenhouse gas to trap heat in the atmosphere relative to that of carbon dioxide.
2. Negative sign indicates a sink.

Revised Table 9.3.4
Expanded Refinery Greenhouse Gas Emissions (Natural Gas)

Greenhouse Gases	GWP	Greenhouse Gas Emissions - CO2e (tonnes/year)						
		Steam Power Station	Digestion	Calcination	Lime Plant	Liquor Purification	Onsite Transport (diesel use)	Total for Expanded Refinery
Carbon Dioxide	1	1,404,622	-10,550	660,998	29,146	98,117	31,466	2,213,799
Methane	21	57	0	267	8	4	2	338
Nitrous Oxide	310	839	0	395	74	59	1	1,368
Total (weighted for GWP)		1,405,518	-10,550	661,660	29,228	98,180	31,469	2,215,505

Note - Negative sign indicates a sink

Revised Table 9.3.5
Expanded Refinery Greenhouse Gas Emissions (Fuel Oil)

Greenhouse Gases	GWP	Greenhouse Gas Emissions - CO2e (tonnes/year)						
		Steam Power Station	Digestion	Calcination	Lime Plant	Liquor Purification	Onsite Transport (diesel use)	Total for Expanded Refinery
Carbon Dioxide	1	1,930,896	-10,550	852,509	29,146	131,155	31,467	2,936,216
Methane	21	441	0	243	8	30	2	724
Nitrous Oxide	310	4,880	0	2,145	74	552	1	7,661
Total (weighted for GWP)		1,936,216	-10,550	854,906	29,228	131,738	31,470	2,973,007

Note - Negative sign indicates a sink

On the basis of the estimated emission given above, the greenhouse gas emissions per tonne of alumina produced are given in the revised Table 9.3.6 below. This shows a 4% reduction in greenhouse emission rate between the existing and expanded refinery (fuel oil case) consistent with the predicted 4% increase in energy efficiency associated with the expansion.

Revised Table 9.3.6
Greenhouse Gas Emission Rate

(tonnes/tonne of alumina)

Existing Refinery	Expanded Refinery (Natural Gas)	Expanded Refinery (Fuel Oil)
0.81	0.58	0.78

Sources of Greenhouse Gases (6)

A respondent has asked for a brief description of, or value for, each of the processes resulting in emissions in each of the refinery stages to demonstrate that all of the emissions have been accounted for.

Each of the process generating greenhouse have been listed in the tables above.

Other Greenhouse Gases (6)

A respondent have asked if there are any emissions of sulfur hexafluoride, hydrofluorocarbons, or perfluorocarbons.

There are no emissions of sulfur hexafluoride, hydrofluorocarbons, or perfluorocarbons. These are emission common from aluminium smelters not alumina refineries.

Construction Phase Emissions (6)

A respondent have asked that the EIS also accounts for any additional greenhouse gases emitted as part of the construction phase and as additional energy consumed due to the planned increase in housing.

During construction there will be limited fuel usage for transport around the site and transport between the site and the construction village. At most, it is expected that additional fuel usage would approximate the amount currently consumed for on-site transport. On this basis greenhouse gas generation during construction should not add more than about 1.5% to the total greenhouse gases currently being generated (24,600 tonnes per year).

Any increase in greenhouse gases from additional energy used to accommodate the construction workers is accounted for in the emissions from the steam power station (SPS) given in Tables 9.3.4 and 9.3.5 of the Draft EIS. The SPS increased capacity has been calculated to meet both production process demands and demand for domestic electricity usage.

Total Emissions (14)

A respondent considers that the project should be assessed on the total quantity of greenhouse gas emissions rather than the amount of emissions per tonne of alumina produced.

The Draft EIS presents the total quantity of greenhouse gas emissions to be produced by the expanded refinery for both the gas and fuel oil scenarios.

9.4 Management of Greenhouse Gas Emissions (6)

Industrial Processes (6)

A respondent has stated that there is little discussion in the Draft EIS about any efforts to reduce greenhouse gas emissions from industrial (chemical) processes and have asked that if there are any opportunities for this they should be clarified in the EIS.

Tables 9.3.3 to 9.3.5 in the Draft EIS show the main sources of greenhouse gases are fuel combustion in:

- Steam power station
- Calcination
- Lime plant

- Liquor purification
- On site transport

There is a minor direct emission of greenhouse gases from two industrial process within the refinery:

- Lime burning
- Liquor purification

The digestion and liquor circuit process areas absorb CO_2 from the atmosphere. This also occurs at the RDA where CO_2 is absorbed into the large exposed waste water surface area, and also in process vessels at the refinery where air is blown through the liquor to agitate tanks and prevent particle settling. The result of this uptake is shown in tables 9.3.3 to 9.3.5 as a negative greenhouse gas production figure in the column labelled "Digestion".

Offsets (6)

A respondent has stated that in providing information about proposed offset programs Alcan Gove has not demonstrated the environmental, economic and social aspects of the programs nor has it identified the financial and other costs associated with the programs. In subsequent discussions with Alcan Gove, the respondent has agreed to provide an outline of an offset proposal.

Alcan Gove is discussing offset proposals with the respondent.

Nhulunbuy Building Code (6)

A respondent has asked for a copy of the Nhulunbuy Building Code.

A copy of the code was posted on 30 March 2004.

10.3 Existing Noise Levels (3)

A respondent has asked that a wider range of attended noise monitoring be undertaken to determine seasonal predominance of insect noise.

Alcan Gove has committed to ongoing noise monitoring in the Noise EMP. This monitoring will be staggered to cover seasonal variations.

10.5.1 Refinery Noise (3,)

Low Frequency Noise (3)

A respondent has asked for a comment on the impact of low frequency noise.

As discussed in Section 10.3.1 of the Draft EIS, vacuum pumps in the Hydrate area emit a low frequency noise that can travel significant distances particularly during calm nights. Modelling has shown that, while this noise may be able to be heard at a significant distance from the refinery, it is at a level below that which is specified in the draft NT Regulation as being likely to cause disturbance. There have been no complaints about this noise to date.

Furthermore, as discussed in Section 10.4.2 of the Draft EIS, the new vacuum pumps to be installed as part of the expansion will be 10 dB(A) quieter than the existing pumps through improved design and the use of acoustic enclosures.

10.6.1 Refinery Construction (3,6)

Noise Barrier at Galupa (3,6)

Two respondents have asked that the terrain shielding effect at Galupa should be tested to determine whether the noise exceedences during refinery construction might be mitigated. Details of the type and design of the noise barrier could be provided.

Alcan Gove has sought and received advice from a specialist noise consultant and related this advice to outcomes of previous discussions with the Galupa community. Alcan will continue to consult the Galupa community to determine whether they wish to accept an offer for Alcan to install a 2.5 m high noise attenuating fence on an earth bund along the western and northern boundaries of the community. This structure would attenuate traffic noise from the road to the north and noise from movement of equipment to the western where wharf-related activity will take place during the construction phase. The noise barrier would not reduce noise emanating from the refinery. The specialist advice on noise provided during the development of the EIS indicated that construction noise at the refinery itself would be less obvious to the community than changes in traffic noise. The noise barrier would only be installed in line with wishes of the Galupa community.

Noise modelling has indicated that for noise sources at Perkins Wharf and along Melville Bay Road, the attenuating fence will achieve a noise reduction of approximately 4 dB(A).

Commissioning Noise (3)

A respondent has raised concerns that noise from the commissioning of plant and equipment at the refinery could be a source of annoyance as it tends to occur before all noise attenuating equipment has been installed.

The construction contractor will be required to install acoustic control measures before testing any noise generating equipment. Where this is not possible, temporary noise shields will be installed.

10.7 Noise Management (3)

A respondent has recommended that a comprehensive noise monitoring program be put in place to prove the modelling results for the scenarios proposed.

As stated in the Noise EMP, Alcan Gove is committed to undertaking noise monitoring after commissioning and subsequently at two yearly intervals. This will enable the accuracy of the noise modelling results to be confirmed.

11.2.1 Refinery Catchment

It was pointed out at the meeting with NT Government agencies that while Section 11.2.1.3 of the Draft EIS notes that the refinery outfall discharges stormwater, cooling water, waste water from the RDA neutralisation facility, and recovered groundwater, it does not mention treated sewage effluent.

It should be noted that treated sewage effluent is also discharged from the refinery outfall.

11.3.1 Current Surface Water Management - Refinery (1,2,5,6)

Scale Management (6)

A respondent has noted that improvements to the previous methods of scale transfer have been made in which scale material is not placed on the ground. They are of the opinion that Alcan Gove should commit to continue with this system despite the use of concrete hardstands and bunds and the overhaul of the washer system.

The noted existing improved methods of scale transfer will continue to be used.

Rain Water and Process Water Management (2,5)

Two respondents have asked for details on how rainwater and process water in bunded areas is collected and returned to the process. To aid understanding Alcan has been requested to include a flow diagram of surface and waste water. This should include inputs (including sources, sources of contamination etc) outputs, quantities and flow directions.

A flow diagram showing the arrangements for surface water management for the existing refinery is given in Figure 3.

Process Spills

Alcan Gove aims to prevent escape of process liquors as far as possible. Section 11.3.1.3 of the Draft EIS outlines the design, operational and maintenance measures that are taken to ensure process liquors are kept within pipes and vessels.

In the event that there is an escape of process liquor, the aim is to contain it and to prevent its escape to the open environment. The last subsection of Section 11.3.1.3 describes the current status of tank containment and identifies areas where additional work will be carried out in order to ensure Australian Standards for bunding and containment are met.

The most significant work is required in the north-eastern area of the refinery, where there is insufficient collection capacity. Improving tanks bunds and upgrading the Stockpile Creek Sediment Pond to function as a containment pond will rectify this.

Having contained any process spills, it is a relatively simple matter to pump them back to the section of the process from which they were lost. Each bunded area around tanks is fitted with a sump and the concrete platforms are directed towards the sump for collection and pumping. The containment ponds can be pumped out using portable pumps.

Rainwater

The stormwater drainage network and bunded area system at the refinery has generally been developed to segregate clean and dirty areas. Alcan Gove has implemented an improvement program to evaluate the stormwater performance and construct drainage and/or bunded system upgrades where required.

The main types of refinery catchment areas and associated stormwater collection system are described below.

Bunded Areas

Bunded areas are internally drained to collection sumps and collected dirty stormwater is pumped to holding tanks that are located throughout the refinery. The pumps are sized to cater for 200 year Average Recurrence Interval (ARI) rainfall conditions, and an improvement program is underway to upgrade bunded areas pumps that have insufficient capacity. The bunded areas are pumped to specific tanks depending on their location within the refinery as shown conceptually on Figure 3. The destination tanks for specific bunded areas can be altered as required to optimise the use of available storage in other tanks. All stormwater from bunded areas contained in the tanks is reused in the refinery process or pumped to the RDA.

Unbunded Process Areas

All roads and unbunded process areas within the refinery may generate contaminated runoff. These areas are generally drained to one of two main containment ponds (Southern Pond or Western Pond).

Western Pond Catchment

In the Western Pond catchment, the unbunded process areas drain to the Western Channel and are diverted into the Western Pond by a small diversion weir. The water contained in the Western Pond is tested with continuous monitoring of electrical conductivity (EC) and, when EC is less than 7.5 mS/cm, Western Pond waters are pumped back into the Western Channel and discharged to Melville Bay via the Refinery Outfall. When water in the Western Pond does not meet discharge quality criteria, it is pumped to holding tanks for transfer to the RDA or reuse in the refinery process.

Alcan Gove has identified areas of non-process catchments to the west and north of the refinery and has commenced an upgrade program to divert these clean areas around the Western Pond.

Southern Pond

Unbunded process areas in the Southern Pond catchment drain directly to the Southern Pond. Stormwater contained in the Southern Pond is pumped to holding tanks for reuse in the refinery or transfer to the RDA.

Stockpile Creek Catchment

The northern part of the ferrosilt area currently extends into the Stockpile Creek sub-catchment. There is currently no containment pond system for stormwater from this unbunded process area but runoff passes through

a settlement pond before entering Stockpile Creek. As part of the third stage and refinery containment upgrades all process areas in this location will be bunded.

Clean Areas

Clean (non-process) unbunded areas at and around the refinery drain directly to the Western Channel and discharge into Melville Bay.

Stage 3 Expansion

The Stage 3 expansion will improve stormwater collection and management at the refinery. The expansion will involve construction of new refinery facilities that will be designed with bunding as described in the Draft EIS. All new bunds will be designed with sumps and pumps to prevent overflow.

Stormwater Treatment (1, 6)

Two respondents have asked for a description of any improvements planned for the interception of stormwater and its treatment prior to discharge following rainfall events. They consider that there appears to be a high potential for fugitive discharges of contaminated stormwater to the environment.

See description above.

Light Fuel Tank Farm (6)

A respondent has asked for more information about stormwater management at the light fuel and harbour tanks farms:

- *Where does it discharge*
- *What controls are in place*
- *What happens when bunds overflow in high rainfall event*
- *Emergency response details*

When storm water is confirmed to be suitable for release from bunded areas at the light fuel and harbour tank farms, it is discharged via manually operated valves to drains on the southern side of the bunded areas to Melville Bay.

Discharges are carried out in compliance with controls which are detailed in local operating instructions. These include:

- Visually inspections for hydrocarbons or other contaminants (eg: precipitate, sediment, and large amounts of dust). If any of these are present water is not to be released without further assessment by the refinery's EHS Department.
- Oily water separation system.
- Testing for alkalinity. Water can only be released if the calibrated pH meter reading is between 6.5 and 9.4.
- Water samples for off-site analysis are to be collected prior to first release, at least once per week whenever discharges are required.
- The Operators daily log book is to be updated with times, locations & results of water releases.

The bunds have sufficient capacity to prevent overflow from rainfall events.

GOVEPLAN provides emergency response procedures for oil spills. This is supplemented by site-specific emergency response plans.

Hydrate Storage (6)

A respondent has asked how is the occasional storage of hydrate undertaken to prevent contamination of surface water runoff.

Loading to or from the area will not occur during rain periods. Runoff will pass though a sump to collect sediment load before being discharged to the site's storm water system.

Timeframe for Improvements (1,6)

Two respondents have asked for the timeframe for bunding and containment improvement measures.

All bunding associated with the expansion will be installed during the construction period. The bunding and containment improvements for the existing refinery will be completed by 2009.

11.3.2 Current Surface Water Management – RDA (1,8)

Residue Layers (8)

A respondent has raised concerns about the overall stability of the RDA ponds because the monsoon rains may continue to wet the surface which may then not be able to dry out before the next layer of residue is planned to be deposited. Their concern is that this may affect the overall compaction of the residue and its relative density.

Operating procedures over the last ten years since dry stacking commenced has ensured that sufficient area is always available to enable adequate surface drying. This includes wet seasons with some of the highest rainfalls recorded. The drying areas required for the expanded refinery have already been determined and allocated.

Contaminants (1)

A respondent has asked for an inventory of the loadings of the principal contaminants on site such as vanadium and arsenic.

Alcan Gove maintains an inventory of all solid and liquid wastes discharged to the RDA and periodically samples these waste streams. The concentration of trace elements in the waste varies over time in response to process changes. It should also be noted that the principal contaminants in the waste originate from the bauxite ore itself and are naturally found in soils throughout the region. These elements are not added to the waste during the refining process. Therefore any inventory of particular trace elements at the RDA reflects what was present in the ore prior to the mining and refining processes.

Of the 55 million tonnes of residue and waste water currently stored in the RDA, the current inventory of vanadium and arsenic which is contained within the mineral structure of the residue and dissolved in the wastewater is estimated to be 25,000 tonnes (0.05%) and 300 tonnes (0.0005%) respectively. Vanadium and arsenic are part of the mineral matrix that is bound up in soil and/or mined ore and neither element is expected to be biologically available.

RDA Bund Wall Integrity

Information was sought at a meeting of NT Government agencies on storm surge effects and risks to the integrity of the bund walls at the RDA.

The Highest Astronomical Tide (HAT) at Gove is approximately 1.9 m above Mean Sea Level (i.e. approximately AHD). Since the toe of the lowest embankment of the RDA is RL 5m AHD, a storm surge of greater than 3 m would be required to affect it. The 1974 EIS of the RDA (Dames & Moore, 1974) reported that the 1 in 50 year storm surge for the Gulf of Carpentaria is 2.44 m. Alcan Gove is aware that the Bureau of Meteorology will be modeling the storm surge effects for the Northern Territory coastline in the near future. Alcan Gove will consult the Bureau in regards to local information for the Gove region and Melville Bay. This information will update current understanding of potential storm surge effects on the RDA including the predicted impact of sea level rise due to global warming.

11.4 Water Quality Monitoring System (1)

Reporting System (1)

A respondent requires that Alcan Gove discusses and agrees with them on a reporting system for surface water quality. The agreed program needs to be included in the Mining Management Plan. Reporting should include both digital data on a regular basis and interpretive reports. Similarly agreement is required on the extent, nature and timing of monitoring data provided.

Alcan Gove currently provides surface water quality data bimonthly and will consult with DBIRD on the future reporting requirements.

Real Time Monitoring

A question was asked at a meeting with NT Government agencies about the extent of real time water quality monitoring that is undertaken at the refinery outfall to enable a quick response in the event of an upset or emergency condition.

On-line alkalinity monitoring is undertaken at the discharge end of the refinery outfall. The refinery's central control room has alarms set for high alkalinity and prescribed preventative actions are taken in the event of high alkalinity being recorded. In addition the central control room has video monitors to detect any visible discharge.

11.7.2 Seawater Cooling Discharge (1)

A respondent has asked what the bleed water is likely to contain and how much of it will be discharged.

The biocides and corrosion inhibitors present in the cooling water are listed in Section 7.3.1 of this EIS Supplement.

11.9.2 Refinery Discharge Quality (6)

Waste Water Neutralisation Plant Effluent (6)

A respondent has asked for an explanation of the reasons for an increase in precipitate and dissolved metal loads in the discharge from waste water neutralisation plant.

To help eliminate stored waste water inventory the neutralisation rate will increase from 50 to 350 m^3/hr and will include trace amounts of Bayer liquor contaminants. The settling process will eliminate the majority of sediment, but minor concentrations may still be present. In order to compensate for this extra load, control measures on other waste streams will be improved. As shown in Table 11.9.1 of the Draft EIS, the total metal load as indicated by vanadium will reduce and the precipitate load will increase by only 3%. Alcan Gove is investigating further continuous improvement initiatives to settle precipitate.

Discharge Rate

A question was asked at a meeting with NT Government agencies as to why the refinery discharge does not increase at the same rate as refinery production.

It should be noted that although the refinery's production will increase by 75% with the expansion, there is not an equivalent increase in the discharge of refinery waste water from the refinery outfall. The refinery discharge will only increase by 6% (6,000 m^3/hr to 6,340 m^3/ hr). This is because the primary component of the waste water discharge is evaporation cooling water. The amount of evaporation cooling water discharged following the expansion will not increase as evaporation cooling for the Third Stage will be a closed circuit freshwater cooling system which recycles the cooling water through a cooling tower.

Cooling for Stages 1 and 2 (6)

A respondent has asked, given that Alcan Gove is committed to achieving a zero mixing zone for its discharge, what measures will be implemented to prevent any further caustic contamination of discharge water and precipitate to Melville Bay if the cooling system for Stages 1 and 2 is not to be upgraded.

Alcan Gove is committed to the reduction of the impact area in Melville Bay through the following:

- Upgrading of the site's containment system
- Continuous improvement of operational controls eg. evaporation barometric levels
- Review longer-term options to reduce the effects of the highest impact activities

11.9.4 Water Quality Monitoring and Impact Mitigation (1,11)

Monitoring Sites (1,11)

Two respondents have asked where the new water quality monitoring sites will be. DBIRD expects Alcan to formally agree their program under the Mining Management Act.

Water monitoring sites will be selected in consultation with DIPE and DBIRD and will be incorporated into the Mining Management Plan.

Changes to Monitoring Program (11)

A respondent has asked that the changes to the water quality monitoring program include the following:

- *Measurement of chlorophyll 'a' concentrations and dissolved oxygen levels to assess the trophic status of receiving waters and to determine the significance of nutrient concentrations in surface water discharges to the marine environment.*
- *New surface water quality monitoring sites at the refinery to characterise water quality discharge from the waste water neutralisation plant into the Seawater Channel.*
- *Additional flow monitoring to quantify discharges from the waste water neutralisation plant into the Seawater Channel.*

Alcan Gove will include the above changes in the revised monitoring program.

12.1.3 Groundwater Standards (1,3)

Locally Based Criteria (1)

A respondent has asked if Alcan Gove has considered using local water quality data to develop water quality criteria in the manner suggested in the ANZECC Guidelines.

Alcan Gove will further develop data on local conditions and include this in the development of trigger levels for investigation in accordance with the ANZECC guidelines.

Groundwater Remediation Targets (3)

A respondent is seeking a commitment from Alcan Gove to long-term groundwater remediation targets. They require these targets to be measurable minimum standards that are acceptable to the regulatory agencies and the traditional owners and will be achieved to meet decommissioning requirements.

Alcan Gove is committed to long-term groundwater remediation and will establish groundwater quality objectives and targets by December 2004.

Groundwater Protection (1)

A respondent considers that the draft EIS implies that, if groundwater is not to be used for human consumption in the foreseeable future, only the effect on marine waters is important. They note that protection of the environment on site should also include the protection of groundwater itself.

This is noted. Alcan Gove is already reducing its impact on groundwater quality through a range of initiatives and will continue to do so.

Remedial Actions (1)

A respondent has asked what will be the remedial action if trigger values for contaminated groundwater are exceeded at both the refinery and the RDA.

Several remedial options are available. These include:

- Further reduction of contamination from sources
- Increased groundwater recovery rate

- Interception of contaminated groundwater

12.1.4 Existing Environment – Refinery (3,5,6,11)

Groundwater Contamination (5)

A respondent has asked for more information on groundwater contamination at the refinery.

Alcan Gove will discuss with the respondent, their information requirements and make further information available.

Groundwater Remediation (11)

A respondent has asked that Alcan Gove endeavours to continue determining ways of removing caustic contamination from all groundwater at the refinery, in the long-term.

Alcan Gove is committed to ensuring that, in the long term, groundwater at the refinery is not contaminated. It is for this reason that the programs described in the Draft EIS which are aimed at reducing or eliminating the sources of groundwater contamination have been implemented. Further information on the measures to be taken in the expanded refinery to prevent the placement of caustic contaminated materials on the ground (thus increasing the potential for groundwater contamination) is given in Section 11.3.1 of this Supplement. Furthermore, remediation is underway via the recovery bores which remove contaminated groundwater from the refinery area.

Interaction with Marine Environment (3)

A respondent has asked for information on the potential for additional interaction of contaminated groundwater with the marine environment in intertidal or below sea level elevations.

As discussed in Section 14.2.2.of the Draft EIS, investigations of the effects of the seepage of groundwater underlying the refinery into the marine environment at Northern Beach were undertaken in 1995 and 2001. These investigations indicated that apart from the natural discolouration of water clarity over a small area there was no measurable environmental impact occurring to the marine environment as a result of the groundwater discharge.

This issue is discussed in more detail in Section 14.3.2 of this EIS Supplement.

Bottom Sludge in Tanks (3)

A respondent has asked about the fate of the sludge that accumulates at the bottom of fuel tanks.

This material is disposed of at the RDA where it is contained in a controlled location which prevents its discharge to the environment.

Discharge of Recovered Groundwater (6)

The groundwater recovery program discharges into the refinery discharge channel without any form of treatment. A respondent has commented that this implies that to improve the quality of groundwater through-flow to the northern and southern beaches, the quality of discharge water to Melville Bay is being compromised.

The recovery and disposal of groundwater into Melville Bay avoids elevated concentrations of trace elements in intertidal areas along the northern and southern beaches. Water quality studies undertaken before and after the discharge of groundwater showed no measurable change in outfall quality. Alcan Gove is developing waste water treatment options for this flow.

12.2.4 Existing Environment – RDA (3,8,11)

Dimbukawuy Rocks (8)

A respondent has raised concerns over the proximity of Dimbukawuy Rocks to the RDA. Dimbukawuy Rocks hold a strong cultural value for Rirratjingu people, and they are concerned that residue may slip and breach the pond walls. The community members are seeking some assurance that the Dimbukawuy Rock site is not in any danger of being swamped by residue. They would like to see a determination made of the overall structural integrity of all the pond walls to ensure safety mechanisms.

The Residue Disposal Area operates under procedures and management practices that are established through Alcan Gove's ISO 14001 accredited Environmental Management System (EMS). This includes the identification and management of all significant risks associated with residue disposal activities. The design, operation and maintenance considerations to ensure the integrity of the embankments are addressed in Section 3.6.4 of the Draft EIS and elsewhere in this EIS Supplement.

All containment structures at the RDA are monitored, maintained and managed in accordance with best practice engineering standards including compliance with guidelines of the Australian National Committee on Large Dams. Independent expert consultants provide the technical support to help ensure compliance with these standards and guidelines and report regularly to Alcan Gove on their monitoring results. Annual reports on the structural integrity of the ponds are provided each year to the Northern Territory Government. The wall stability monitoring results for the area around Dhimbukka Rocks have not indicated any stability issues.

Rirratjingu people visit Dhimbukka Rocks regularly and are able to access the site at any time, subject to safety requirements. No concerns about the site have been expressed to Alcan Gove employees during such visits. However, in response to the submission from Yirrkala Dhanbul Association, Alcan Gove will directly consult with the people expressing concerns to improve understanding and ensure the site is managed to their satisfaction.

The stability of the RDA embankments is further discussed in Section 3.6.

1999 Release to Drimmie Arm (8)

In relation to the 1999 release to Drimmie Arm, A respondent would like to see more analytical data to provide an overview of the extent of environmental damage, and a process of analysis to conclude what exactly is meant by recovery, and to what extent recovery has occurred.

Copies of the relevant reports will be provided to the respondent.

RDA Drainage at Closure (8)

A respondent is concerned that, whilst the drainage system at the RDA are currently managed and overseen by Alcan and YBE, upon completion of the ponds, if regrowth is proven to be successful, then the routine management regime will change and the potential for this area to soak or absorb water may lead to the pond core becoming unstable and breaching the walls.

The revegetation process will include provision of subsurface drainage to remove excess water from the soil profile so that it discharges safely without moving towards the deeper into the residue storage. This design prevents the movement of water towards and through the pond walls. In addition the dry stacking of mud ensures very low permeability and therefore eliminated the potential for any water storage in the main body of the stored residue.

Mangrove Dieback (3,11)

One respondent requires further evidence to be presented to rule out the possibility of groundwater contamination as a contributing factor to mangrove dieback at the RDA. Another respondent has asked for an assessment of the effects of rising water tables on mangroves and other coastal flora.

The mangrove species in the area were suited to a pattern of wetting and drying that no longer exists. This pattern has changed to permanent saturation due to rising groundwater levels as a result of hydrostatic pressure exerted by the RDA. Alcan Gove undertook an investigation of this change which is reported in LDM, 2000.

The investigation found that a persistent elevated water table is the most likely and observable impact that has occurred to the mangroves. A copy of this report will be made available to the respondent.

Leachate Potential of Wastes Disposed at the RDA (3)

A respondent has asked for an assessment of the leachate potential of wastes disposed at the RDA as a result of exposure to a caustic environment.

The RDA has been designed to contain all contaminants within its embankments. This includes the containment of any potential leachate which may result from exposure of waste to a caustic environment. In addition, the dry stacked residue has a very low permeability and hence effectively encapsulates any waste disposed of at the RDA.

12.2.5 RDA Groundwater Impacts from Expansion (3)

A respondent has asked for explanation of the statement in the Draft EIS that "a reduction in the volume of wastewater stored" at the RDA will reduce groundwater risk "due to lower hydraulic pressure".

The above statement referred to the reduction in the depth of free-standing water at the RDA once the Waste Water Inventory Reduction Project is implemented. If the depth of water is reduced, the hydraulic head is also reduced. However, it is acknowledged that the total hydraulic pressure will include the total depth of stored residue which is significantly greater than the depth of stored water on the surface.

13.2 Marine Monitoring and Investigation Program (3,11)

Two respondents have asked for details of a number of references that are given about marine investigations but whose main findings have not been presented in the EIS.

Alcan Gove will contact the respondents and provide the requested information.

13.3.1 Water Quality Standards (3,5,11).

Level of Disturbance (5,11)

A respondent has commented that from work undertaken by MAG, Melville Bay near the refinery is considered a "moderately disturbed ecosystem", not "slightly to moderately disturbed".

A conservative approach has been adopted with respect to application of the ANZECC classification. Within the area under consideration the level of ecosystem disturbance varies over a quite small distances. For example, in the immediate vicinity of the outfall the ecosystem would be described as "highly disturbed", in the vicinity of the working jetties as "moderately disturbed", elsewhere in Gove Harbour "slightly to moderately disturbed", and only "slightly disturbed" elsewhere around the Peninsula (e.g. Wallaby Beach).

Nevertheless, the respondent's assessment is noted and will be taken into account in the derivation of locally applicable trigger values for marine discharge.

Cultural and Spiritual Values (3)

A respondent has noted that the Draft EIS does not acknowledge that "cultural and spiritual values" exist when considering water quality values.

The water quality assessment presented in the Draft EIS is based on identified "beneficial uses" as presently defined by the Northern Territory government and to which it is possible to apply appropriately defined water quality criteria. It is acknowledged that cultural and spiritual values exist over part or all of the waters under consideration. It is also noted that there are no water quality guidelines for the protection of "cultural and spiritual values" and thus it is not possible to determine, on an objective basis, whether water quality does or does not meet the requirements for the protection of cultural and spiritual values.

Nevertheless, it is a requirement of the ANZECC guidelines that, when developing locally applicable trigger values, the input from potentially affected communities is sought. Alcan Gove will seek input from the

Traditional Owners and others on the cultural and spiritual values of Gove Harbour in developing the trigger values.

Ecotoxicological Data (3)

A respondent has asked that Alcan Gove looks at ecotoxicological data for key parameters when developing local water quality triggers.

Alcan Gove has committed to monitoring to determine background water quality and to establish local water quality triggers based on this. A proposed marine health monitoring program will be provided to the DIPE in June 2004 as part of an obligation under the waste discharge licence. It will take into account all relevant methods for developing water quality triggers.

13.4.2 Gove Harbour Water Quality (3)

Background Sites (3)

A respondent has stated that sites that are impacted by the outfall should not be used as background sites.

The implications of using data from sites that are intermittently impacted by the outfall are acknowledged in the Draft EIS. The statistical data on background water levels used for the Draft EIS were adjusted so that they were comparable to the conservative trigger levels established by ANZECC (2000). The proposed marine health monitoring program will include the selection of more appropriate background sites.

Use of Five Years of Data (3)

A respondent is seeking justification as to why only 5 years of data have been used to describe existing water quality.

In reviewing the Alcan Gove environmental database it was considered inappropriate to consider data older than five years due to changes in sample analysis methodology and plant operations that would make these data unreliable if they were applied to present operational discharges.

Table 13.4.1 (3)

A respondent have asked that Table 13.4.1 should include the number of samples, the mean, standard deviation, minimum, and maximum.

The statistical data requested is given in the following tables.

Parameter	Dundas Point (Background)									
	Dry Season					Wet Season				
	n	min.	max.	mean	st. dev.	n	min.	max.	mean	st. dev.
Temperature (°C)	1	28	28	28	-	0	-	-	-	-
TSS (mg/L)	27	4	73	23.6	16.8	14	2	37	13.6	10.1
Aluminium (µg/L)	31	<5	51	15.9	12.3	15	<5	27	9.3	6.4
Arsenic (µg/L)	30	<5	5	5.0	0.1	15	<5	<5	<5	-
Vanadium (µg/L)	29	1.7	27	6.6	6.1	15	2.4	18	4.3	3.9

Parameter	Refinery Outfall (Discharge)									
	Dry Season					Wet Season				
	n	min.	max.	mean	st. dev.	n	min.	max.	mean	st. dev.
Temperature (°C)	1198	29	52	43.9	2.9	395	32	52	45.7	2.5
TSS (mg/L)	103	11	360	89.7	66.2	43	11	260	88.7	59.9
Aluminium (µg/L)	126	<5	270	45.1	46.0	48	<5	1744	101.1	252.6
Arsenic (µg/L)	93	<5	80	8.6	9.8	32	<5	16	6.1	2.7
Vanadium (µg/L)	128	9	610	101.4	69.3	48	10	325	91.6	55.4

Parameter	Seawater Intakes (Background)									
	Dry Season					Wet Season				
	n	min.	max.	mean	st. dev.	n	min.	max.	mean	st. dev.
Temperature (°C)	1197	11	65	29.1	3.8	516	26	63	30.8	34.5
TSS (mg/L)	74	2	65	15.0	14.8	30	2	436	29.9	78.3
Aluminium (µg/L)	78	<5	360	33.0	46.4	32	<5	87	26.9	19.9
Arsenic (µg/L)	47	<5	13	5.4	1.3	18	<5	8	5.2	0.7
Vanadium (µg/L)	79	<5	100	17.4	18.4	32	2	25	8.1	6.1

13.4.3 Drimmie Arm Water Quality (3)

A respondent has asked that in describing Drimmie Arm water quality, existing data should be compared against background as well as ANZECC guidelines.

Section 13.4.3 of the Draft EIS refers to a survey of Drimmie Arm undertaken in 2000 (URS, 2001e). This report compares the water quality in Drimmie Arm with that in No Name Creek which is considered to be representative of background levels. The respondent has been provided with a copy of this report.

13.5.1 Gove Harbour Sediment Quality (3,6,11)

Impacts from Flocculant (3,6)

Two respondents have asked that the impacts sustained by the flocculation of precipitate over the substrates in Gove Harbour be addressed.

The precipitation of flocculant in Gove Harbour has resulted in an area where benthic invertebrate fauna are absent (approx. 70 ha) or present in reduced abundance and diversity (approx. 50 ha). The area impacted comprises mainly soft bottom (sands and silts), with some flocculant present around the rocky parts of the shoreline and Harbour Islet.

Remediation of Flocculant (11)

A respondent has asked Alcan Gove to address the issue of remediation of the flocculant in the Bay and to identify and undertake a remediation program as part of any further expansion.

The small particle size of the precipitate poses difficulties in remediating the area, as its removal by normal dredging techniques could result in an expansion of the area of impact due to particle dispersion. Alcan Gove has a continuous improvement program aimed at reducing the precipitate load to the bay. Alcan Gove will undertake research into remediation options.

Alcan Gove is committed to the reduction of the impact area in Melville Bay through the following:

- Upgrading of the site's containment system.
- Continuous improvement of operational controls eg. evaporation barometric levels.
- Reviewing longer-term options to reduce the effects of the highest impact activities.
- Monitoring changes in flocculant extent.
- Remediation of the Bay following refinery closure.

"One Off" Sediment Surveys (3)

A respondent considers that "one off" sediment surveys are not scientifically robust and the data are not presented in the EIS.

As discussed in Section 13.2.2.1 of the Draft EIS, there have now been three surveys of the sediments of Gove Harbour, each undertaken using similar methods and techniques. The latter two surveys were undertaken to confirm and further refine the area of impact identified in the first survey. The data suggest that there has been no substantial change in the area of impact over the period of survey.

Sediment surveys in many cases are considered preferable for long-term contaminant studies rather than water testing, as metal concentrations in sediments typically represent a time-integrated picture of exposure to contaminated water flows, whereas water parameters vary temporally in response to factors such as tide and wind.

Arsenic (3)

Because the ANZECC trigger levels for arsenic were exceeded at one point, a respondent has asked for further investigations to be undertaken.

Arsenic will continue to be included in the marine monitoring program and any trends in sediment concentrations will be identified. If any adverse trends are identified, investigations into potential sources and remedial actions will be undertaken.

13.5.2 Drimmie Arm Sediment Quality (3)

A respondent has noted that the sediment analysis for Drimmie Arm described in the Draft EIS does not indicate how "elevated" metal concentrations were nor how much they had "declined" by 2000 or how they relate to ANZECC trigger values.

This information is included in reports (LDM, 2000 and URS, 2001e) provided to the respondent and Alcan Gove will discuss this information directly with the respondent. The overall conclusion of URS 2001e was that there was no indication of persistent detrimental effects from the 1999 discharge into Drimmie Arm on water quality, mangroves or trace element concentrations in biota.

13.6 Refinery Expansion Marine Impacts (1,2,11)

Refinery Outfall (1,2)

Two respondents have asked that Alcan Gove identifies what steps they will take to lower discharge volume and TSS concentration to Melville Bay to allow its recovery. One respondent also requests assurance that all avenues for mitigation have been explored.

As stated in the Draft EIS, the discharge volume from the expanded refinery will remain similar to current discharge as seawater cooling is not used in Stage 3 (refer Section 11.9.2). Nevertheless the discharge per tonne of alumina produced from the expanded refinery will reduce by 40%.

Alcan Gove has committed to continual reduction of TSS as discussed in Section 25.5.3.5 of the Draft EIS.

Accidental Release from RDA (2,11)

Two respondents have suggested that as the additional residue is planned to be deposited in the existing RDA, this will increase the risk of the accidental release of alkaline waters into the adjacent marine environment

following heavy rain. They have asked that Alcan Gove addresses the change in risk from the additional residue and whether existing strategies are appropriate to address the changed risk profile if any.

As discussed in ES 9.10, the capacity of the RDA will be increased to match the increased rate of residue generation. In addition the waste water reduction project will reduce the potential for accidental releases by reducing the volume of stored waste water. The liquor purification process will also significantly reduce the concentration of caustic in the residue. These actions will ensure that the risk of any accidental release of alkaline waters to the adjacent marine environment will not increase as a result of the refinery expansion.

13.7.1 Refinery Outfall Discharge (3,14)

Contaminant Load (3)

A respondent has asked for a discussion of the impact of contaminant load on the ecosystem.

The contaminant load from the refinery has resulted in an impact on the seafloor surrounding the outfall resulting in loss and reduction in benthic fauna. A full description of the existing ecosystem including the impact of the existing refinery discharge is given in Section 14.3 of the Draft EIS.

Cumulative Impact (14)

A respondent has expressed concern about the cumulative impact of the continuous discharge of vanadium and other metals on the marine ecosystem.

Table 13.6.1 in the Draft EIS shows that the predicted concentration of vanadium discharged from the refinery will decrease from the existing 184 µg/L to 120 µg/L after the expansion. The effects of the cumulative impacts from the discharge over the last 30 years of the refinery's operation have been described in Sections 13 and 14 of the Draft EIS. Given the reduced metal concentrations in the discharge from the expanded refinery and the relatively small increase in discharge volume of less than 6%, the cumulative impacts of metal concentrations are expected to reduce from what exists at present.

13.7.2 Changed Shipping Movements (2,3,6,11)

Ballast Water Management (6)

A respondent has asked for an indication of what the "current good practices in managing ballast water" are in Section 13.7.2.1 of the Draft EIS.

Ballast water is discharged by vessels taking on cargo. At Gove this comprises bulk carriers taking on alumina, bauxite and hydrate. Ballast water discharge in Australian ports is managed under mandatory ballast water management requirements introduced in 2001. The requirements are enforced by the Australian Quarantine Inspection Service (AQIS) under the *Quarantine Act 1908.* Ballast water management options include:

- application of the Ballast Water Decision Support System (BWDSS) (tank-by-tank risk assessment)
- non-discharge of "high-risk" ballast water in Australian ports or waters
- tank to tank transfer
- full ballast water exchange at sea

Aquatic Pests (2,11)

Two respondents have noted that the Draft EIS does not mention any protocol for checking for aquatic pests. They have asked that Alcan Gove addresses the change in risk associated with this change in volumes of ballast water and whether existing strategies are appropriate to address the changed risk profile if any.

The ballast water management strategies discussed above address the issue of aquatic pests. In addition, all vessels arriving in Australia from international waters are required to submit a Quarantine Pre-Arrival Report (QPAR) to AQIS. This includes reporting of ballast water management procedures undertaken. AQIS officers undertake verification inspections. These may include sampling of ballast water.

The risk profile for the expanded refinery will not change significantly with the modified shipping regime associated with the expanded refinery. This is because the risk is related more to the origin of the export ships rather than the volume of ballast water. While there will be a small increase in ballast water (approximately 15%), the ships will continue to travel generally to and from the same ports as they do as present. The cessation of bauxite exports will result in one source of risk being eliminated.

During construction, vessels delivering materials will also be subject to the same AQIS requirements.

GOVEPLAN (6)

A respondent has asked for details from the updated GOVEPLAN.

The GOVEPLAN is provided to the marine safety division of DIPE as part of the Northern Territory oil spill plan process. A copy of GOVEPLAN will be provided to the respondent.

Ship Spills (3)

To manage ship spills, a respondent has asked that the application of the National Plan as implemented by AMSA as it applies to Gove should be examined.

Alcan Gove manages ship spills in accordance with GOVEPLAN (see above). GOVEPLAN is compliant with the National Plan implemented by AMSA.

13.8 Marine Management (2,3,11)

Biological Monitoring (3)

A respondent has asked that regular biological monitoring be undertaken to assess impacts and to assure traditional owners that fish, mussels, oysters etc are safe to eat.

Biological monitoring will be included in the marine health monitoring program currently being developed. This will be undertaken in conjunction with the traditional owners and their representatives. Assessment of impacts on local marine food sources will also be included.

Sediment Monitoring (3)

A respondent has asked that sediment monitoring be included as part of the regular monitoring program.

Sediment monitoring will be included in the marine health monitoring program currently being developed.

Risk of Release from RDA (3,11)

Two respondents have stated that, as the additional residue is planned to be deposited in the existing RDA, there will be an increase in the risk of the accidental release of alkaline waters into the adjacent marine environment following heavy rain. They have asked Alcan Gove to address the change in risk and whether existing strategies are appropriate to address the changed risk profile, if any.

As discussed in ES 9.10, the capacity of the RDA will be increased to match the increase rate of residue generation. Because of this, the risk of any accidental release of alkaline waters to the adjacent marine environment will not increase as a result of the refinery expansion.

14.2.1 Refinery Outfall Reference (3)

A respondent has noted that the reference to Hanley (1993) is uncheckable as it was never completed and Museum and Art Galleries does not have a copy.

Hanley (1993) was not published and the reference in the Draft EIS was in relation to data collected by Hanley. These data will be made available to the respondent.

14.2.2 Northern Beach Reference (3)

A respondent has asked that the term "significant" used in the Draft EIS be defined and that the survey conclusions should be in the Appendices.

The finding of no significant impact on marine biota was based on observation that there was no difference in the diversity and abundance of macro invertebrates and marine algae at increasing distances from the zone of discharge, having regard to the natural habitat variability present along the Northern Beach shoreline.

A copy of the report's conclusions can be made available to the respondent.

14.2.3 Drimmie Arm Reference (2,3,11)

Three respondents have asked that further details of the Drimmie Arm discharge study (URS 2001e) be provided. Information sought includes what the effect was, what taxa recovered, what did not, over what time period would the recovery take, etc.

A copy of the referenced study can be made available to the respondents.

14.3.1 Regional Influences and Marine Biogeography (3,11)

Groote Biographic Region (11)

A respondent has indicated that "Groote Biographic Region" is old terminology and that it is best to use "North Australian Biographic Region".

The term "Groote Biogeographic Region" has been adopted from the Interim Marine and Coastal Regionalisation for Australia (IMCRA June 1998, Version 3.3) and represents a meso-scale biogeographic unit. The term "North Australian Biogeographic Region" suggests a macro-scale unit. However, the latter term can be used if desired.

Tidal Reference (3)

A respondent has asked for a reference for the statement that the tidal range is meso-tidal with a 2-3 m variation.

The reference is "Interim Marine and Coastal Regionalisation for Australia: an ecosystem classification for marine and coastal environments (IMCRA Technical Group, June 1998, Version 3.3)."

CRC Reference (11)

A respondent has noted that CRC et al 2003 (aquatic pest survey) was not included in the References section of the Draft EIS.

Reference to the aquatic pest survey report I - CRC Reef Research and URS Australia Limited 2003, Port Baseline Survey for Introduced Marine Pests - Port of Gove. Report prepared for Alcan Gove Pty Limited.

Regional Habitats (3,11)

The Draft EIS states that species in the Gove area are "generally distributed for thousands of kilometres" across northern Australia and into Indonesia, Papua New Guinea and the Philippines. A respondent has said that this is not correct and apparently at odds with Section 14.3.1.1. They state that the fish and other marine fauna of the Gove area do not necessarily resemble that of Indonesia etc. A respondent has said that a number of NT coastal fish species are restricted to north-western Australia, including Gove, and many are adapted to turbid inshore habitats. In addition, another respondent has asked for a reference to the discussion on regional habitats.

The suite of habitats present in Melville Bay occurs widely along the northern Australian coastline and coastlines of neighbouring islands. What does differ is the combination of habitats and their relative areas present in different locations. The majority of tropical marine animal and plant species, including more conspicuous

elements such as dugong, sea turtles, larger fish (particularly pelagic species), seagrasses and algae are widely distributed in tropical waters. For example, the majority of Australia's tropical fish species are described as widely distributed in the Indo-Pacific region, with distribution patterns extending from east Africa to Micronesia and Polynesia (Allen G.R. and Swainston R, 1988 The Marine Fishes of North Western Australia, Western Australian Museum).

It is anticipated that there will be some level of endemism associated with any given area distribution and this will be most marked in those non-migratory species whose reproductive strategies are not designed to take advantage of distribution by tidal currents. Alcan Gove will undertake surveys to contribute to current knowledge on local endemism in association with the NT Museum.

14.3.2 Southern Melville Bay (3,6,8,11,14)

Figure 14.3.7 (11)

Throughout section 14.3.2 the Draft EIS compares abundance of benthic fauna, and numbers of benthic fauna (see Fig. 14.3.7 also). A respondent has said that it is unclear whether these parameters refer to species diversity (numbers of taxa), or numbers of individuals (for each taxon).

The Draft EIS refers to numbers of individuals.

Fish Species (11)

Although the Draft EIS states that fish "avoid" the refinery discharge plume, a respondent has asked what species of fish are present.

No detailed fish surveys have been conducted in the area in or adjacent to the discharge plume. The observation of avoidance of the plume by fish is based on field observation of the abundance and diversity of fish occurring in and adjacent to the plume. The avoidance behaviour is due to heat and turbidity which are physical stressors to which short exposure will not result in any long term detrimental effects.

No Name Bay (8)

A respondent would like to know the importance of the seagrass/mangrove communities in No Name Bay and Creek area.

No Name Bay contains the most extensive seagrass meadows identified around the Gove Peninsula. In Southern Melville Bay, North Creek Bay and the area around the mouth of the Giddy River may support similar distributions and abundance. Similarly, the mangrove communities fringing No Name Bay are important in the context of the Gove Peninsula and similar in extent to that found around North Creek and the Latram River, but less extensive than those found around the Giddy River

Macrofauna (3)

A respondent has said that the Draft EIS barely mentions fish and mobile animals such as crustacea. Grab samples reported in the Draft EIS do not allow observation of resident fish for example, which form assemblages linked to habitat types.

The survey of the sediments of Gove Harbour is based primarily on the results of grab sampling, with some limited dive observations and video survey. In the case of Figure 14.3.7 in the Draft EIS all of the data presented are based on the grab samples. The Gove Harbour studies have focused on the effects of the wastewater discharge and the grab sample surveys deliberately targeted sessile species and species that have limited mobility in order to assess the effect of the wastewater plume. Data from highly mobile species (e.g. fish) are less robust as there is no way of estimating the period an individual may have been exposed to the plume.

Microbiota (3)

A respondent has asked for more information on microbiota in sediments.

Fauna in sediments have been investigated by grab sampling and sieving using 1 mm aperture sieves. Fauna below this size have not been studied at Gove as there are no comparative data available to assess the results. However, cyanobacteria and algae are know to be present in Gove Harbour.

Caustic Effects on Seagrass (3)

A respondent has asked for more information on the effects of caustic discharge on seagrass.

The effect of discharge of caustic wastewater on seagrasses would depend on the alkalinity and volume of water discharged and the proximity of the seagrass to the point of discharge. Due to the buffering capacity of seawater, i.e the ability of seawater to neutralise alkaline and acidic waters, any impact on seagrass due to alkalinity is unlikely unless the discharge is of high volume/concentration, or is directly over a seagrass meadow.

Small Fish Species (3)

A respondent has asked for a listing of small fish species.

There has been no census of small fish species associated with specific habitats at Gove.

Signathids (3)

A respondent has asked for a discussion of any effects on signathids.

Refer to previous comment.

Metals Effects on Benthic Biota (3)

A respondent has asked for a discussion of the effects of metals on benthic biota.

Ongoing marine investigations to be undertaken in Gove Harbour will include the effects of metals on benthic biota.

Discharge to Northern Beach (3)

A respondent has asked for further justification that tannins are the source of the colour in Northern Beach groundwater discharge. They have also expressed concern about the interaction of the seepage at Northern Beach with the marine environment in the intertidal or below sea elevations.

An investigative marine survey was first undertaken in May 1995 (LDM, 1995) to determine if shoreline seepage of groundwater on part of Northern Beach had affected macrobiota within the inter-tidal or near-shore sub-tidal communities.

Identification of potential effects was based on comparing the composition and status of the communities colonising the various tidal zones and habitats at the affected site with those occurring at three similar but more distant sites located up to 2.5 km away.

The following conclusions were drawn from the survey results:

- The dark, red-brown colour of the water is due to the presence of fine organic matter, humic acid and fine particles of iron hydroxy-oxides and possibly sulfide.
- Physico-chemical data suggest that, apart for possibly copper, chromium and inorganic arsenic, rapid dilution of seepage water both below and at the shoreline/seawater interface ensures that any trace metal concentrates which exceed water quality criteria for protecting marine ecosystems are highly localised.
- The active seepage area of dark-stained groundwater was approximately 100 m long and compromised a narrow band occupying the lower inter-tidal zone and the sandy sub-littoral zone (less than 1m deep at lowest astronomical tide).
- Other than at the outwelling points (where black cakes of crumbly and weakly-cemented sediment occur), there has been no staining to adjacent rock or sediments in or beyond the active seepage zone.
- No effects could be identified at the seepage site with respect to the composition, abundance, diversity and apparent health of the surface-dwelling macrobiota colonising the near-shore sub-tidal substrates. For example, there was no sign of eutrophication or evidence of increased stress, including symptoms such as increased mucus secretions, bleaching or elevated partial mortalities to individual colonies.

- Compared with reefs at comparable locations in northern Australia, the intertidal and near-shore fringing reef communities examined at Northern Beach do not exhibit any visually marked reduction in the diversity or abundance of benthic macrobiota, nor any particularly unusual features or combinations or associations of species.

The main conclusions drawn from the 1995 survey results were that:

- The contents and properties of the dark-stained seepage appear relatively inert and biologically innocuous (especially following the initial dilutions at the beach/seawater interface).
- The seepage had not produced any marked or ecologically-significant adverse change to the shoreline communities along Northern Beach.

The intertidal and shallow sub-tidal surveys were repeated in 2000 to determine whether any change was apparent over that time, and to examine the interactions between the groundwater and seawater to determine if there was cause for concern about impacts on the marine environment.

During the 2000 survey, dark-brown groundwater was still observed at low tide discharging from the beach at several points. The discharge continued to be visible until the lower inter-tidal zone was covered by the rising tide.

Excavation to groundwater a short distance back from the waterline at a site some 200 m to the east revealed the presence of groundwater with a light-brown coloured suspended precipitate present. It appeared that the precipitate results from the mixing of groundwater with seawater within the beach sediments.

Comparison with 1995 data indicated that the inter-tidal habitats had not undergone any subsequent significant physical change. Plant and animal species diversity, abundance and distribution were also similar to that recorded in 1995. The metal concentrations in oysters from Northern Beach met the National Food Authority standards for all metals for which criteria have been established.

Comparisons between the 1995 and 2000 diver observations and video records suggest that there had been no substantial change in the coverage or health of corals on the nearshore reefs.

The 2000 survey concluded that the main impact of the groundwater discharge on the physical environment at Northern Beach was a visual one, that is the brown colouration of nearshore water in the immediate area of the discharge during periods of seepage. In 2000 the extent of staining was reduced compared to what it was in 1995 and much less that that apparent in aerial photographs dating from the period immediately before the recovery bores were commissioned (1999).

Despite the obvious colouration of the water in the seepage area, there was no apparent staining of the beach sand or beach rock. The only exception was a small area of the 'mineralised deposit' found at the centre of the discharge area.

There was evidence from the mixing experiments undertaken and the examination of the mineralised deposit that precipitation within the beach sands and at the beach surface plays a significant part in reducing the concentration of trace elements and organic carbon in the coloured seepage.

No impact from the groundwater discharge was detected on either the inter-tidal or the shallow sub-tidal biological communities.

Grapsid Crabs (3)

A respondent has asked for more information on Grapsid Crabs

The crab species and genera listed in the text on mangrove fauna are mentioned because they are conspicuous elements of the fauna. It is not intended in any way to suggest a complete listing of fauna. The sesarmids, i.e. species of the genus Sesarma, are members of the family Grapsidae, often referred to as "shore crabs".

Mangrove Systems (3)

A respondent has asked for a reference to support the statement in the Draft EIS that says that the mangrove systems in the Latram and Giddy Rivers would be similar to, if not greater than, No Name Creek.

This information is based on interpretation of aerial photography and field observation and is presented in map form in Figure 14.3.1 in the Draft EIS.

Mangrove Fauna (3)

A respondent has asked for more information on mangrove fauna.

A copy of a report with additional mangrove fauna information will be provided to the respondent

Rocky Shores (3)

A respondent considers that the last sentence in paragraph 1 on P 14-9 of the Draft EIS is too general and does not discuss the plethora of coral species which colonise this habitat.

The last sentence of paragraph 1, P14-9 refers to the limited variability in structure of the rocky shore formations along the northern shore of Gove Harbour, compared for example to those along the southern shore of the Harbour or at Wargarpunda Point. Typically, species numbers increase with increasing habitat diversity.

The extent of corals in Gove Harbour is discussed on P14-5 of the Draft EIS.

Fish (11)

A respondent has asked for more information about fish species present with respect to EPBC Act threatened species.

While no surveys have been undertaken in Melville Bay specifically for fish, no species listed on the EPBC and NT lists of threatened species has been observed during habitat and other marine investigations around the Gove Peninsula.

Rare or Significant Marine Habitats (11)

A respondent has asked for information that supports the statement in the Draft EIS that there are no rare or significant marine habitats present.

All of the marine habitats determined to have been impacted by the refinery or at potential risk of impact from the expanded refinery are known to occur elsewhere within Melville Bay. A copy of the marine habitat survey report will be provided to the respondent.

Fluted Giant Clam (11)

A respondent has asked for information about the fluted giant clam.

The fluted giant clam is not listed as a threatened species. It has a wide distribution but is under pressure, largely from over fishing and damage to its reef habitat. There is little suitable habitat for this species in the area actually or potentially likely to be impacted by the proposed expansion.

Definition of "Significant" (3)

A respondent has asked for a definition of the term "significant" used in Section 14.3.2.4 of the Draft EIS.

In this context, "no significant impact" means there will be no measurable effect on the listed migratory species as a result of the refinery expansion.

Avoidance Behaviour (6)

Section 14.3.2.4 of the Draft EIS includes a comment on the ability of migratory species to avoid environmental conditions that could be injurious to their health, due to their mobility. A respondent has noted that while this might be true in some instances, there are potentially harmful conditions that are not easily detected by organisms and they do not consider that such a statement should not be used as a reason to allow environmental damage to continue.

As indicated in Section 13.4.2 and Figures 13.7.1, 13.7.2 and 13.7.3 of the Draft EIS, the physical effects of temperature and turbidity from the outfall impact most widely (i.e. over the greatest area of the harbour) on water quality and are most likely to affect the behaviour of fish and other mobile fauna before they encounter environmental conditions that could be injurious to their health. This is not seen as a justification of the

discharge. Rather it recognises the varying contributions of the components of the discharge, both physical and chemical, to the likely overall impacts on the marine fauna.

Macro- Invertebrates (14)

A respondent has expressed concern that there is scientific uncertainty as to the factors which are causing the death of macro-invertebrate fauna in an area of 70 ha of Gove Harbour.

The investigations undertaken to date indicate that the lack of macro-invertebrate fauna in the affected area it is likely to be caused by smothering of habitat by flocculant and oxygen depletion. Alcan Gove has committed to ongoing investigations into the nature of these effects and to reducing the input of flocculant.

14.3.3 Fishing (3)

A respondent has asked for a discussion of the elevated cadmium level in local rock oysters and potential health threat from traditional fishing.

The refinery has not been found to cause an increase in the natural concentrations of cadmium in Melville Bay. Elevated levels of cadmium in rock oysters is a common natural phenomenon in tropical Australian waters. More details can be found in McConchie and Saenger 1993, *Heavy Metals in Sediments, Waters and Biota from Melville Bay, Northern Territory*, report prepared for Nabalco Pty Ltd by Centre for Coastal Management.

14.4 Marine Standards (3,6)

TBT (6)

A respondent has asked for a discussion on the ban on the use of TBT in vessels under 25m in length and the Australian Government commitment to phase out TBT application on all ships by 2008.

Alcan Gove supports Australian Government's initiatives to control TBT. The majority of vessels using Alcan Gove's port facilities are foreign registered bulk carriers, which operate under International Maritime Organisation regulations. Adopted in 2001, the *International Convention on the Control of Harmful Anti-Fouling Systems on Ships*, calls for a global prohibition on the application of organotin compounds which act as biocides in anti-fouling systems on ships by 1 January 2003, and a complete prohibition by 1 January 2008.

There is an existing ban on the use of TBT on non-aluminium hulled vessels less than 25 m in length.

AFFF (3)

A respondent has asked for a discussion on AFFF foam that is stored at the wharf and used for fire fighting. It is occasionally discharged and a discussion on its impacts is required.

Aqueous Film Forming Foam (AFFF) is used at the wharf and can make contact with the marine environment when used for fire fighting. The substance that is used is Ansulite 3% AFFF, manufactured by ANSUL Incorporated. Its Material Safety Data Sheet indicates the following:

- It is not classified as hazardous according to NOHSC criteria.
- Low toxicity – low irritant. This product may only present a hazard with direct eye contact, prolonged and repeated skin contact or with vapour fume inhalation at high levels.
- Accidental release measures include:
  - Personal protection: prevent skin and eye contact.
  - Clean up - use an absorbent material such as diatomaceous earth, vermiculite, saw dust etc. and sweep up as much as possible for disposal at an approved landfill site. Prevent from being washed into drains and waterways.
- Handing and storage - no special conditions are required for safe storage.
- Disposal - prevent contamination of drains or waterways, as aquatic life may be threatened and environmental damage may result. Dispose of in compliance with national, regional and local provisions in force.

- Toxicological information:
  - The toxicity of the product mixture has not been determined.
- Ecological Information:

Fish	Lepomis marcrochinus	LC50 (96hrs)	1,300 mg/L
	Carrassius auratus	LC50 (24hrs)	2,700 mg/L
Daphnids	Daphnia magna	EC50 (24hrs)	3,184 mg/L
Algae	Scenedesmus subspicatus	EC50 (96hrs)	>100 mg/L

LC50 the concentration of chemical that causes a 50% of the test animal in a given time.
EC50 the concentration of chemical that causes a 50% reduction in dry weight.

14.5.1 Shipping (3,14)

GOVEPLAN (3)

A respondent has asked that GOVEPLAN be listed in the EMP and that a copy be provided.

The Marine Management Plan given in Section 25.3.9 of the Draft EIS has included an action to upgrade GOVEPLAN to accommodate the expanded operations. A copy will be provided to the respondent.

Marine Pests (3)

A respondent has asked what measures will be put in place to control marine pests with the increased shipping.

Alcan Gove will continue to support the implementation of the mandatory ballast water management requirements administered by AQIS under the *Quarantine Act 1908*, and any additional requirements that may subsequently be introduced by the Northern Territory government.

Alcan Gove has completed a baseline survey for targeted marine pests (Port Baseline Survey 2000). This is available for the respondent if required.

The NT Government, with Alcan Gove support, has been carrying out surveillance sampling for targeted marine pests in Gove Harbour.

Some equipment will be imported via Darwin where it will be subject to AQIS requirements. The remainder from foreign ports will be cleared in Gove and will be subject to AQIS requirements.

Increased Risk of Oil Spills (14)

A respondent has expressed concern about the increased risk of oil spills in the event that gas supply is delayed.

Section 14.5.1.2 of the Draft EIS has recognised that there will be an increased risk of oil spill if there is a delay in the supply of gas. However, this is expected to be for a short time only. Furthermore, Alcan Gove has a comprehensive oil spill prevention and management plan (GOVEPLAN) which will be updated to include consideration of the increase oil shipments.

14.5.2 Benthic Macrofauna (3,11)

Benthic Fauna (11)

A respondent has asked for a discussion on the effects on the benthic fauna of the expanded refinery on the area adjacent the RDA.

No effects to benthic fauna adjacent to the RDA are expected as a consequence of the refinery expansion because water flows from the RDA lease will be limited to drainage of non-operational areas. All wastewater from the RDA that is to be discharged will be pumped back to the refinery for discharge via the refinery outfall channel. The discharge from the refinery is remote from the marine area around the RDA and will have no effect there.

Definition of "Significant" (3)

A respondent has asked for a definition of the term "significant" used in Section 14.5.2 of the Draft EIS.

The use of the word 'significant' in this instance is defined in the following sentence. That is, "… the area in Gove Harbour where benthic macrofauna are either absent or are in reduced numbers due to temperature and flocculant effects from the discharge will not increase above the current 1% to 2% of the total area of such habitat present in Southern Melville Bay."

14.5.3 Turtles (14)

One respondent considers that turtles have not been considered in sufficient detail.

As discussed in Section 14.5.3 of the Draft EIS, there are no significant turtle habitats in the area surrounding the refinery and there will be no loss of potential habitat as a result of the refinery expansion. Because of this, further more detailed assessment of turtles was not warranted.

15.2.2 Data Sources – Terrestrial Biology (8)

A respondent has stated that existing information on terrestrial biology is limited and needs to be supported by further studies.

Alcan Gove recognises that the ecology of north-eastern Arnhem Land is poorly known, as are many large areas in Australia. Alcan Gove has contributed to the ecological knowledge of the area through a number of studies, including specific research programs and survey work completed for the current EIS. Although that survey was necessarily restricted to the area of influence of the refinery expansion project, Alcan Gove intends to conduct further biological survey work within and surrounding the wider area in the future.

The data sources quoted in the Draft EIS are the three most relevant to the flora surveys. Many additional data sources were used, and these are referenced through the text.

15.2.5 Regional Context (3,6,8)

Reference (6)

A respondent has noted that the reference Woinarski (2002) was not included in the Draft EIS.

The reference is as follows.

Woinarski, J (2001) Threatened Species Information Sheet, Golden Bandicoot *Isoodon aurantus,* Parks & Wildlife Commission of Northern Territory.

Effect of Fire (8)

A respondent has asked Alcan Gove to address the role that fire plays and to undertake trial burns under controlled conditions. Gamarrwa Nuwul Landcare invite Alcan Gove to discuss the options and alternatives of taking action or not taking action.

As noted in Section 15.2.7.2 of the Draft EIS, the proposed project will not have an impact on existing fire regimes in the surrounding vegetation. Alcan Gove already has a fire management plan in place for the site, which will be followed for the proposed refinery expansion project.

With reference to the issue of fire in the broader ecology of the region, Alcan Gove would be interested in supporting any proposed research programs.

Cinnamon Fungus (8)

A respondent has asked for an action plan for the management of Cinnamon Fungus to be put together in a cooperative approach to vegetation management.

As noted in Section 15.2.5.1 of the Draft EIS, the cause of the observed decline in the early 1980s could not be confirmed as attributable to fungal disease. It is Alcan Gove's policy to monitor the health of vegetation within the project area (see Section 25.5.3.10) and any future incidents will be investigated on a case by case basis. Despite extensive investigations no *Phytopthora cinnamoni* has been detected in the Gove region. Other known pathogens and soil chemical contamination have also been discounted as possible sources.

Groundwater Effects (8)

A respondent has noted the reference in the Draft EIS to increased groundwater effects in the vicinity of Pond 5. They would like to discuss the implications of factoring this area into the future impact projections, or to discuss what options exist for rehabilitation in the future.

See Section 12.2.4.

Tetradonta Dieback (6)

A respondent has asked if there are any proposals by Alcn Gove to monitor the tetradonta dieback. They have asked if the survival of some trees and the death of others due to the variation in severity of die-back. OEH have asked that this event be explored in more detail and the reference document (Davidson, 2001) made available to them.

As discussed in Section 15.2.5.1 of the Draft EIS, the issue of *tetradonta* dieback has been researched by a number of organisations over many years. Despite this effort, no clear cause of the dieback has been identified. No fungal pathogen, including *Phytopthora cinnamomi* has been found to be responsible for the dieback, and similarly, toxins have been excluded from the possible list of causes. A combination of natural environmental stresses, included the extreme rainfall event of April 1999 have been suggested by the investigating specialists as possible causes. Alcan Gove will support any ongoing investigations or research into this issue.

Arenga Palm (3)

A respondent has asked for the NT status of Arenga palm.

The Arenga palm (*Arenga australasica*), is not considered threatened under the *Territory Parks and Wildlife Conservation Act 2000*. This species does not occur within the project area.

Fire Effects on Acacias (3)

A respondent has asked for clarification of the statement in Section 15.2.5.2 of the Draft EIS that says " the Acacia species (unnamed) may be affected detrimentally by altered fire regimes." Does this mean to little or too much burning.

The statement refers to a change in either direction as either too much or too little burning can result in detrimental effects.

15.2.6 Flora Survey (3)

Closed Monsoon Rainforest (3)

A respondent has noted that closed monsoon rainforest is close to the mine and may be affected by mining and the gas pipeline.

Areas where monsoon rainforest might occur include near the mining area, on unmined parts of the lease, or along the proposed gas pipeline. These are all outside the area to be affected by the refinery expansion. Consequently the Refinery Expansion EIS has not investigated this community.

Monsoon forests and vine thickets are protected by a vegetative buffer between these communities and mine areas. The mine site fire management strategy, consisting of annual fire assessments and back burning from fire breaks, has also added to the protection of these monsoon forest communities.

Alcan Gove has committed to undertaking an ongoing vegetation monitoring program over the lease area and this will include the monsoon rainforest areas in the vicinity of the mining activities.

Construction Worker Impacts (3)

A respondent has asked for consideration to be given to the impact of construction worker recreational activities on Aboriginal Protection Areas.

See Section 21.7

Regional Connectivity (3)

A respondent has taken issue with the statement in Section 15.2.6.4 of the Draft EIS that "loss of regional connectivity will not be an issue."

Given the small amount of vegetation clearance proposed for the project (1.9 ha), the fact that most of it already highly disturbed, and that it is located within the footprint of the existing refinery, the project's impact on regional vegetation connectivity cannot be considered to be a significant issue. Existing wildlife corridors, in particular the mangrove and beach margins, will be maintained.

15.2.7 Project Effects (3,4,6,8)

Rhodes Grass (3,6)

A respondent has noted that Chloris gayana (Rhodes grass) is listed as a weed that could spread further, yet this species is used in the initial stages of mine rehabilitation. On further inspection, Chloris gayana is listed in an Australian Government resource document, Weed Categories for Natural and Agricultural Ecosystem Management, as naturalised and known to be a minor problem warranting control at 4 or more locations within a state or territory. However, as stated in the draft EIS, the species may not persist in competition with native grasses within the rehabilitated areas. The respondent has asked that this should be made clear in the EIS. Another respondent thought it was inconsistent that Rhodes grass is listed as an existing weed but is used for reahbilitatin.

While some varieties of Chloris gayana (Rhodes Grass) are listed as a weed species in agricultural areas, the variety used in the mine site (known as "Pioneer") is not considered a weed. Trials to select the preferred ground cover species 30 years ago showed that the "Pioneer" variety of Rhodes Grass was the most suitable ground cover plant to provide the necessary soil stabilisation in the first few years of mine revegetation.

This was recommended by the NT government at the time.

After 30 years of its use at the mine, experience confirms that the "Pioneer" variety is

- not a weed
- it does not compete with native grasses
- it dies out when the trees, shrubs and native grasses take over

Soils at the Gove mine site are too poor in nutrients to ensure its survival. Rhodes Grass requires large amounts of fertiliser to sustain it, as found in agricultural areas.

Other varieties Rhodes Grass could be introduced as a weed and therefore have been included in the Mine Site Weed Management Plan for identification and control purposes

Weeds (8)

A respondent has noted that the local Miwatj Regional Weed Committee has produced a regional list of prohibited weeds and named locally threatening processes created by certain species. They have asked that this list be incorporated into the EMP.

Alcan Gove is a member of the Miwatj Regional Weed Committee and will support the inclusion of the prohibited weeds list. It should be noted that the committee's strategic plan, which includes the prohibited weeds list, has been referred to DIPE for review and endorsement. Once the strategic plan is endorsed by DIPE, Alcan Gove will incorporate it into the EMP.

Vetiver Grass (6)

A respondent has noted that vetiver grass, though apparently sterile, may also have the capacity to become a weed due to its resilience. They have asked that this species be monitored and managed to ensure that its potential to spread is minimised.

The cultivar (Monto) used for erosion control works within Australia is sterile. This cultivar has been rigorously tested under a range of conditions (glasshouse, field conditions and in dryland, irrigated and wetland habitats) and has been found to produce no viable seed.

The growth habit of vetiver is an upright clumpy grass and does not produce stoloniferous roots (runners) so the potential for rapid spread or establishment from vegetative material washed off site is minimal. Vetiver is very susceptible to common herbicides (Roundup) so should be easy to eradicate if so desired. It is also readily shaded out, so its potential to persist and spread in natural vegetation is minimal.

Alcan Gove is committed to ongoing monitoring of this cultivar.

Vetiver is only used for soil stabilisation on the slopes of the RDA embankments. Prior to its use, Alcan Gove sought advice from NT and Queensland regulatory authorities who confirmed its suitability and sterility.

Introduced Species (3)

A respondent has noted that introduced species such as Lantana and Mexican Poppy have been planted at the refinery.

Alcan Gove will remove all weed species used in landscaping the refinery.

Mosquito Habitat (4)

A respondent has asked that disturbed sites be landscaped to be free draining to prevent potential mosquito breeding on rehabilitated surfaces.

As part of the detail design there will be a review of the drainage and landscaping arrangements to ensure sites are free draining. The contractor's EMP will require all construction areas to be monitored during the project construction phase.

A vector control program will be included in the health management program for construction workers. All construction workers will be screened at their pre-employment medical examinations to identify potential carriers of the parasite through a basic questionnaire. This does not have the intention to prevent people from working at the project, but rather prevent the spread of disease in the community.

The focus of the construction phase flora management plan will be to prevent the clearing of areas as far as reasonably practicable (Section 25.4.3.6 of the Draft EIS). Where clearing cannot be prevented, the areas will only be grubbed just prior to the contractor mobilising. The contractor's EMP will be verified to ensure that they have identified the potential impact of standing water as well as the mitigation measures that will be implemented to reduce the time that any water will be left standing.

Dry Season Survey (3)

A respondent has asked that the statement in Section 15.2.7.4 of the Draft EIS that says "a visual inspection during the survey did not indicate any obvious sign of stress to the vegetation" needs to be qualified as it was based on a dry season survey only.

Management plans for air quality and vegetation are outlined in Section 25 of the Draft EIS. Alcan Gove will implement regular dust monitoring and vegetation health monitoring programs at selected sites in and around the refinery to determine the long term impacts, if any, of the expanded refinery. Due to improved dust control measures proposed for the expansion project (Section 8.5.3 of the Draft EIS), it is expected that dust impacts on vegetation will reduce.

Furthermore, Alcan Gove has committed to an ongoing vegetation monitoring program which will include wet season monitoring. In this way any seasonal variations in vegetation stress will be identified.

Dust Effects (3)

A respondent has asked for a comment on dust impacts from mining on vegetation and invertebrates.

At the mine, dust is mainly generated by trucks driving on haul roads. This dust is controlled by the spraying of water on haul roads. There is also some dust emitted from the crusher at the mine. As mentioned earlier, there is a significant capital improvement program under way to rectify this.

Bauxite is an inert material, containing no harmful contaminants that are toxic to plants and invertebrates. It is believed that there is limited impact as a result of the dust loading on vegetation and invertebrates.

Caustic Mist (3)

A respondent has asked that a monitoring and a management plan be implemented for caustic mist from cooling towers.

As discussed in Section 15.2.7.5 of the Draft EIS, caustic emissions from the new cooling tower will be managed by the installation of mist eliminators that are designed to minimise the amount of mist emitted. Alcan Gove has committed to confirming the effectives of the eliminators by monitoring the health of the surrounding vegetation during the first two years following commissioning of the new cooling tower.

Monitoring and management of caustic mist will be included in the air quality environmental management plan.

Monitoring of SO_2 Effects (3)

A respondent has asked for SO2 effects on vegetation to be monitored in the wet season as well as the dry season.

Alcan Gove has committed to an ongoing vegetation monitoring program which will include wet season monitoring. In this way any seasonal variations in SO_2 effects on vegetation will be identified.

Conclusions of Doley (2003) (3)

A respondent has noted that Doley(2003) which was contained in Appendix E4 of the Draft EIS concluded "that SO2 injury was very likely to occur to plant species growing in the vicinity of the refinery." They also quoted that Doley states " it is not possible to extrapolate from this data set to indicate which of the many untested species amt be particularly sensitive to SO2." and that "No direct information is available on the sensitivity of rainforest species…".

The correct quote from the conclusion in Doley (2003) is "that injury is very **un**likely to occur to plant species growing in the vicinity of the Gove alumina refinery".

The conclusion in the section of Doley (2003) from which the last two quotes given above were taken is "Provided that the frequency of occurrence of the maximum concentration events is low, it is concluded that the extent of injury occurring on plants at the refinery site would be small, and may be confined to a small proportion of all the leaves on a plant". The air quality modelling reported in Section 8.7 of the Draft EIS has shown that the frequency of occurrence of maximum concentration events will be low. Hence, Doley's conclusion that any extent of SO_2 injury would be small would apply.

Concern about the rainforest species relates to the fact that this is the preferred habitat of the Gove crow butterfly. However, the butterfly's preferred habitat (tall monsoon forest) is not present in the vicinity of the refinery. The nearest known habitat of the Gove crow butterfly is near Yirrkala which is over 20 km from the refinery. At this distance, ground level concentrations of SO_2 would be small and unlikely to be any threat to rainforest species.

References (3)

A respondent has asked for the "various authors" referred to in Section 15.2.7.6 of the Draft EIS to be listed.
The references referred to include:

- Clark and Murray, 1990
- Dodd and Doley, 1998
- Fulford and Murray, 1990

- Murray, 1984
- Murray and Wilson, 1988
- Murray et al, 1991

Full references for the above are given in Appendix 1 of Appendix E4 of the Draft EIS.

15.2.8 Flora Management (3,7,8)

Quarantine Measures (3)

A respondent has asked that quarantine measures for transport out of Gove be mentioned.

Section 15.2.8 of the Draft EIS states that quarantine inspection for all vessels entering Australian waters from overseas is the responsibility of the Australian Quarantine Inspectorate Service (AQIS). While this is normally undertaken by customs officials, Alcan Gove personnel also monitor incoming vessels and equipment to ensure compliance with Australian quarantine requirements. The same procedures also apply to all outgoing vessels which also comply with AQIS requirements.

Chipping of Plants (8)

A respondent has suggested that it is not advisable to chip plants that have seed stock or plants that regrow vegetatively, such as Alternanthera sp. due to the potential for portability of the seed stock and vegetation into undisturbed areas.

This comment has been noted and will be reflected in operational procedures.

Vegetation Monitoring (7)

A respondent would like to see a long term vegetation monitoring program to determine whether the mining operations are having any impact on vegetation structure and extent. Such a survey would help to ensure that timely action can be taken if changes are occurring whether as a result of drawdown on the water table or other factors including effects on rainforest habitats of the Gove crow butterfly.

Alcan Gove has committed to an ongoing vegetation monitoring program which will include the issues raised by the respondent

15.3.5 Fauna Survey Results (3,4)

Wet Season Surveys (3)

A respondent has asked that wet season fauna surveys be undertaken.

Alcan Gove has committed to an ongoing fauna monitoring program which will include wet season monitoring. In this way any seasonal variations will be identified.

Survey Adequacy (3)

A respondent has suggested that finding only 13 species while there are 75 recorded for the region indicates that the fauna survey was inadequate.

The complete reptile list for the region includes 75 species, and is provided to inform readers of the regional reptile diversity, and also to highlight the possibility of any threatened species in the area. Many of the species recorded from the region are not likely to occur on the project area because habitats where these species occur are not present.

It is acknowledged that brief field surveys will never document the complete fauna of a site – such an inventory study could take several years. However, brief surveys are useful in identifying key habitats and species associations, providing site-specific information, and complementing regional lists to identify potential habitat for threatened species.

As has been mentioned previously, Alcan Gove has committed to conducting further ecological surveys in the Gove region and these are likely to identify the presence of additional fauna species.

Feral Cats (3)

A respondent has asked that a reference be made to support that statement in the Draft EIS that there is a low number of feral cats.

The comment in the Draft EIS on the number of feral cats within the project area is based on evidence found during the EIS field surveys. Populations of feral cats may fluctuate seasonally and annually.

Gas Pipeline Effect on Yellow Crazy Ants (3)

A respondent has stated that the gas pipeline will increase the potential to spread yellow crazy ants.

The potential for the gas pipeline to spread yellow crazy ants will be addressed in the pipeline's EIS.

Cane Toad (3)

A respondent has asked for the cane toad control measures as contained in the NT parliamentary Committee report to be listed.

Below is a summary of the NT Government report "Issues associated with the progressive entry into the Northern Territory of Cane toads", Volume 1, Report No. 1, October 2003.

"Given all the evidence received, the Committee is of the view that cane toads are a national issue. Throughout the Inquiry, the need for co-operative and collaborative arrangements between key stakeholders, at local and regional levels, in the Northern Territory, the States and the Commonwealth, was continually raised. Such co-ordinated arrangements would serve as a focal point for co-ordinating management and research strategies to address the issues regarding cane toads, offering a concerted approach towards effective control or possible eradication. In the more immediate term, the need for the Northern Territory to forge links with Western Australia to attempt to control cane toads spreading across the border was also identified. This chapter looks at the evidence received by the Committee in respect of these issues. (Chapter 6)

Chapter 4 – Managing the Risks and Impact

The Committee recommends that:

1. That the Northern Territory's Department of Infrastructure Planning and Environment develop and implement a Plan of Management for the control of cane toads.
2. That the Commonwealth and Northern Territory Governments continue with the development and management of quarantine regimes to protect offshore islands currently without cane toads.
3. That the Northern Territory Government takes immediate steps to erect a cane toad proof fence across the neck of the Cobourg Peninsula.
4. That the Northern Territory Government lobby the Commonwealth Government to reclassify the cane toad from a "pest" to a "menace" under the Commonwealth's *Environmental Protection and Biodiversity Conservation Act, 1999*.
5. That the Northern Territory Government nominate cane toads as a threatening process under the *Environmental Protection and Biodiversity Conservation Act, 1999*.
6. That the Northern Territory Government and relevant Commonwealth agencies continue to monitor the effects of translocating northern quolls to offshore islands.

Recommendations

1. (12) That the Northern Territory Government make the management and control of cane toads a high priority in respect of monitoring the cane toad's spread, and of co-ordinating research.
2. (13) That the Northern Territory Government pursue with the Commonwealth and the states of Queensland, Western Australia, New South Wales and South Australia the establishment of a national task force to co-ordinate efforts to control and possibly eradicate cane toads.

3. (14) That the membership of the national task force should include, but not necessarily be limited to, representatives of key stakeholder groups such as CSIRO, Parks and Wildlife Commission of the Northern Territory (PWCNT), Co-operative Research Centre-Tropical Savannahs Management-Charles Darwin University, interstate academics, Environment Australia, Frogwatch NT, and peak Indigenous organisations.
4. (15) That the role and function of the national task force include:

   (a) co-ordinate efforts to control and possibly eradicate cane toads in Australia

   (b) identify and pursue funding

   (c) ensure ongoing consultation and collaboration with the three tiers of Government, environment groups, tertiary institutions and other research bodies, relevant corporations and industry

   (d) any other roles and functions agreed to by the membership
5. (16). That the Northern Territory Government immediately approach the Western Australian Government, for the purpose of establishing an agreement on a coordinated program to research, control and possible eradicate cane toads in Australia's north-west.
6. (17) That the Northern Territory Government reports to parliament on the progress of implementing the Inquiry's recommendations.

   The full report can be found at http://www.nt.gov.au/lant/parliament/committees/Environ%20and%20Sustainable/Cane%20toad-Report-Vol%201.pdf"

Alcan Gove will implement relevant recommendations of this report where appropriate.

Dengue Vector Mosquito (4)

A respondent has asked that a discussion should be provided about the dengue vector mosquito species that have the potential to be introduced into the Gove area. Both of these species can be transported to Gove from vessels arriving from overseas destinations where these species are endemic. Aedes aegypti could also be transported to Gove by sea and land transport originating from Qld, where this species is endemic.

AQIS quarantine procedures are applied to all ships visiting Gove and this will continue with the expanded refinery. Furthermore, there is no shipping and minimal land transport from Queensland either now or with the expanded refinery. Consequently no significant change to the risk profile for dengue vector mosquitos is expected during the operational phase.

During construction, particular attention will be paid to the Pre-Assembly Modules (PAMs). The origin of these shipments has not yet been determined but it most likely to be an overseas port. All of these ship movement will be subject to AQIS quarantine measures. In addition, the shipping contract for the PAMs will include quarantine requirements which will include provision for dengue mosquito species.

15.3.6 Significant Fauna Species and Habitats (3,7,14)

Wood Frog (3)

A respondent has stated that the wood frog may occur in mining areas and a management plan for this species is recommended.

The wood frog (*Rana daemeli*) may occur along freshwater streams within the mining lease but these areas will not be mined. The specialised habitat in which this species occurs is not present within the areas to be affected by the refinery expansion. Alcan Gove is committed to further baseline ecological surveys of the Gove area, and should this species be found within or close to the mining lease area, an appropriate management plan will be implemented.

Mining Effects on Birds (3)

A respondent has noted that Appendix E9of the Draft EIS is stated as listing 5 near threatened bird species although there are actually 6 listed. They also comment that some of these species may occur within the mining lease area

The number of near-threatened bird species listed is 6 rather than 5 and this error in the Draft EIS is acknowledged.

It is possible that the other "near-threatened" bird species could occur within the mining area, however it is not considered that these species could be affected by the refinery expansion.

Mammal (3)

A respondent has commented that Section 15.3.6.2 of the Draft EIS in stating that two species "are of particular interest" does not indicate who they are of interest to. They state that others are of strong cultural interest to Traditional Owners. NLC has also asked for a discussion of the potential presence of the northern hopping mouse.

The reference to two mammal species "of particular interest" is related to their official conservation status according to State, National and International listings, as identified in Section 15.3.6.1 of the Draft EIS. Marine fauna species of Aboriginal interest are being recorded in a database maintained by the Dhimurru Land Management and Aboriginal Corporation.

The coastal dune habitat near the refinery offers sub-optimal habitat for the northern hopping mouse at best and is already heavily disturbed. The presence or otherwise of the northern hopping mouse in these locations will be determined through the proposed ongoing fauna monitoring program.

The second species referred to above is the golden bandicoot, which has not been identified or recorded in the Yirrkala area since 1939, and is now considered extinct in mainland parts of the region.

Gove Crow Butterfly Project (7)

A respondent has asked for Alcan Gove to provide support to the current Dhimurru project on the Gove Crow butterfly, and to identify possible impacts of mining operation on the species.

As explained previously, dust and vegetation health monitoring will be conducted by Alcan Gove at various locations around the area of influence of the expanded refinery. The proposed ongoing ecological monitoring program will extend to the mining area and the presence of any habitat and food plants of the Gove crow butterfly will be identified and monitoring points will be established.

Gove Crow Butterfly Monitoring (3)

A respondent has asked for Alcan Gove to implement a monitoring plan for the Gove crow butterfly which should include seasonality issues as well as the identification of target food plants and measurement of dust settlement on them.

Alcan Gove has committed to an ongoing fauna monitoring program which will include the Gove crow butterfly. The program will include seasonal monitoring, and the identification of target food plants.

Northern Hopping Mouse (14)

A respondent considers that it is a sad reflection on the refinery's current environmental impacts that the northern hopping mouse has not yet been located in the vicinity of the refinery.

The northern hopping mouse was not identified in the EIS fauna survey because, as discussed in Section 15.3.6.2 of the Draft EIS, only minor patches of its habitat occur in the study area and those patches that do occur are heavily disturbed and suffer from dingo and feral cat predation.

15.3.7 Impact Assessment (3)

Dust Effects (3)

A respondent has asked for a discussion of the effects of alumina dust and the traditional owner concerns regarding general country health.

See section 15.2.7.

Cane Toads (3)

A respondent has noted that Alcan Gove's EMS has not controlled the spread of cane toads.

The terrestrial fauna management plan given in Section 25.5.3.11 of the Draft EIS includes a commitment to monitor the presence of feral species within the lease area. This includes cane toads.

Definition of "Significant" (3)

A respondent has asked for a definition of the term "significant" used in Section 15.3.7.4 of the Draft EIS.

The Draft EIS indicates that, during the peak of the construction phase, the predicted number of traffic movements will increase from 770 to 1,000 per day (approximately 30%). While this may increase the risk of road-killed animals, the effect has been described in the Draft EIS as "no significance increase" as the existing frequency of road casualties for fauna is low and any increase will be from a low base. Furthermore the 30% increase in traffic will exist for only a short period (approximately 6 months). During the balance of the construction phase, the increase in traffic movements will be less.

15.4.1 Previous Studies of Biting Insects (4)

A respondent has provided the following corrections to Table 15.4.1:

- *Anopheles farauti s.l. is not known to breed in containers. It should be added that preferred breeding sites include coastal and brackish reed swamps, and freshwater swamps.*
- *Culex annulirostris also breed in extensive freshwater and coastal reed swamps, stormwater drains, sewage effluent and organic wastewater.*

The above comments are noted.

15.4.4 Impact Assessment – Biting Insects (4)

A respondent has provided the following advice on the management of biting insects:

- *All drainage channels and spoon drains should be maintained annually. They should be constructed to contain no depressions, and if subject to the dry season low flow of water, should contain a concrete low flow invert. Erosion prevention structures should be constructed at all drain end points.*
- *Rock bars should be constructed to drain trapped upstream water within five days.*
- *The construction workforce accommodation facility should be designed appropriately to minimise potential biting insect problems.*
- *Insectocution devices should not be relied upon for protection from biting insect attack.*
- *Workers should be provided with a copy of the MEB's 'Personal Protection from Mosquitoes and Biting Midges in the NT'.*

Alcan Gove will ensure that all of the above management measures will be implemented as appropriate.

16.4.5 Soil Erosion (8)

A respondent considers that erosion at the RDA ponds both internally and externally is indicative of the overall susceptibility to erosion. They state that wave action and run off combining to form gully erosion on the internal

walls of Pond 6 indicates that a problem does exist. YDC believes this warrants further inspection or analysis. It is for this reason the YDC have asked for core samples in the RDA area to assess the integrity of the finished ponds and their ability to withstand surface water absorption and erosion.

Erosion will occur on the outside of the walls and is monitored visually. The internal structure of the walls is monitored by observing water pressure build up, as measured by piezometers in the walls. The waste water reduction project will reduce the potential for water pressure build up by decreasing the volume of stored waste water. In the event of visually determined erosion on the outside, or if there is water pressure build up indicating water is seeping into the walls, remedial earthworks is undertaken routinely. The provision of core samples is likely to provide only limited information.

16.5.1 Earthquake History (8)

Members of a respondent group have indicated that earth tremors have been felt at Yirrkala, but the low density of seismographs makes this difficult to assess. In relation to the concerns raised regarding the RDA, they felt that earthquakes or tremors may add a level of uncertainty to the concerns raised by the YDC.

A review of the seismicity of the Gove area was completed in 1998. The report states that few earthquakes have been felt in the Gove area since European settlement. Most of these were large magnitude Indonesian earthquakes. There were eight recorded events within 500 km of Gove from 1921 to 1998. The most recent occurred in 1998 in the Gulf of Carpentaria with a magnitude 4.8 and there was one in Arnhem Land in 1996 with a magnitude 3.0. Even though the occurrence of earthquakes in the Gove area is low, the design of the RDA has incorporated allowance for seismicity.

17.8.2 Refinery -Visual Impact (5)

A respondent has commented that the earthworks and excavation required for the haul roads accessing the calcination area will be clearly visible from the sea north of the refinery but that this has not been addressed in the Draft EIS.

The work proposed for the construction of the haul roads will be visible from the sea to the north-west of the refinery. However, the number of viewers exposed to such views will be limited to people in boats. Furthermore, these works will be undertaken only during the construction phase. At the end of construction, the site will be revegetated and screened so that ongoing visual impact from the north-west will be reduced.

18.6 Expansion Impacts – Lighting (16)

A respondent has noted that the Draft EIS does not address the spill of light above the refinery, town & mine i.e.: "Skyglow". They suggest that the answer to this problem is addressed by the "International Dark Sky Association", and they endorse their recommendations as world's best practice for outdoor lighting.

The management strategies to control light spill from the refinery that are discussed in Section 18.7 of the Draft EIS are designed to limit additional light effects horizontally and vertically. To this extent additional "skyglow" effects from the expansion will be reduced. Furthermore, the recommendations of the International Dark Sky Association will be considered when specifying new lights for the expansion.

19.2 Rehabilitation and Closure Standards (7,8)

Recreation Areas (7)

A respondent has asked that the site's closure plan includes provision of funding to assist with rehabilitation of recreation areas and access impacts.

As discussed in Section 21.7, Alcan Gove currently makes substantial annual contributions to Dhimurru for land management activities and all recreation permits to be issued by Dhimurru during the construction phase will be charged at commercial rates.

Fire Management (8)

Members of a respondent group have concerns about the lack of a fire regime in the mine rehabilitation area, mainly due to their concern that the fuel loads in this area are very high.

See Section 4.9.6.

19.3.1 Mine Rehabilitation (3,8)

Tree Species (3)

A respondent has raised a concern that some of the tree species used in the mine rehabilitation have not been requested by the Traditional Owners.

All tree species used in the rehabilitation naturally occur in the Gove region. Alcan Gove will hold discussions with the Traditional Owners regarding what tree species are considered to be appropriate.

Chloris Gayana (3)

A respondent has raised concern about the use of Chloris gayana which is planned to fade out due to competition from native vegetation within 4-5 years. Recent data from Wedd (2002 – unpublished masters thesis) shows that although Chloris gayana may decline after 5 years, it is still found persisting through to 26 years after seeding.

Section 19.3.1 of the Draft EIS states that pasture grasses including *Chloris gayana* (Rhodes grass) are used at the mine site to protect the soil from erosion after mining and to provide a micro-climate that promotes the germination and establishment of native trees. It also states that these grasses fade out within four to five years due to competition from native vegetation and a decline in fertility.

Research by Wedd (2002) has noted that *Chloris gayana* was present in the rehabilitation areas at high numbers two years after reseeding, before reducing in number and becoming absent after eight years since reseeding. However, at sites that were reseeded 20 years ago, Wedd (2002) has shown that *Chloris gayana* had returned (20% of the grasses present).

Fire Protection Plan (8)

A respondent group believes that Alcan Gove should develop a Fire Protection Plan for its entire lease area.

See Section 4.9.6.

19.3.2 Mine Closure Criteria (3,8)

Rehabilitation Success (3)

A respondent has suggested that the recent work by the CSIRO on measuring the success of the mine rehabilitation be referenced.

This work is still in progress. It has not yet written up due to contractual difficulties within CSIRO

Species Mix and Structure (8)

A respondent group has suggested that what Alcan Gove should aim for is a species mix and structure with relatively close densities to those areas adjacent to the mine site to create a seamless connection in ecological boundaries.

Discussions with the respondent group are ongoing with regard to rehabilitation standards for the mine site. These discussions will include the appropriate species mix and structure. In addition, land is to be provided to enable trials of different species mixtures to be undertaken.

19.4.1 Refinery Rehabilitation (3)

A respondent commented that some of the landscaping at the refinery has used exotic species and that this should not be encouraged, as there is potential for weed spread.

Alcan Gove has committed to removing weeds at the refinery.

19.5 Residue Disposal Area – Rehabilitation (3)

A respondent has asked for a discussion of the old scale dumps and how will they be remediated.

These scale dumps are included in the Alcan Gove site closure plan. Possible remediation methodology includes:

- Soil contamination assessment
- Groundwater contamination assessment
- Soil and groundwater remediation as required
- Soil capping and vegetation establishment
- Land form reshaping and erosion control

19.5.1 RDA Rehabilitation (3,6,8)

Rehabilitation Standard (8)

A respondent has noted that the development of rehabilitation at the RDA is still ongoing and developmental. Rehabilitation will be crucial to this area's ongoing stability, and that to prevent erosion or structural breakdown the ground cover will play an important role.

The University of Queensland revegetation research program has been completed and a process for revegetation of the mud farm surface has been defined. Currently the first stage of revegetation process is starting, with deposition of the process sand layer on the north-west corner of Pond 3 mud farm. The process sand is treated with seawater and rainwater to convert it to growing medium for revegetation. It is targeted that 40 ha of mud farm area will be closed for revegetation by 2009.

Residue Reuse (6)

A respondent has asked for a discussion of the possible exploitation of the RDA resource if it becomes viable to do so in the future.

Alcan has identified that currently there are limited opportunities for reuse. However, Alcan Gove recognises the future potential for reuse of this resource and is actively minimising contamination of disposed residue.

Erosion Control (6)

A respondent has noted that Section 19.5.1 of the Draft EIS indicates that the goal of final RDA landform is to prevent contact between residue and the external environment and to accomplish this erosion will need to be prevented. It notes that there is a high probability that in the future residue will be eroded into the surrounding environment and monitoring of a decommissioned RDA will need to be very long term to account for this.

Monitoring and control of erosion from the decommissioned RDA is allowed for in the Alcan Gove site closure plan.

Vetiver Grass (3)

A respondent has asked for a discussion of the trials for the use of Vetiver sp. as to whether there is any concern for its spread into surrounding vegetation.

The issue of *vetiver sp*. is discussed in Section 15.2.7 of this EIS Supplement.

20.1 Introduction – Cultural Heritage (3)

One respondent asked that a geographical context be provided, as this may be pertinent to archaeological sites.

A full description of the geographical context of the region is given in Sections 16.2 (Geology) and 16.3 (Geomorphology, Land Systems and Land Units) of the Draft EIS.

20.2 Historical Context – Cultural Heritage (6,14)

Past and Present Use of the Site (6)

A respondent requires further information on the past and present uses of the site (Aboriginal and non-Aboriginal) and archaeological places and objects protected under the Northern Territory of Australia Heritage Conservation Act 1991.

Section 20 of the Draft EIS summarises relevant anthropological and archaeological aspects of the Gove area. This section attempted to summarise the issues that were most relevant to the effects of increasing alumina production and related activities. It is acknowledged that there is more available information on past and present uses and on archaeological places and objects. Alcan Gove is aware of this information and uses it, in addition to advice from Yolngu people, Government and non-government organisations representing Aboriginal people, to help direct its communications, consultation and heritage protection activities. A list of additional references on past and present uses is provided below in response to questions in Section 20.6.3.

Original Mine Development (14)

A respondent has stated that there is no mention of the original mine being developed against the wishes of the Yolngu people or of subsequent protest events.

There were some Yolngu leaders who in the early 1960s were against mining in the Gove region. This culminated in the submission of the "Bark Petition" against mining which was presented and read to the Commonwealth House of Representatives on 28th August 1963.

The history of social impact in the Gove Area apart from mining includes, but is not limited to:

- The loss of trade links with the Macassans.
- Violent confrontation with pastoralists in the 19th century.
- Japanese exploitation of coastal resources early in the 20th Century.
- Introduction on Missions to the area prior to World War II.
- World War II, including the establishment of several thousand Australian defence personnel in the region.
- The European Launching Development Operations site was established by the Federal Government in the Gove region in the late 1960s-early 1970s.
- Changes in the legal rights of aboriginal people in the 1960s.
- Movement back to homelands.

The history of discovery and ultimately the extraction of bauxite in the Gove area extend back to 1949 when a small high-grade deposit was discovered on Marchinbar Island, north of Gove.

- Three companies (British Aluminium, Comalco and Gominco) carried out exploration drilling activities between 1955 and 1964 around the Gove airstrip.
- A House of Representatives Select Committee on "Grievances of Yirrkala Aborigines, Arnhem land Reserve", was appointed by motion on 12 September 1963. A number of recommendations were subsequently made and acted on by the Select Committee.
- Nabalco Pty Limited was formed in 1964
- Nabalco's owners, Swiss Aluminium and Gove Alumina were granted a Special Mining Lease by the Commonwealth Government in 1965
- Nabalco carried out drilling and exported some bauxite for pilot studies in 1966 and 1967
- The Mining (Gove Peninsula Nabalco Agreement) Act (1968) was established and from then on, mining continued and the construction of the alumina refinery began. The recommendations of the House of

Representatives Select Committee provided a basis for Nabalco's obligations under the Agreement Act, to the Commonwealth Government and the traditional owners.

- In 1971, local aboriginal people took court action against Nabalco and the Commonwealth Government, seeking freedom of occupation of their lands, damages and prevention of further mining activities. The court decision was against the plaintiffs.
- The *Aboriginal land Rights (Northern Territory) Act* (1976) came into force on 26 January 1977.

20.5 Cross Cultural Relationships (3)

A respondent considers that the community consultation of the Traditional Owners on the expansion has been insufficient from the Traditional Owners' perspective.

Alcan Gove feels it has taken all reasonable steps to ensure continuing and open dialogue with all stakeholders, including the traditional owners, on the expansion.

Table 23.5.2 in the Draft EIS lists the forms of communication undertaken for each group in the community including all key organisations representing local indigenous people. Notes were taken during each communication event to ensure that all issues were noted and included for consideration in the Draft EIS. This communication program commenced more than twelve months prior to the release of the Draft EIS. As information about the project became available, it was passed on to all groups and individuals via the range of media outlined in Section 23. All key stakeholder groups and individuals were informed directly at the time of release of the EIS guidelines as well as the Draft EIS itself. Free copies of the Draft EIS were provided to individuals and groups representing local aboriginal people, as was the Yolngu Matha language version of the Executive Summary. Copies of the Executive Summary were also freely distributed

In early 2003, Alcan Gove agreed with the NLC to assist communications on the expansion by providing support for fortnightly visits by a project officer. The first visits took place in mid 2003. Alcan Gove has maintained its commitment to this communication process with regular visits taking place since then.

Alcan Gove's expectation has been that the fortnightly site visits would assist NLC in both understanding more about Alcan Gove's current and future operations and provide another important avenue for this understanding to be exchanged between the NLC project officer and the relevant Yolngu communities.

20.6.1 Register of National Estate (3,6)

Database Search (3,6)

Section 20.6.1 identifies three places recognised on the Register of the National Estate (RNE). An online search of the Australian Heritage Database of the Gove (6273) 1:100,000 Map sheet for all lists, including the RNE, Commonwealth, Natural and World Heritage list, identifies five indicative places and a registered place listed on the RNE. A respondent has requested Alcan Gove to liaise directly with the Australian Heritage Council and or Commonwealth Department of the Environment and Heritage to identify whether the heritage values of these places may be affected by the proposed expansion. Another respondent has queried the relevance of the Register of National Estate listing as none of these area are located within the mine lease.

Alcan Gove referred the proposed expansion project to the Commonwealth Government for its determination in relation to possible assessment under the *Environmental Protection and Biodiversity Conservation Act*. The Commonwealth Government decided, taking into account environment and heritage matters of national significance, that the project would not constitute a controlled action under the Act.

Of the six places (five indicative and one registered) listed on the Register of the National Estate (RNE), the only one said to be potentially affected by 'threatening'" activities is the "Rocky Bay Jungle" which is adjacent to mining operations carried out by Alcan Gove and Yirrkala Business Enterprises. The mining in this area is carried out in accordance with all current requirements. The mining is managed so that drainage from cleared areas is captured internally within the mining area, preventing transportation of silt off-site and ensuring maintenance of infiltration to groundwater. The expansion will not alter the mining process in the area.

In response to this and other submissions in regard to the 'jungle' habitats surrounding the Alcan Gove leases, a commitment has been made to carry out regular monitoring of these habitats to measure change in their boundaries and their health over time.

All of the other listed places are not close enough to the current and proposed operations to be affected in any way by mining and related activities.

Table 20.6.1 (6)

A respondent has queried the relevance of the Register of the National Estate listing (Table 20.6.1) as none of the areas are located within the mine lease region.

The table was included to show the location of the nearest places that are listed on the register (see comments on Section 20.6.1 above).

20.6.2 Archaeological and Heritage Place and Object Listing (3,6)

Archaeological Assessment (3)

A respondent has suggested that Alcan Gove commits to fully assessing the archaeological landscape, site and objects.

Alcan Gove is in continuing consultation with the Aboriginal Areas Protection Authority regarding this issue.

Unrecorded Places or Objects (6)

A respondent considers that the Draft EIS has not addressed the possibility that previously unrecorded prescribed archaeological places or objects may occur within the footprint of the mine lease boundary and may be impacted upon by the expansion of the mine.

There is no 'expansion' of the mine proposed or required for the purposes of the refinery expansion. All mining operations will occur within the existing lease in accordance with current legal requirements and voluntary obligations. An archaeological survey of the mining area has been undertaken ("Report on Survey of Sacred Sites – Gove Peninsula", E C Evans, June 1966). In the event that any further lease areas are required in the future, they will be sought in accordance with relevant approval procedures.

20.6.3 Indigenous Sites Of Significance (3,6,8,13)

Aboriginal Interests (3)

A respondent considers that there has been no discussion in the Draft EIS on aboriginal interests in the land and what the impacts on those interests will be.

The refinery expansion will not have any new impact on Aboriginal interests in the land. The existing relationship between current operations and indigenous sites is outlined in Section 20.6.3 of the Draft EIS.

This includes consideration of the Indigenous Protected Area Management Plan which was prepared by DLMAC to identify areas declared by the Aboriginal people to hold cultural significance. Traditional Yolngu values are the primary focus of the Management Plan. These values are linked to the landscape and seascape and are an important component of their society providing food and shelter. A link between indigenous persons ancestral past and the present generation living on the land is also outlined.

The Draft EIS also discusses sites that are registered with the Aboriginal Area Protection Authority.

Spiritual Interests (3)

A respondent has said that the Draft EIS does not provide a discussion about spiritual and physical interests in the land.

The Aboriginal interests discussed above include spiritual and physical interests.

References (3)

A respondent has stated that the references in Section 20.6.3 of the Draft EIS are out of date.

It is acknowledged that there is a significant number of relevant references on the history and contemporary aspects of Yolngu culture. A few examples of references that could have been listed are:

- Cole, Keith, *The Aborigines of Arnhem Land,* Rigby, Adelaide, 1979
- Dewar, Mickey, '*The Black War' in Arnhem Land: Missionaries and the Yolngu 1908 – 1940* Australian National University North Australia Research Unit, Darwin, 1992
- Trudgeon, Richard, *Why Warriors lie down and die* Aboriginal Resource and Development Services Inc. Darwin 2000
- Wells, Edgar, *Reward and Punishment in Arnhem Land,* Australian Institute of Aboriginal Studies, Canberra, 1982.
- Williams, Nancy M. *The Yolngu and Their Land,* Australian Institute of Aboriginal Studies, Canberra. 1986

Included in some of the references above are bibliographies that contain additional useful references of direct and indirect relevance to Yolngu culture

Definition of Site of Significance (3)

A respondent has asked for an overview of what may constitute a site of significance.

The Aboriginal Areas Protection Authority (AAPA) has advised that registered sites are sites that Aboriginal custodians has asked the AAPA to protect and that have been documented and evaluated by the Authority.

Recorded sites are sites that have been made known to the Authority from a variety of sources including requests to have sites entered in the Register maintained by the Authority. In many cases, the Authority has not been able to assess the accuracy of its information regarding recorded sites.

The Draft EIS considered both recorded and registered sites to be significant.

Refinery Outfall (8)

The area around the refinery outfall is Galpu Clan country and several members of a respondent group believe that this area is culturally sensitive, and have asked to have it included as a site for further examination.

Alcan Gove will consult with relevant groups on this matter.

Banyan Tree (8)

A respondent has advised that community members have asked that the Banyan Tree located in the refinery be added to the AAPA Site register.

Noted.

Authority Certificate (13)

A respondent has sought clarification that Alcan Gove is intending to apply for an AAPA Certificate and understands the Certificate process.

Discussions have commenced with the Aboriginal Areas Protection Authority on this matter. Alcan Gove understands the certification process.

Archaeological Survey (6)

A respondent has recommended that Alcan Gove undertakes an archaeological survey program of the existing mining lease to identify archaeological places with the view to develop management strategies that will mitigate the impact of mining activities on these places. They have suggested that the survey program be undertaken in two stages.

- *Stage 1 should involve an archaeological survey of those areas that will be impacted upon in the short to medium term future. These areas include the Eldo deposit and that part of the refinery construction access road located on Wargarpunda Point. A survey of the existing mining fringe should also be undertaken.*

- *Stage 2 should involve a series of stratified and random archaeological surveys to further define the nature of Aboriginal occupation on the Gove Peninsula. These surveys should be also target areas proposed for mining in the medium to long term.*

This survey should be undertaken prior to any earthworks, clearing or ancillary activities that may disturb prescribed archaeological places or objects and constitute a breach of the Heritage Conservation Act 1991.

There is no expansion of the mine proposed or required for the purposes of the refinery expansion. All operations will occur within the existing lease in accordance with current legal requirements and voluntary obligations. An archaeological survey of the mining area has been undertaken ("Report on Survey of Sacred Sites – Gove Peninsula", E C Evans, June 1966). In the event that any further lease areas are required in the future, they will be sought in accordance with all relevant approval procedures.

Table 20.6.2 (3)

A respondent has noted some errors in Table 20.6.2. They include the incorrect spelling of "Dhuwa" as well as incorrect status of sites and locations and incorrect referencing. Many sites have not been included such as registered shell middens, Macassan sites and ceremony grounds.

The incorrect spelling is noted. Subsequent to the preparation of the Draft EIS, Alcan Gove has obtained the latest copy of the register of sacred sites in the Gove area from the Aboriginal Area Protection Authority. This register provides a description and the location of all sites within the vicinity of Alcan Gove leases.

Sacred Sites (13)

A respondent has state that the third paragraph of Section 20.6.3.2 of the Draft EIS is misleading in that it implies that sites that are not registered are not 'sacred sites'. This is not the case. This paragraph also implies that areas of significance are not sacred sites. There is no such distinction under the NTSSA with any area of significance according to Aboriginal tradition, being classified as a sacred site (Section 3).

This point of clarification is noted.

AAPA has advised that "Registered sites are sites that Aboriginal custodians have asked the Authority to protect and that have been documented and evaluated by the Authority."

"Recorded sites are sites that have been made known to the Authority from a variety of sources including requests to have sites entered in the Register maintained by the Authority. In many cases, the Authority has not been able to assess the accuracy of its information regarding recorded sites."

20.8.1 Impact of Alcan Gove Expansion (3)

A respondent considers that, as the only sites of significance that are discussed in the Draft EIS have been those registered by the AAPA, there may be more sites of significance that can only be identified by an archaeological survey.

There is no 'expansion' of the mine proposed or required for the purposes of the refinery expansion. All operations will occur within the existing lease in accordance with current legal requirements and voluntary obligations. An archaeological survey of the mining area has been undertaken ("Report on Survey of Sacred Sites – Gove Peninsula", E C Evans, June 1966). In the event that any further lease areas are required in the future, they will be sought in accordance with relevant approval procedures.

21.3.1 Nhulunbuy – Land Use and Planning (5)

Section 21.3.1 states that "steps are being taken to provide a more normalised town". A respondent has advised that while preliminary discussions have been held between Alcan Gove and Government about the status of Nhulunbuy, these discussions should not be characterised as "steps are being taken to provide a more normalised town".

Noted. Alcan Gove will continue to work with the Northern Territory Government on this issue.

21.4.2.1 Demography – Yirrkala (8)

A respondent has pointed out a number of what they consider to be errors in the demographic data provided by the Australian Bureau of Statistics.

Noted. The ABS was the most widely recognised official source of statistics available to Alcan Gove.

21.4.9.1 Harmony Djamamirri Mala Group (5)

A respondent has noted that Eden Gray Spence chairs the Harmony Djamamirri Mala Group and advises that although it may have been an early initiative of Alcan Gove's Community Reference Group to do something about alcohol and anti-social behaviour, the Harmony Group is not a subcommittee of the Community Reference Group as stated in 23.5.2 of the Draft EIS.

This arrangement is noted.

21.4.11 Tourism (12)

A respondent considers that there is an absence in the EIS of any mention of tourism which has been occurring on the Gove Peninsula for over 20 years.

Section 21.4.1 of the Draft EIS discusses tourism. It is recognised as an industry for the Gove Peninsula.

21.5 Social Impact of Existing Alcan Gove Presence (3,14)

A respondent considers that the Draft EIS does not adequately address the negative aspects of Alcan Gove's presence and that there is an inadequate assessment of the impact of 30 year's of the mine's presence on Aboriginal people. Similarly the other respondent considers that the social impact assessment is superficial and one-sided.

The social impact assessment undertaken for the Draft EIS focussed on the impacts of the refinery expansion rather than on the complex issues underlying the region's social structure.

As discussed in Section 20.2 above, there has been a long history of change for Yolngu people. It is acknowledged that the development of the township of Nhulunbuy and the accompanying mining and alumina operations would not only have positive impacts on local Aboriginal people. As with other towns in the Northern Territory, negative social impacts occur (eg. substance abuse and criminal activities). However, the causes of these negative impacts can be complex. Alcan Gove will continue to support collaborative efforts to improve social well-being in and around Gove.

Alcan Gove is co-funding the construction and staffing of a facility which can receive clients suffering from substance abuse, and who can obtain culturally appropriate treatment and rehabilitation to address their problems. A business plan for the development and operation of the centre was drafted and communicated in 2003. The plan has been prepared to address problems with excessive alcohol and drug consumption and associated family violence in the Gove regional communities. Alcan Gove undertook this initiative in support of Alcan's commitment to sustainable communities.

(See also comments under Section 23.5.3 below).

21.7 Social and Community Impacts (2,3,4,7,10,15,17)

Community Contacts (7)

A respondent has stated that it appears that many of the conclusions of the social assessment have been based on a community survey with a total of six respondents. It considers that there is no distinction between the Nhulunbuy residents' position on certain issues and those of the Yolngu communities. Dhimurru claims that it was not approached by URS to comment on social impacts in the course of their investigation.

During the course of EIS preparation there were numerous contacts and discussion with the Yolngu community regarding the refinery expansion project and the EIS consultation program. They included consultation through the Regional Community Reference Group as well as with other separate Yolngu organisations. Further details of the consultation undertaken with Yolngu communities are given in Section 23.5 of this EIS Supplement.

Negative Social Impacts (10)

A respondent has stated that the social impact assessment is inadequate. He considers that no attention is paid to the detrimental impacts of the mine, including the large influx of non-Aboriginal people, and the establishment of the town, with increased access to alcohol and other social risks. No mention was made in the Draft EIS of initial opposition of the local Yolngu to the mine, nor the historic protest actions which followed.

See comments above in Section 21.5.

Construction Worker Profile (4)

To aid their planning for health services, a respondent has asked what will be the profile of the construction workers.

The construction workforce will be sourced from the Northern Territory and other part of Australia.

The majority will have worked on large construction projects in similar conditions and remoteness. It is envisaged that the majority of workers will be males between 25-55 years of age. The workers will be experienced construction workers. They are likely to be fit and in good health otherwise they would find it difficult to cope with the rigours of construction work. There is unlikely to be a significant demand for the treatment of chronic health problems.

Further details on the likely profile of the construction workforce are given in Section 21.7.1.1 of the Draft EIS.

All workers will be required to undertake a medical examination prior to an offer of employment. In addition, the workers will be required to agree to a personal code of conduct during their period of employment.

Construction Village Site (2)

A respondent notes that the Draft EIS refers to a single workers village on Melville Road. However that the site is bisected by Defence Land, hence DCM considers that technically it would be more correct to refer to two villages in close proximity on Melville Bay Road. A Plan would be useful to delineate this.

The potential construction village site at Nhulunbuy is bisected by Defence Land. Hence while the village would be located on two separate blocks of land, it would operate as one village. The location of the village site is shown on Figure 4.

Code of Conduct (3,7,17)

A number of respondents have asked for a copy of the code of conduct to be developed for the construction workers.

Alcan Gove will provide a copy to all interested parties when it is available.

Two respondents were represented at meeting with the construction contractors on 30th March 2004 when the code of conduct was discussed.

The code will be drafted and made available as soon as Construction Enterprise Bargaining Agreement has been completed.

Alcohol Provision at Construction Village (7)

A respondent would like to know what will be the arrangements for the provision of alcohol at the construction village.

Alcohol management procedures will include the following:

- There will be a limited licence club in the construction village.

- Opened cans only served at the club.
- No sale of take-away liquor.
- Card key entry to village for contractors only.

Transport Arrangements (7)

A respondent would like to know what will be the transport arrangements for contractors.

A bus service will be available to transport all construction workers between the construction village and the refinery each day. In addition, up to 40-50 managers/supervisors may be resident in town accommodation and it is expected that they will have their own vehicles.

Complaint Procedures (7)

A respondent would like to know what will be the complaint procedures during the construction phase.

A free call phone number will be available to all members of the community. In addition, there will be a full time Community Relations Manager located at the Alcan Gove Community Affairs office. A Community Relations officer will also to be appointed.

Aboriginal Liaison Officer (7)

A respondent would like to know if there will be an additional aboriginal liaison officer appointed.

An additional aboriginal liaison officer will be appointed.

Dhimurru Space (7)

A respondent has asked if they will have some space between office and the construction village

A buffer will be provided between the DLMAC office and the construction village.

Shift Arrangements (7)

A respondent would like to know what the shift arrangements will be for construction workers.

Shift arrangements cannot be confirmed until the Construction Enterprise Bargaining Agreement has been completed. However the current expectation is that the shifts could be 10 hour day shifts, 6 days per week, 6 weeks on site with 1 week off site. Days off will be staggered as far as possible.

Cross Cultural Training (7)

A respondent has asked that all people to be employed on the project be given cross cultural training before they commence work.

Alcan Gove has committed to ensuring that all construction personnel receive cross-cultural training during site induction.

Flight Arrangements (7)

A respondent would like to know what arrangements are being made for flights into and out of Gove.

The currently preferred option is for chartering of large jets for shift changes in addition to continuation of the usual service from current suppliers as now. The current modifications at the airport will accommodate larger jets.

Commercial Accommodation (7)

A respondent would like to know what arrangements are being put in place to ensure adequate commercial accommodation will be available in Nhulunbuy.

The provision of new commercial accommodation in Nhulunbuy is being investigated as an investment opportunity by the NLC for the Traditional Owners.

Existing Alcan Accommodation (15)

A respondent considers that some existing Alcan owned accommodation facilities are available and should be used for the construction workforce.

The existing Alcan owned facilities are fully utilised and would not be available during the construction period.

Recreation Permits (7)

A respondent has asked for arrangements to be in place to ensure that construction personnel obtain Dhimurru permits for access to identified recreation areas. The respondent has also asked that they be adequately resourced to issues permits and to monitor and manage impacts in recreational areas.

As discussed in Section 21.7.3.4 of the Draft EIS, access to recreational areas will be controlled by the use of recreational permits.

Permits issued to the construction workers will be at commercial permit rates charged by Dhimurru to provide resources to both issue permits and monitor and manage impacts on recreational areas.

Alcan Gove currently provides $135,000 to Dhimurru Land Management Aboriginal Corporation (Dhimurru) each year, a fully air conditioned house with rental value of $25,000 per year, the special project material and roadworks provided through YNOTS, as well as technical support and nursery products.

Dhimurru has already begun discussions with the construction contractors about the use and management of recreational areas. More detailed discussion will continue over the next few months addressing a range of options including the provision of support for road access and other recreational-based infrastructure.

Rehabilitation of Recreation Areas (7)

A respondent has asked that provision be made for the rehabilitation or repairing of recreational areas if required.

During the construction phase of the expansion project, Alcan Gove will provide specific support to Dhimurru for minimising the impact of extra visitors to recreation areas through a management strategy to be agreed with Dhimurru. Alcan Gove has already held some discussions with Dhimurru on the matter of recreational area management during the construction phase. As part of this consultation process, on 30 March 2004, a large group of Dhimurru representatives attended a meeting held with representatives of the construction contract manager, LSL. Commitments were made at that meeting to continue consultation with Dhimurru on a range of matters including the management of recreational areas and access to them.

Threats to Recreational Areas. (15)

A respondent considers that the existing recreational areas are threatened by the construction workers and the local Yolngu culture will not be respected.

As discussed above, adequate provision will be made for the management, protection, and rehabilitation of recreational areas in consultation with the Yolngu people.

Alcan Gove has committed to ensuring that all construction personnel receive cross-cultural training before they begin work.

Recreational Facilities for Construction Workers (7)

A respondent has asked that a range of recreational resources be provided within the construction village so that the capacity of existing facilities in the region is not exceeded.

A comprehensive range of recreational facilities will be provided in the construction village.

Wet Canteen (7)

A respondent has asked that a wet canteen be provided in the construction village so as not to increase general access to existing liquor outlets.

A wet canteen will be provided in the construction village.

21.7.3 Community Facilities (4,7,15)

Health Services (4)

A respondent has expressed concern about the ability of existing health services to cope (within existing resources) with the additional population growth of up to 1,200 workers between 25-55 years of age during the construction phase. They have asked for further discussions with Alcan Gove regarding these issues.

The department's concerns about additional workforce numbers are noted. Alcan Gove has advised the NT Government of the expected population change and expects that health services will be provided by the relevant Government agencies. Alcan Gove will continue discussions with the Department of Health and Community Services on changes in workforce numbers during the construction phase.

Police Numbers (7)

A respondent has asked for increased police presence during the construction phase.

Alcan Gove will continue discussions with the Department for Police Fire and Emergency Services with the aim of having adequate police service for the construction period.

Community Services (15)

A respondent has stated that the existing community services will not cope with the construction workforce.

It is recognised that there will be an additional demand on services from the construction workforce. It is for this reason that many of the services required will be provided within the construction village and will not impose a demand on the existing services. In addition, Alcan Gove is working with the Northern Territory Government and relevant service providers regarding any additional measures that may be necessary to accommodate the demands of the construction workforce.

Town Design Life (15)

A respondent has stated that the town will need to continue after its design life.

Noted.

Payment for Town Upgrades (15)

A respondent has stated that the town upgrades should be undertaken by Alcan Gove now rather than later by the Northern Territory taxpayer.

Alcan Gove will continue to maintain and upgrade town and local facilities and services including:

- Upgrade of airport
- Upgrade of town and local power distribution system
- Upgrade of amenity of Alcan Gove owned accommodation
- Provision of additional land for development in Nhulunbuy
- Contribution to social harmony and employment programs
- Working with the NT Government to ensure provision of health, education, police and emergency services

In addition Alcan Gove, through the Nhulunbuy Corporation, will continue to maintain and upgrade town facilities including:

- Replacement and upgrade of the town refuse facility
- Installation of stormwater drains.
- Road construction and sealing
- Replacement of water mains

- Upgrade of town swimming pool
- Maintenance of two self-cleaning toilets in the town centre

Construction Worker Impacts (15)

A respondent considers that construction workers will have a potentially devastating effect on the community. They think that a closed construction camp should be provided that is separate from the town.

As discussed in Section 21.7.3.5 of the Draft EIS, a range of management strategies will be implemented by Alcan Gove and the construction contractor to minimise the effects of the construction workers on the community.

Capacity of Recreation Facilities (15)

A respondent considers that the capacity of existing recreation facilities and clubs will not be adequate to cater for the construction workers.

Alcan Gove and the construction contractor have been consulting with the owners/managers of recreational facilities including local clubs.

New Community Benefits (15)

A respondent considers that new community benefits should be provided.

New community facilities arising (directly or indirectly) from the refinery expansion will include additional port facilities, new airport and terminal, and improved power system. The construction village and recreational facilities will be offered for community use when it is not longer required for project use.

21.8.7 Off-Site Construction (5)

If the prefabrication or transhipment of PAMs is to occur in the NT, a respondent has asked that the report addresses fabrication sites within the NT and the site nominated.

A decision has not yet been made on the location of the PAM prefabrication site or if it will be necessary to have a transhipment site. If either of these is to be located in the NT, their environmental implications will be fully addressed and discussed with relevant NT government agencies.

22.4 Economic Effects of the Expanded Operations (15)

A respondent have stated that the FIFO employees will not contribute to the NT economy.

Whilst on site, FIFO workers will generate a demand for goods and services such as accommodation, food, community services and recreational facilities. Meeting the demand for these goods and services will have a positive effect on the Northern Territory economy.

Whilst off site, those FIFO workers who live in Darwin, will continue to positively influence the Northern Territory economy with additional demands for similar services to those listed above. In addition these goods and services will also be sought by the workers' families.

23.5 Consultation Formats (7,14,15).

Yolngu Consultation (7)

A respondent considers that the public consultation period was not adequate for informed Yolngu participation in the assessment process. They felt that as the Yolngu language summary of the project was not released until March 10th it further limited the period available for effective Yolngu participation. They expressed concern that as their submission on the Draft EIS was made after the closing date that it might not be addressed to the same extent as submissions received by the closing date. The respondent said that they were not aware of a structured

approach to consulting the Yolngu community ahead of the EIS. NLC have also stated that the level of consultation with affected communities was inadequate.

During the course of EIS preparation there were numerous contacts and discussion with the Yolngu community regarding the refinery expansion project and the EIS consultation program. They included consultation through the Regional Community Reference Group as well as with other separate Yolngu organisations.

The Regional Community Reference Group represented the local indigenous community, traditional land owners, local indigenous businesses, and associated organisations. This group met four times between February 2003 and January 2004. Although the expansion project was not the primary focus of this group, the project was discussed at a number of these meetings and presentations made about what the project involved. Feedback was sought from the group on issues or concerns they had about the project.

In addition to the reference group, discussions were held with numerous other indigenous groups over the same period. A summary of the contacts made is listed in the following table.

Date	Groups	Topic
February 2003	Marngarr Community Council Gumatji Association Laynhapuy Homelands Northern Land Council Yirrkala Dhanbul Council	General introduction to the expansion project
April 2003	Dhimurru Land Management	Meeting convened but nobody came
April 2003	Yirrkala Dhanbul Council Laynhapuy Homelands Gumatji Association	Information on EIS and consultation processes
July 2003	Gumatji Association Miwatj Health Aboriginal Corporation Yirrkala Dhanbul Council	Discussed preliminary EIS results and sought information and feedback
July 2003	Dhimurru Land Management	Attempted to arrange a meeting but nobody was available
October 2003	Dhimurru Land Management	Communications (email and fax) about issues and information requests
December 2003	Yirrkala School	Discussion of statistics and sought issues of concern

Despite the late submission from DLMAC, all of their comments have been addressed in the EIS Supplement.

Groups Other Than the Reference Group (7)

A respondent has commented that the Community Reference Group process should not be relied upon to adequately represent Yolngu interests. The Community Reference Group had a larger agenda than the expansion itself and lacked the specific focus required to review the expansion proposal.

It is recognised that the reference groups consider issues other than the expansion project. However, the expansion project was one of the items on the Groups' agendas. This is why consultation was held with the reference groups on the project. However, as discussed above, the Regional Reference Group was not the only method used for Yolngu consultation. Meetings and discussions were held with many other Yolngu groups over the 12 months of EIS preparation. This consultation will continue through the project's construction phase.

Consultation Process (14)

A respondent considers that the consultation process has been deficient. They say this is because of the following:

1. *There were only 8 responses received from the first feedback form and 6 from the second.*
2. *There is no indication of how many members of the public were interviewed*
3. *There is no distinction between feedback from Yolngu people and non-Aboriginal people*
4. *There has been no consultation with Yolngu people except through the Community Reference Group*
5. *There are insufficient details on the impacts on Galupa.*

In response to these comments, the following responses are relevant:

1. The feedback forms were sent to all stakeholders on the consultation database plus copies were included in newspaper distributed to the communities of Nhulunbuy, Yirrkala and Ski Beach (average circulation 1,100). While Alcan Gove could not control the number of responses, the consultation process was effective in ensuring that the community had access to the project information.
2. Section 23.5.9 indicates that a large number of groups who were interviewed during the consultation process. Each of these groups represented an even larger number of constituents. In addition, discussions were held with members of the public at the Arafura Festival which was attended by over 2,000 people and at the Darwin EXPO. All members of the general public were invited to contact the EIS study team if they had any concerns or needs for information via newspaper advertisements, the project newsletter and the website.
3. Privacy concerns prevented the identification of the source of the issues raised during the consultation. All feedback was considered equally independent of whether it was from a Yolngu or non-Aboriginal source.
4. As discussed in Section 23.5.9 of the Draft EIS and above, there has been extensive consultation with Yolngu people in addition to the Community Reference Group.
5. Impacts on Galupa have been address in the relevant sections of the Draft EIS eg. noise effects in Section 10.5 and air quality effects in Section 8.7.

ECNT Meeting (14)

A respondent (ECNT) indicated that contrary to what was said in the Draft EIS that they did raise issues at their meeting with Alcan Gove in April 2003.

The objective of the meeting in April 2003 was for Alcan Gove to advise the ECNT of the submission of the project's Notice of Intent (NOI) to the NT Government and to initiate an ongoing communication process. Alcan Gove provided an overview presentation of the NOI. The ECNT Coordinator at that time agreed to provide feedback and to communicate with Alcan Gove as more information became available. ECNT has raised issues in their submission on the Draft EIS and these have been addressed in this EIS Supplement.

Union Consultation (15)

A respondent claims that they were excluded from the community consultation.

Nobody was excluded from the community consultation process. The whole community was invited to become involved. This included employees of Alcan Gove and associated contractors who would have been aware of the consultation process. In addition, on-going consultation was provided to all employees of Alcan Gove and associated contractors. This included presentation by management, regular articles in the monthly newsletters, and discussions during regular staff meetings.

24.2.3 Consequence Analysis (3)

Chlorine Leak (3)

A respondent has asked how was the risk determined for the chlorine leak scenario.

Chlorine is used to disinfect the town water supply.

The risk was determined by considering the likelihood of a chlorine leak occurring and whether people could be affected by such a leak. The likelihood of a leak occurring was determined from a review of the design of the chlorine storage facility and a review of published data on leaks and spills from similar facilities. A computer model called ARCHIE (Section 24.2.3.1 of the Draft EIS) was used to determine if the nearest populated area (the airport) would be affected and, if so, at what concentrations.

Unconfined Vapour Cloud Explosion (3)

A respondent has asked for a further explanation of the unconfined vapour cloud explosion scenario.

This scenario relates to an explosion of natural gas at the gate station where the gas pipeline delivers the gas to the refinery. The scenario assumes that there has been a leak of gas and a cloud of it has formed around the sources of the leak and that it subsequently explodes in the open air (i.e. not confined in a storage tank).

Management Controls (3)

A respondent has asked for information on the controls to be put in place to reduce the risks from the chlorine store and the gate station.

To reduce the risk at the chlorine store, the option of removing gaseous chlorine and replacing it with solid chlorine in the form of pellets is being considered. This will eliminate the potential for chlorine gas to escape to surrounding areas.

Environmental Risk (3)

A respondent has stated that the Draft EIS has not examined environmental risk associated with the mine, the refinery, increased shipping and waste disposal.

The environmental risks from the refinery, shipping and waste disposal have been addressed throughout the Draft EIS and further explained in this Supplement.

The site's environmental risks are managed through EHS First which is Alcan's environment, health and safety management system. It provides the framework to manage Alcan Gove's environmental, health and safety risks by using a comprehensive risk management process in accordance with the requirements of the Australian/New Zealand Standard AS/NZ 4360: 1999 Risk Management. Further details are given in Section 24.1 of the Draft EIS.

24.4.4 Emergency Response Plans (6)

Plan Detail (6)

A respondent considers that generally, the emergency response plan information provided in Section 24 contains insufficient detail to determine what actions will be undertaken during the response or to assess the adequacy of the implemented response measures in preventing or mitigating environmental harm.

The information provided in the Draft EIS was only a brief summary of the very detailed emergency response plans Alcan Gove has developed. Complete details of any emergency response plan can be provided to the respondent once the plans of interest have been advised.

Stormwater Flooding Emergency Response Plan (6)

A respondent has stated that while Section 24.4.4.5 of the Draft EIS contains an emergency response plan for stormwater, it does not contain adequate detail with regards to the emergency management of stormwater egress to the environment as inferred in Section 11.3.1.2.

Alcan Gove's emergency response plan encompasses the management of stormwater overflow. A copy of the relevant emergency management manual and procedures will be provided to the respondent.

25.4.3 Draft Construction Environment Management Plan (1,3,7)

Plan Enforcement (1)

A respondent has asked the following questions about the construction environment management plan:

- *How does Alcan plan to place responsibility on the contractors? Presumably, the first part of Section 25 will be part of the tender documents and contracts.*

- *Will contractors be required to be specific about their mitigation remedies?*
- *Does Alcan plan a formal audit of the mitigation?*
- *Will Alcan require the contractors to specifically measure or monitor any aspect of their work?*

The answer to all of the above questions is "yes".

All contractors undertaking work for the project will be required to enter into a formal agreement which will have specific terms and conditions to which they must legally comply with.

In selecting suitable contractors there are several steps required. The first step is to ensure that the contractor has suitable previous experience and this is determined from a pre-qualification process. A formal bid process is then undertaken and the contract will be awarded based on key criteria. Once awarded, regular reviews, audits and on going monitoring will ensure compliance with the contractual requirements.

All contractors will be required to submit environment health and safety plans to be discussed, negotiated and approved by the project management team and Alcan Gove. Compliance audits will be conducted on all contractors during the life of the project.

Environment On-Site (1)

A respondent has stated that the environment on site as well as off site should be protected.

Noted. Alcan Gove has an approved Mining Management Plan (MMP) in accordance with the requirements of the Mining Management Act. The MMP includes commitments to the protection of the environment both on site and off site.

Significant Clearing (3)

A respondent has asked for a definition of "significant clearing" in the terrestrial flora management plan and how will traditional owners be notified?

As soon as the details of the areas to be cleared are known, the information will be discussed with the traditional owners. Concerns about the clearing specific vegetated areas identified by the traditional owners will be discussed and resolved.

Off Site Impacts (7)

A respondent has stated that no comment is provided in the Draft EMP regarding the management of off site recreational impacts. They expected it to spell out Alcan Gove's policy on minimising the impacts of offsite activity on Yolngu estates and objectives and actions to achieve specified goals. The Draft EIS should at least have stated Alcan's continuing support for comprehensive and adequate programs to minimise recreational impacts, manage identified recreation areas, and rehabilitate those areas on completion of the mining and processing operation.

As discussed in Section 21.7 above, Alcan Gove has committed to supporting comprehensive programs to minimise recreational impacts, to manage them, and to rehabilitate them.

Alcan Gove already provides $135,000 to DLMAC each year, plus a fully air conditioned house with rental value of $25,000 per year, plus the special project material and roadworks provided through YNOTS. This commitment will continue as per their agreement with Alcan Gove.

During the construction phase of the expansion project, Alcan will provide specific support to Dhimurru for minimising the impact of extra visitors to recreation areas through a funding and management strategy to be agreed with Dhimurru. Alcan Gove has already held some discussions with Dhimurru on the matter of recreational area management during the construction phase. As part of this consultation process, on 30 March 2004, a large group of Dhimurru representatives attended a meeting held with representatives of the construction contract manager, LSL. Commitments were made at that meeting to continue consultation with Dhimurru on a range of matters including the management of recreational areas and access to them.

25.5.3 Draft Expanded Refinery Environment Management Plans (1,3,5,7)

Discharge Standards (3)

A respondent has asked for a commitment to develop the water quality discharge standard by December 2004 and not to wait until the expanded refinery is on line.

As stated in Section 13.3.1 of the Draft EIS, Alcan Gove has committed to developing locally applicable trigger values by December 2004.

Non Essential Entry (3)

A respondent has asked for a definition of the term "non-essential entry" used in the terrestrial flora and fauna management plans.

This relates to entry to an area which is not essential for the completion of an operation or task required for the construction work.

Achieving Social Objectives (7)

A respondent considers that the Draft EIS provides little in the way of specific detail regarding the actions that Alcan Gove will undertake to ensure that social objectives and targets are met.

Alcan Gove is committed to supporting the local community both for the present and the long-term future. Alcan Gove will assist with the development of social and financial infrastructure that will help bring about a sustainable economy to underpin community development beyond the cessation of its operations in the area.

Alcan Gove has internal objectives and targets to help track progress on contributions to community development activities. At the same time, Alcan Gove is mindful that it should not be unilaterally setting objectives and targets for social and community improvements that are the responsibility of the whole community. Alcan Gove has therefore provided input, and where appropriate, support for a range of community organisations and Government-based groups that deal with community issues in Gove and the surrounding region.

Some of the key organisations that include Alcan Gove representation and participation include:

- Nhulunbuy Town and Indigenous Regional Community reference groups
- Djamamirri Mala Harmony Group (to help reduce anti-social behaviour in the local community)
- Arnhemland Regional Development Board
- Ministerial Advisory Board for Education and Training
- Ministerial Advisory Board on Indigenous Economic Development Task Force
- Nhulunbuy Town Board

Each of these groups has their own social objectives and targets to which Alcan Gove has and will continue to contribute.

Alcan Gove also provides financial and in-kind support to local volunteer and sporting groups, schools, Dhimurru Land Management, Waterwatch, Yirrkala Dhanbul Landcare, YNOTS indigenous training school, and Yothu Yindi Foundation.

Mosquito Management Plan (5)

The following modifications to the mosquito management plan in the Draft EIS were suggested by DHCS:

Objective: It should be added under the objectives 'to prevent importation of dengue vector mosquito species from mining related activities'.

Actions: It should be added that all overseas vessels, as well as vessels and road transport from Qld, be inspected as per AQIS guidelines and the MEB guideline 'Exotic Aedes surveillance and exclusion from the Northern Territory of Australia', to prevent the importation of dengue vector mosquito species.

Actions: Workers should be educated about all the early symptoms of mosquito borne arbovirus disease, as well as the early symptoms of malaria.

Monitoring: It should be added that Alcan Gove will work with the NT Department of Health and Community Services, Nhulunbuy Corporation and AQIS to prevent the importation of dengue vector mosquito species into Gove.

Alcan Gove will incorporate the above modifications into its mosquito management plan.

Appendix C – Noise Impact Assessment Report (1)

Noise Barrier at Galupa (1)

A respondent has asked if Alcan Gove has considered the use of small acoustic barriers for use between the noisy equipment such as jackhammers and Galupa?

Alcan Gove has sought and received advice from a specialist noise consultant and related this advice to outcomes of previous discussions with the Galupa community. Alcan will continue to consult the Galupa community to determine whether they wish to accept an offer for Alcan to install a 2.5 m noise attenuating fence on an earthern bund along the western and northern boundaries of the community. This structure would attenuate traffic noise from the road to the north and noise from movement of equipment to the western where wharf-related activity will take place during the construction phase. The noise barrier would not reduce noise emanating from the refinery. The specialist advice on noise provided during the development of the EIS indicated that construction noise at the refinery itself would be less obvious to the community than changes in traffic noise. The noise barrier would only be installed in line with wishes of the Galupa community.

Noise Levels at Galupa (1)

A respondenthas commented that noise levels at Galupa are already a little high for a quiet remote area. While the increase in noise from the expansion is not large, (less than 1 dB) it should be pointed out that a 3dB increase is a doubling of the noise energy. DBIRD considers a 1 dB increase is very audible.

As stated in Section 10.5.1 of the Draft EIS, normally noise needs to increase by approximately 3 dB before it is considered to be of significance. This is supported by some noise jurisdictions which regulate noise level increases to be less than 3 dB above background. Noise level increases of less than 1 dB are generally not noticed by residents.

Reducing Noise Levels at Galupa (1)

A respondent has asked if Alcan Gove has considered any opportunity to reduce noise levels at Galupa during the expansion.

A noise barrier will be constructed at Galupa as discussed above.

Appendix D – Surface Water Data (11)

A respondent has requested that a chlorophyll "a" monitoring program should be commenced as soon as possible (not "considered" as stated in the Draft EIS).

Alcan Gove has introduced chlorophyll "a" in its water quality monitoring program.

Appendix E – Terrestrial Biology (11)

A respondent has commented that the species listed are mostly terrestrial, with a few marine vertebrates included. There is no mention of other significant marine taxa being present in the area, sawfish for example. They have asked if there any EBPC Act species present.

While no surveys of fish species have been undertaken in Melville Bay, no species which is been listed on the EPBC and NT lists of threatened species has been observed during habitat and other marine investigations around the Gove peninsula

Appendix H – Groundwater (12)

Monitoring Program – Modifications (12)

A respondent has asked for the meaning of the statement in H.1.2 of Appendix H which states that the monitoring program has been "rationalised and modified on several occasions".

The groundwater monitoring program has reviewed periodically by independent specialist consultants URS. The purpose of the reviews is to ensure maximum efficiency and effectiveness of the program. Historical data, trends and changes in risk profile are analysed and recommendations made on monitoring frequency and appropriate indicator parameters. The reference to rationalisation and modification in the Draft EIS was in relation to these reviews and the subsequent changes made to the program. These changes are limited to a greater focus on indicator parameters and priority risk areas. The ability of the program to record historical trends is maintained.

Monitoring Program – Methodology (12)

A respondent has asked how can monitoring be carried out accurately if the methodology has been changed.

Alcan Gove's monitoring methodologies are changed to improve the quality (including accuracy) of the data collected. In addition to normal quality control procedures, where program changes are made, monitoring procedures include a requirement for duplicate sampling for the required period. This enables an effective assessment of the effect of the change in methodology.

Monitoring Program – Restrictions (12)

A respondent had stated that the statement that monitoring could not be completed on occasion because of "logistical and access restrictions" is not acceptable and they consider that it could lead to the conclusion that there might be problems.

Alcan Gove makes every practicable effort to maintain its commitment to regular monitoring subject to occupational health, safety, and legal requirements. There have been occasions where employees were potentially exposed to unacceptable health and safety risks due to changes in the work environment at the sampling locations. On these occasions monitoring was not completed.

Appendix J – Groundwater Supply Report (1,8)

Contaminant Modelling (1)

A respondent has asked if Alcan Gove considered coupling a contaminant component to the groundwater model.

Any risk of contamination to the water supply aquifer would be determined by monitoring and managed through remediation and communication with stakeholders.

Caustic to Ground (1)

A respondent has asked if the benefit of reducing the caustic to ground incidents in reducing the source term is considerable.

There is no potential source of caustic contamination that could impact on the water that is extracted for pubic consumption. Any significant reduction in caustic to ground incidents at the refinery is expected to be reflected in measurable improvement in groundwater quality within a short period. To confirm this, monitoring results would have to show a consistent downward trend over several seasons (i.e. at least 2 years).

Contamination Reduction Rate (1)

A respondent has asked how fast the groundwater contamination is likely to reduce.

See comment above.

Groundwater Recovery Program (1)

A respondent has asked how much effect the groundwater recovery program is having on groundwater contamination levels and if the beneficial impact is only on the marine environment.

The objective of the groundwater recovery programme is to intercept flow of groundwater to areas outside the refinery lease area. The groundwater flow to Northern Beach is intercepted to minimise the concentration of trace metals in the intertidal area. This recovery process also reduces the accumulation of contaminants in the groundwater below the refinery.

Modelling Assumptions (8)

A respondent has noted that the Appendix J states that a number of key assumptions had to be made. They would like to see these addressed due to their concerns about water in the Yirrkala Creek and Gunyipinya billabong.

As discussed in Section 5.1 of this EIS Supplement, it is now proposed to reduce the maximum extraction rate and to install the new groundwater bores at a location which is much further from Yirrkala Creek and Gunyipinya Billabong. At this location, the additional groundwater abstraction is not expected to change the current flows in either Yirrkala Creek or the Gunyipinya billabong.

References (12)

A respondent has noted that the majority of references supporting claims made in Sections 13 and 14 are unpublished reports – some of these are also drafts (e.g. URS reports 2001-2003; Hanley 1993; LDM 1999, 2000). The reports are not available on Alcan Gove's website, and nor readily available in any public library. It was suggested that the claims made in the report cannot be readily validated by the public, undermining the effectiveness of the consultation process.

Alcan Gove will make the reports available to those respondents who have requested them. It should be noted that Hanley (1993) was not published and the reference in the Draft EIS was in relation to data collected by Hanley. This information will be made available to the respondent.

Project Changes

The Draft EIS was being prepared in parallel with the project's Definitive Feasibility Study. Design changes have occurred in some of the project elements since the submission of the Draft EIS. These changes are summarised below. They have not resulted in any significant changes to the environmental impacts reported in the Draft EIS.

Construction Timing, Workforce and Accommodation

Since the submission of the Draft EIS, further analysis has shown that the project's viability requires the originally planned 30-month construction period to be shortened to 24 months. This is a positive development from the point of view of social impact of the construction workforce since it shortens their time on site. However, given that the same number of work hours is required to complete the construction, there will be an increase in the number of construction workers on site.

In the Draft EIS, Alcan's preliminary estimate of the peak construction workforce was 1,200, to be accommodated at the serviced construction village. Workforce numbers have been refined since then and the maximum number of people who will be living in the village at any time is now estimated to be approximately 1,500. The peak will cover a period of 8 months. The village will be built with a capacity of about 1,800 rooms since, at any one time, a percentage of the workforce will be on a rostered week off. The rooms will be allocated to each worker for the duration of his/her employment on site. Experience has shown that unshared accommodation results in improved social harmony compared to a shared room arrangement. To provide sufficient area for the accommodation facilities, some of the village's recreational facilities will be located on the northern side of Arnhem Road.

In addition to the construction workforce, there is also a need to house construction management personnel and their families for the 2-year construction period. Alcan Gove is negotiating a joint venture with the Traditional Owners for the construction of 55 new houses at Wallaby Beach for this purpose.

The above workforce numbers are estimates only and the final numbers will depend on a number of variables that cannot yet be confirmed. These include:

- Finalisation of the project design.
- Negotiation of the site's Enterprise Bargaining Agreement.
- Roster arrangements.
- Project scheduling.

Residue Separation, Filtration and Washing

Since the Draft EIS was published, a number of process improvements that also bring environmental benefit have been identified in the residue separation, filtration and washing area. These are discussed below.

- Instead of processing residue from the pressure decanters through the existing desanding area, it will now be processed through new deep cone thickeners arranged as a single train of five vessels in series to facilitate the counter-current washing of the entire residue stream. The existing desanding area will be retained unchanged for possible use in the future if recovery of sand from the residue is identified to be beneficial.

- The existing multi-stage thickeners that are currently used for residue separation and washing, instead of being converted to red mud washers, will no longer be needed as washers or thickeners. Several of these tanks will be converted to operate as storage vessels for refinery contaminated waters, fresh caustic, cleaning liquors (new and used), pond liquor and spent liquor. The redundant thickeners will be available for the storage of stormwater from within bunded and containment areas during rainfall events. This and other waste water streams will be continuously recycled into the residue washing circuit. A number of these thickener tanks will become totally redundant and will be demolished.

The major environmental benefits of these process changes are installation of new tanks that will meet Australian Standard bunding requirements, increased capacity to store process liquids and potentially contaminated stormwater, and a reduced risk of caustic to ground incidents during cleaning operations.

Water Supply

The Draft EIS indicated that the refinery expansion would require an increase in the capacity of the water supply system from 12,000 ML/year to 14,000 ML/year. However, as part of more detailed review of water requirements and management practices, the required capacity has been reduced to 13,000 ML/year. As a result of this change and based on comments received on the Draft EIS, a review of the location of the proposed new water supply bores has been undertaken.

The groundwater model reported in the Draft EIS assessed the effect of a line of new production bores to the east of the airport. Following discussions with DIPE and concerns expressed in other submissions over the potential effects on Yirrkala Creek and Shady Gum Creek, it was decided to move the new bores to a location to the west of the airport and closer to the Latram River (Figure 5).

This effect of the bores at this new location is being assessed using the groundwater model. The model is being modified and tested to take into account DIPE's suggestions about the structure of the aquifer. It will be used in addition to a field investigation to provide assurance that not only will the impact at Yirrkala Creek be acceptable, but also that flow and wetland conditions in other areas affected by the aquifer discharge will not be adversely affected. The model assumptions and results are under currently discussion with DIPE and once the preferred borefield arrangements have been determined, the necessary approvals will be sought.

To confirm the aquifer assumptions used in the model, it is proposed to undertake a field program of drilling and testing at the location of the new borefield. The scope of this field program will be developed in consultation with the DIPE.

Rock Breaking Techniques

Geotechnical surveys undertaken to date have identified rock at a number of locations on site which will be required to be removed safely and efficiently. The rock formation of Gove is extremely hard and there is very little natural fracturing. The potential areas of solid rock are shown on Figure 1.

Rock fracturing utilising the latest technology is the preferred method for excavation to reduce the time for hydraulic jack hammering and to limit the amount of continuous noise, low level vibration, and dust that is generated. Due to the characteristics and potential amount of rock on the site, it is expected that some blasting will be required. If other rock breaking methods were employed, the duration for the excavation would be extended and will require increased mechanical equipment.

In line with standard practice, it is proposed to conduct some initial test blasts to establish the suitability, security, safety and environmental conditions of blasting. A full risk assessment and predictive modelling simulation will be undertaken by explosive experts utilising the results of the test blasts.

Subject to the results of the tests, it is expected that the duration of the use of controlled explosive charges will be intermittent over a period of 4- 6 months in the 2 year construction period. The noise model submitted as part of the Draft EIS will be reviewed and updated and further attenuation measures will be implemented if necessary. For the duration of the blasting, dust monitoring will be undertaken as described in the Draft EIS.

Professional and experienced explosive experts will undertake the blasting in accordance with all Australian Standards on safety in accordance with recognised best practice. The storage and security of all explosive material and equipment will be in accordance with recognised Australian and industry best practice and will be kept in secure compounds.

PAM Road

The PAM haul road is likely to cross the conveyor further to the south than was originally proposed in the Draft EIS. The options for the placement of this road are currently being investigated and will be confirmed in the detailed design stage. The PAM road is required to be operational from October 2005 through to February 2007. It will be rehabilitated once it is no longer required. Runoff from the PAM road will be managed to prevent erosion and siltation.

Shipping

In the Draft EIS, 40 purpose built PAM barges were specified to bring in both PAMs and construction material. After more detailed investigation, it is now recognised that the most effective means of bringing in construction material is via standard barges which are much smaller than the barges to be used for the PAMs. Throughout the construction phase, approximately 300,000 tonnes of construction equipment will be bought in via approximately 240 barge movements. These barges will be unloaded at both Perkins Wharf and the General Cargo Wharf. For the peak construction period, up to 12 barges per month will be required. All barges will be subject to the same quarantine requirements described in the Draft EIS.

The increased ship movements in Melville Bay will require greater piloting arrangements to provide control of the barges entering and leaving Melville Bay. As part of the standard maritime procedures, captains will be advised of the entry/exit and control requirements. Alcan Gove's Port Captain will coordinate the pilot requirements.

A specialist logistics company will be contracted to coordinate the movements of the barges across Perkins Wharf with the PAM movements and across the General Cargo Wharf with the current refinery and town cargo movements to ensure there is minimal disruption. The majority of the construction cargo will be unloaded via the General Cargo Wharf.

The PAMs will be unloaded via the expanded Perkins Wharf as described in the Draft EIS. The existing Perkins Wharf unloading area will be kept free for all normal deliveries.

Ballast water will be managed as described in the Draft EIS.

GLOSSARY

Some respondents have asked for an explanation of the following terms

Abundance	A more than adequate quantity or supply
Brownfield Expansion	Expansion of an existing industrial or commercial property
Diversity	The distribution and abundance of different plants and animals within an area
Greenfield Development	Development of a property that has not been previously developed

ERRATA (3,5,7,12)

A number of respondents noted some typographical and other errors in the Draft EIS. These errors have been changed below.

Section	Change From	Change To
Executive Summary Summary of Expansion Components Digestion	25% less residue per tonne of alumina	23% less residue per tonne of alumina
Table 4.7.1	Tanker size for expanded refinery - 30,000 t	77,000 t
11.8.3	Section 4.5	Section 4.4
12.1.4.3 - Caustic	URS, 2001c	URS, 2001b
12.1.4.3 - Nutrients	URS, 2001c	URS, 2001b
12.1.5.1	Low loaders	Front end loaders
14.2.2	URS, 2001c	URS, 2001b
14.2.3	LDM, 2000	LDM, 2000c
14.2.3	URS, 2001e	URS, 2001c
14.2.5	LDM, 2000b	Dames & Moore (2000)
14.2.5	LDM, 2000c	LDM, 2000b
14.3.1.1	Groote Biogeographic Region	North Australian Biogeographic Region
14.3.2.2 – Sand Beaches	URS,2001c	URS, 2001b
15.2.5.1 – Gove Peninsula	Wooranski, 2002	Woinarski, 2002a
15.2.6.2 – Species of Cultural Significance	Riiatjinu	Rirratjingu
15.2.6.5	Wooranski, 2002	Woinarski, 2002a
15.4	Mosquitos	mosquitoes
15.4	*Cu*	*Cx*
15.4	*Anopheles farauti*	*Anopheles farauti s.l.*
Appendix E.2	*Pandanus spirilis*	*Pandanus spiralis*
	Grevillea pteridiifolia	*Grevillea pteridifolia*
	Calythrix exstipulata	*Calytrix exstipulata*
	Alloeropsis	*Alloteropsis*
	Buchanania obovata green plum	*Buchanania obovata* Munydjutj
	leteritie	laterite
	gramineous	graminaceous

REFERENCES (3)

One respondent wanted the references to the following.

Wilson, C (2002) Threatened Species Information Sheet. Gove Crow Butterfly *Euploea alcathoe enastri* Parks & Wildlife Commission of NT.

Woinarski, J.C.Z., Gambold, N., Wurst, D., Flannery, T.F., Smith, A.P., Chatto, R., and Fisher, A. (1999). Distribution and habitat of the Northern Hopping Mouse *Notomys aquilo*. Wildlife Research 26, 495-511.

Woinarski, J (2001) Threatened Species Information Sheet. Golden Bandicoot *Isoodon aurantus.* Parks & Wildlife Commission of NT.

APPENDIX A

Submissions on Draft EIS

NORTHERN TERRITORY GOVERNMENT COMMENTS TO THE DRAFT ENVIRONMENTAL IMPACT STATEMENT ALCAN GOVE ALUMINA REFINERY EXPANSION PROJECT

INTRODUCTION

The Northern Territory Government reviewed the draft Environmental Impact Statement pertaining to the Alcan Gove Alumina Refinery Expansion Project. Comments from various Government Agencies were consolidated by the Department of the Chief Minister. Table 1 provides an Index to Agency Submission's.

Table 1

INDEX TO AGENCY SUBMISSION'S

	AGENCY	Sections
	Aboriginal Areas Protection Authority	20.6.3.2 (paragraphs 1 & 2)
	Museums and Art Galleries of the Northern Territory	11.9.4; Section 12 Various Caustic; 12.2.4.2; 13.3.1, 13.5.1; 13.6;13.7.2.1; 14.2.3; 14.3.1.1; 14.3.1.2; 14.3.2; 14.3.2.1; 14.5.2; 14.5.5
	DBIRD – Mines And Petroleum Management Division	ES8.3; ES8.4; ES9.10; ES10.4; 3.4.4; 3.6.4.1; 4.3.4; 4.4; 5.1.7; 5.5.2; 7.2; 7.3.1.1; 7.3.1.2; Section 8; 9.4; 11.3.2.5; 11.4; 11.7.2; 11.7.5; 11.9.1; 11.9.4; Section 12; 12.1; 12.1.3; 12.2; 13.6; Section 25; 25.4; Appendix C; Appendix J;
	DCM – Office of Territory Development	4.7 Table 4.7.1
	Department of Infrastructure Planning and Environment (excl OEH)	Town planning; 3.4; 4.6; 4.9.4; 5.1; 5.4.1; 5.5.2; 8.5.3; 11.3.1.2; 13.3.1; 17.8.2; 21.3.1; 21.4.7.3; 21.4.9; 21.7.2.1; 21.7.2.2; 21.8.7; 21.8.9; 23.5.2
	Department of Health and Community Services	1.7; 4.9.4; 5.1; 5.4; 7.3.1.3; 15.2.7.3; 15.3.5.7; 15.4; Table 15.4.1; 15.4.4.3; 15.4.4.4; 21.7.3.2; 25.5.3.12

Should the proponent wish to seek clarification on these comments the relevant agency contacts are:

John Coleman
Department of Infrastructure Planning and Environment
Telephone: 08 8999 6121
Email: john.coleman@nt.gov.au

David Ashbridge
Department of Health and Community Services
Telephone: 08 8999 2761
Email: david.ashbridge@nt.gov.au

Gillian Jan
Department of Business Industry and Resource Development
Telephone: 08 8999 5190
Email: gillian.jan@nt.gov.au

Jeffery Stead
Aboriginal Areas Protection Authority
Telephone: 08 8999 4700
Email: jeffrey.stead@nt.gov.au

Dr Barry Russell
Museums and Art Galleries of the Northern Territory
Telephone: 08 8999 8245
Email: barry.russell@nt.gov.au

Maria Duchateau
Office of Territoy Development
Telephone: 08 8999 5247
Email: maria.duchateau@nt.gov.au

General

The EIS correctly identifies the importance of the Water Act and the need to protect the environment surrounding a mining site, it however does not appear to adequately consider the Mining management Act. This oversight has led to the formulation of management plans that have objectives to protect the environment off-site but not on the site. Indeed there are many places in the document where the Water Act has been taken into account in assessments, provisions, mitigation, reporting but the requirements under the Mining Management Act has not been considered.

The requirements of the Mining Management Act are to **protect the environment on the site** are not fully identified. For example Section 13 (2) states that "Every person on a mining site has an obligation to take care of the environment". Penalties are listed for various levels of environmental harm **on a mining site**. A mining officer has the power to take action to **protect the environment on the site**, including the provision of information.

The EIS does not need to specify a particular laboratory. The only essential requirement is that the laboratory is NATA registered.

To aid understanding of the report Alcan are requested to include a number of flow diagrams including:

- Surface and Waste Water
- Caustic Material

Which include inputs (includes sources, sources of contamination etc)/outputs, quantities and flow directions.

It would also prove useful for understanding if the EIS were to illustrate process and flows associated with ongoing licensing and monitoring of the facility under various Acts, licenses and regulations such as the Mine Management Act in order to inform the reader and lay person of the processes.

<u>Town Planning</u>

Pursuant to clause (g) of the Special Purposes Lease 214 the Nhulunbuy Town Development Plan will require amendment for development of the construction village and new residential areas of Nhulunbuy.

Draft plans have been prepared by the Department of Infrastructure Planning and Environment to reflect the proposed developments which are now with the company for clearance. Whilst land form and infrastructure requirements are yet to be investigated, there appears to no impediments to the proposed expansion of the developed areas for the construction village and residential area.

It should be noted that town is not subject to the Northern Territory Planning Act or Building Act and therefore any comment in relation to these areas are advisory only.

Executive Summary

ES 8.3 Residue Disposal

Alcan should identify whether sufficient work has been undertaken to determine a final rehabilitation strategy or if additional research is proposed.

There is some industrial waste disposed to different areas of RDA which could be improved in terms of location designation and documentation for future reference in case the red mud becomes a future resource.

ES 8.4 Port

The dust issue with the existing operation at the ship loading point are recognised by all stakeholders and there is a need for improvement. With the expansion of the project, the wharf facility will have to deal with more alumina powder.

An increased level of material handling is likely to generate more dust unless significant improvements are warranted. Firm commitment required (may be significant cost - DFS should take account of the cost).

ES 9.10 Residue Disposal

Alternative use of Alkaline Waste Water in RDA is a desirable option for future residue disposal. How the capacity of this storage matches with increased residue production for the life of the mine is unclear. This may need overall strategic longer-term plan for the life of the mine and should make an essential component of the EIS process.

ES 10.4 Air Quality

Sulphur Dioxide: NEPM goal of 524 µg /m³ is greater than 350µg/m³ for fuel oil and 230µg/m³ for gas separately. The combined emission of fuel oil and gas is 580µg/m³. Is it expected to use only one source of energy at a particular time of operation and two types of energy wouldn't be used simultaneously?

1.7 Planning Issues and Statutory Requirements

The following legislation also applies to the Alcan Gove Alumina Refinery Expansion Project;

- *Public Health Act*
- *Food Act*

Section 3.0 Description of Existing Operation

3.4.4 Crushing and Screening

Presently there are some outstanding issues of dust in the plant area and past efforts of improvements are not working effectively. The added load in the crushing plant may need some effective dust minimising approach and control measures.

3.6 Residue Disposal

There is a risk of a major pollution incident occurring in Melville Bay resulting from failure of one or more of the embankments in the residue disposal area (colloquially known as the red mud ponds). The 30 to 40 metres high embankments are located on and adjacent to mangroves. The most obvious risk would be due to waves/storm surge resulting from a severe tropical cyclone. This has not been addressed in the draft EIS as required by the Guideline for the EIS.

Section 5.4.3 of the EIS Guidelines states "describe residue disposal and impoundment principles, surface configurations, wall designs and construction, estimated flood heights and provisions for extreme rainfall events, erosion protection, spillway design and location, sub drainage and collection sumps. Ensure current geotechnical engineering principles/practices are met."

3.6.4.1 Pond Embankment Design

The statement “No seepage has been observed to date” may not be technically correct or is a very strong claim. It would be more appropriate to state that there are no significant seepages so far. A few areas (down stream of pond 5 and 6) of suspected seepage need detailed investigation to design action plan/remedial works to minimise the impact.

A geotechnical report on this issue – an annual dam review report as per Australian National Committee on Large Dams (ANCOLD) guideline is expected to be submitted to DBIRD.

Section 4.0 Expanded Operation

4.3.4 Residue Separation, Filtration and Washing

When the existing thickeners are converted to red mud washers, there is a chance of caustic to ground incidents. While there are provisions to clean up contaminated material, it would be better if caustic to ground incidents were avoided as this also further contaminates the groundwater in the plant area. Alcan should identify how they plan to minimise/eliminate caustic to ground in this situation.

4.4 Liquor Purification

More information on the Liquor Purification process particularly the emissions from the SLC split out from the rest of the data would make it easier to understand i.e.

- What volumes of organics will be dealt with?
- What potential compounds would be created from the combustion process?
- Section 8.7 does not discuss the emissions from this process in isolation.
- What are the localised effects? (section 4.4.3)
- What are the consequences of facility malfunction?
- Is there an OHS hazard from this?

4.6 Residue Disposal

There is a risk of a major pollution incident occurring in Melville Bay resulting from failure of one or more of the embankments in the residue disposal area (colloquially known as the red mud ponds). The 30 to 40 metres high embankments are located on and adjacent to mangroves. The most obvious risk would be due to waves/storm surge resulting from a severe tropical cyclone. This has not been addressed in the draft EIS as required by the Guideline for the EIS.

Section 5.4.3 of the EIS Guidelines states "describe residue disposal and impoundment principles, surface configurations, wall designs and construction, estimated flood heights and provisions for extreme rainfall events, erosion protection, spillway design and location, sub drainage and collection sumps. Ensure current geotechnical engineering principles/practices are met."

4.7 Port

Table 4.7.1 Ship Movements contains insufficient ship movements/ship size for fuel oil premised upon the base case addressed within the EIS. This table is to be revised.

4.9.4 Construction Village

"All necessary infrastructure will be installed in accordance with local government requirements." In the absence of local government in the town this is taken to mean the Northern Territory Government's Requirements?

Additional workers will increase the volume of waste water required to be treated at the waste water stabilisation ponds. It is unknown if the current sewage treatment facility will be able to adequately process this additional volume. Alcan is requested to address this capacity issue.

In addition, some effluent is currently utilised on the golf course. Environmental Health Officers from the Department of Health and Community Services will contact Alcan and work with them to ensure that there is compliance with the *National Water Quality Management Strategy Guidelines*

for Sewerage Systems – Use of Reclaimed Water November 2000, in regard to use of effluent on the golf course.

Section 5.0 Infrastructure

5.1 Wellfield Modelling

This section discusses water supply and the potential to expand the current water supply bore field. There is discussion in relation to water quantity. However, due to the water being utilised for potable use, it is considered necessary to provide additional detail in relation chemical, radiological and microbiological parameters. The appropriate reference document is the *National Water Quality Management Strategy Australian Drinking Water Guidelines 1996.*

An important issue is the impacts of increasing extraction from their borefield from 9200 ML/year to 14000 ML/year. Their demand is fairly constant throughout the year. This equates to increasing the mean continuous pumping rate from 285 to 445 litres per second. The aquifer the borefield exploits sustains the dry season flow in the Latram River and Yirrkala Creek. These are the only 2 drainages that are perennial and they have a combined dry season flow of between 150 and 400 litres per second. When the licence was originally issued in the 1970s the only issue identified was maintenance of the water supply source from Yirrkala Creek for the Yirrkala community. Environmental flows were not a significant issue. A more complete understanding of the aquifer has only recently been gained from work undertaken for the East Arnhem Water Study. The work reported on in the draft EIS does not adequately address environmental water requirements. The groundwater model utilised for scenario predictions does not appropriately represent the current level of knowledge of the aquifer and the ecosystems it maintains.

Alcan should review this section in terms of the above discussion.

5.1.7 Wellfield Demand

The current water extraction licence is issued by the Controller of Waters under Water Act. The EIS proposes to seek a revised (increased) extraction limit from the Controller of Waters. Under existing legislative provisions and administrative agreements, section 7 of the Water Act excludes authorised mining and petroleum activities. Under agreement with the Controller of Waters, the increased extraction of water will be approved under the Mining Management Act, after appropriate consultation with the Controller of Waters.

5.2 Energy

The EIS indicates that the energy generation system is capable of handling the construction phase of the refinery (page 5-8). This is may not be correct, if the town, Ski Beach and Yirrkala supplies are to be fully secured and backup reserves fully established. Whilst Alcan are commencing a program of up-grading sub-stations in the network distribution options will be required. This

will be best undertaken by a collaborative arrangement between Alcan and the Northern Territory Government.

5.4 Sewerage

Substantial amounts of nutrient rich water enter Nhulunbuy Lagoon as a result of irrigation runoff from the Nhulunbuy Golf Course (Wilson 2000, Whelan and Hayes 1992). The nutrient rich water creates ideal conditions for mosquito breeding. There will be increased need for effluent disposal due to a higher population resulting from the mine expansion. Increased effluent re-use on the golf course and subsequent runoff could exacerbate the mosquito problem at the Golf Course Drain and Nhulunbuy Lagoon. It has previously been suggested that nutrient overflow into the lagoon should be restricted by constructing a holding pond for water and re-dispersal (Wilson 2000). Alternatively, nutrient rich runoff could be collected and piped directly into the sea (Whelan and Hayes 1992). Increased effluent disposal should not occur at the Nhulunbuy Golf Course unless provisions such as those suggested above are made to prevent increased nutrient runoff into Nhulunbuy Lagoon. (Note comment 4.9.4 regarding authorisation)

Overflow from the sewage ponds is currently directed into an interdunal overflow area and into the sea (Lamche 2004). If increased or continual overflow occurs it could affect the drainage of the area by causing heavy algal growth, which may allow surface water ponding by preventing the free flow of water. Any ponding of effluent overflow in the interdunal area would promote prolific breeding of pest and vector mosquito species. Provisions should be made to ensure no ponding of water could occur in the interdunal overflow area.

5.4.1 Refinery sewage

It is noted that it is discharged into the outfall. The proponent should have reference to acceptable standards for such discharge particularly during the construction phase when the load is to double.

5.5.2 Roads

Katherine to Gove - Central Arnhem Highway.

The EIS claims that the expansion of the refinery will have little impact on the road. This is a reasonable comment as the refinery expansion is being dealt with in isolation from the Trans Territory Pipeline Project and that materials for the expansion will be barged in. It is expected that the Central Arnhem Highway will be one of the dominant issues with the EIS for Trans Territory Pipeline.

The Road Network Division has reviewed the draft EIS and is aware of the issues raised by Alcan relating to existing and proposed road infrastructure assets associated with the intended Alumina Refinery Expansion Project.

Road Network Division has however have identified that under Section 5.5.2 ROADS of the draft EIS that:

The Department maintains the Central Arnhem Road & the road located south of the Airport.

- The Melville Bay Road located north of the Airport is the responsibility of ALCAN.
- The draft EIS indicates that the bulk of construction materials will be delivered by sea at the Perkins wharf area which is within the Refinery Site (fig 4.9.1) and will therefore not impact on Northern Territory Government roads (see Section 5.5.2.2).
- Similarly, worker-generated traffic from Nhulunbuy to the Refinery Site (see Section 5.2.2.3) is conducted along Melville Bay Rd, which is managed by ALCAN.
- Road Networks Division is satisfied that issues of road management including noise & dust associated with heavy construction traffic will generally be confined to the refinery site.

Overall, the proposed redevelopment of the refinery will have little impact on the Northern Territory Government road network based on the proponents advice outlined in the draft EIS.

However it is important to note that any variations to the proposals for materials delivery (eg road access of materials) outlined in the draft EIS will need to be notified to the Road Network Division.

The primary impact of the refinery redevelopment on roads managed by the Department of Infrastructure Planning and Environment will be associated with the gas pipeline which is the subject of a separate EIS.

Section 7 Waste Management

7.2 Waste Management Standards

The proponent is not directly required to comply with the Waste Management and Pollution Control Act. Section 6 of the Act excludes mining and petroleum activities authorised under the relevant mining or petroleum legislation.

7.3.1.1 Scale

It would add to the understanding of the document if the chemical composition and physical characteristics of the scale was detailed here.

7.3.1.2 Spilled and Lost Product

If the proponent has reduced spills by 2500 tpa over the last few years, what is the current amount of spills that is estimated to occur? Is this a significant reduction and will the proposed activities continue to improve this.

7.3.1.3 Tyres

Those waste tyres that are provided to local community organisations for use as barriers and borders should be holed to prevent water from ponding and subsequent mosquito breeding.

Section 8 Air Quality

It was noted elsewhere in the document that Alcan plans to seal existing unsealed roads. When will this take place? How much of the construction traffic will be passing over unsealed roads near air-sensitive receivers? The level of construction traffic referred to in the noise section would be enough to generate large quantities of fugitive dust if the trucks travel on unsealed roads.

Has Alcan considered sealing roads affected in this way very early in the construction program? (There is always the water truck approach as an alternative as listed in Section 25.4.3.2) Will the contractors be asked to use a wheel washing facility? This issue will also affect Alcan's own staff.

8.5.3 Shiploader Upgrade

This is a highly visible emission and there needs to be more detail on how the shiploader is to be upgraded to reduce fugitive dusts.

Section 9 Greenhouse Gas

Clarification is sought regarding the relative increase on greenhouse gas emissions per tonne of alumina for the expanded refinery summarised in Table 9.3.6., in the base case where fuel oil is continued to be used.

Section 9.4 Management of Greenhouse Gas Emissions

The changes proposed will result in a reduction in greenhouse gas emissions per unit of alumina produced. This is a major benefit to the operation. However as more alumina will be produced as a result of the expansion, there will be an overall increase in total greenhouse gas emissions.

Section 11 Surface Water

11.3.1.2 Refinery Surface Water

The report needs to provide detail on how rainwater and process water in bunded areas is collected and returned to the process (Waste Water Reuse).

11.3.2.5 Waste Water Inventory

Does Alcan keep an inventory of the loadings of the principal contaminants on site such as vanadium and arsenic?

11.4 Water Quality Monitoring Program

Alcan should note that DBIRD requires that they discuss and agree a reporting system for surface water quality. The agreed program needs to be included in the Mine Management Plan. Reporting should include both digital data on a regular basis and interpretive reports. Similarly agreement is required on the extent, nature and timing of monitoring data provided. Summary reports in the MMP are not sufficient. Data is required in digital form on a regular basis and commitment to each year's program should be made in the MMP.

The proponent will undertake a range of monitoring associated with the mining and processing operations. It may be advantageous to separate the various monitoring programs that have statutory reporting requirements (ie discharge licenses & Mining Management Plan) from the operational monitoring that is not reportable but the company undertakes for its own operational purposes.

11.7.2 Seawater Cooling Discharge

What is the bleed water likely to contain? What is a small quantity of bleed water?

11.7.5 Storm Water Management

The improvements listed are welcomed. Is the changes mentioned part of the expansion or is the timetable more flexible?

11.9 Water Quality Impact sand Mitigation

11.9.1 Overview

Increased water treatment rates will result in increased total load of contaminants to the marine environment.

11.9.4. Water Quality Monitoring and Impact Mitigation.

Where will the new sites be? It is noted that the review will be complete by June 2004. At this time, DBIRD expect Alcan to formally agree their program under the Mining Management Act.

The major review of the marine monitoring requirements should have been included in this EIS, not "wait until June 2004". The Draft EIS is now released without full details of what will be required as per water quality monitoring.

Changes in the water quality discharge program should include (not just "consider") the three dot-points given on pp 11-21-22.

The monitoring tends to focus on water discharge licences.

Section 12 Groundwater

The National Water Quality Strategy prefers that the default triggers are only used in the absence of other data. Has Alcan considered using similar statistical approaches to that suggested in the ANZEEC Guidelines? This approach, if adopted appropriately for the site, can lead to a continual improvement philosophy consistent with ISO14001.

A significant issue relates to the reporting of the known level of contamination in the groundwater beneath the refinery site and the residue disposal area. The information may be available but does not appear in the draft EIS.

Caustic.

Alcan should endeavour to continue determining ways of removing caustic contamination from **all** groundwater, in the long-term.

12.1 Refinery

Monitoring programs should be used as management tools. The objectives set related more to process than to goals. If the collection of monitoring data becomes the main aim, it is rarely used as a management tool. A good program should set quantitative objectives and action plans. It is noted that trigger values will be developed by December 2004. What will Alcan do if these trigger values are exceeded?

12.1.3 Standards

This section (unlike Section 25.5.3.6) seems to imply that if groundwater is not to be used for human consumption in the foreseeable future only the effect on marine waters is important. Environmental impact on groundwater can be very long term (as indicated by the data collected over 1999-2003 in the deeper groundwater in clay regolith. The protection of the environment on site includes the protection of groundwater.

12.2 Residue Disposal Area (RDA)

Monitoring programs should be used as management tools. The objectives set related more to process than to goals. If the collection of monitoring data becomes the main aim, it is rarely used as a management tool. A good program should set quantitative objectives and action plans. It is noted that trigger values will be developed by December 2004. What will Alcan do if these trigger values are exceeded?

12.2.4.2 Groundwater

Water tables have risen outside the RDA embankments – insufficient knowledge exists to estimate long-term impacts on mangroves and other coastal flora – Alcan should assess the impacts of rising water tables. Include

monitoring and development of remediation strategies where an impact identified within 25.5.3.6 Ground Water Management.

Section 13. Marine Water and Sediment Quality.

13.2.2.3 Drimmie Arm

This section mentions a survey undertaken by URS in 2000 (URS 2001e) to ascertain the effects (after heavy rain) of the release of stored water from a pond at the Residue Disposal Site (RDS) into the adjacent marine environment in which the effect on the biota was reported. The survey report concluded that there was partial re-colonization of the sediments by worms and crabs and that there would be a slow recovery of benthic organisms in the affected area. Further details of this report in relation to the effect on the biota should be contained in the following section (14; Marine Habitats), but it is not.

13.3.1 Water Quality

The Gove Area has declared beneficial use of 'aquatic ecosystem protection and recreational water quality and aesthetics'.

From work undertaken by MAGNT, Melville Bay near the refinery is considered a "moderately disturbed ecosystem", not a "slightly to moderately disturbed" system (p.13.3).

13.5.1 Gove Harbour Sediment Quality

The flocculating sediment (700 m radius) is a pollutant that by its very nature prevents settlement of any marine organisms. Alcan has not addressed the issue of remediation and should identify and undertake a remediation program as part of any further expansion of its plant.

13.6 Refinery Expansion

Alcan state that there will be a small increase in outfall discharge (Table 13.6.1). Fig. 13.7.3 shows a greater area that will be affected by suspended solids (1% exceedance time). No apparent effort has been undertaken by Alcan to develop a method to that will **lower** this discharge volume (presently 6,000 m^3/hr). Alcan should identify what steps they will take to lower discharge/TSS to allow the recovery of this part of the harbour. DBIRD also note this and request assurance that all avenues for mitigation have been explored.

13.7.2.1 Ballast Water

The 15% increase in ballast water discharge is not "small" (p.13.10). There is no mention of any protocol for checking for aquatic pests, either here or sect.14.5.13; Alcan should address the change in risk associated with this change in volumes and clearly whether existing strategies are appropriate to address the changed risk profile is any.

General

With the planned expansion, the report notes (section 4.6) that the current technique of disposing residue will continue until 2011 and that there will be a large (nearly two times) increase in production of red mud solids (Table 4.6.1). As this additional residue is planned to be deposited in the existing RDS, then this will surely increase the risk of the accidental release of alkaline waters into the adjacent marine environment following heavy rain. Alcan should address the change in risk associated with this change in volumes and clearly whether existing strategies are appropriate to address the changed risk profile is any

Section 14. Marine habitats.

General comments

This report is voluminous and apparently thorough, but contains many generalised, and difficult to substantiate statements, which make it difficult to assess the conclusion that the expansion will have 'little change to the existing zone of impact' in relation to marine habitats (ES-17).

14.2.3 Drimmie Arm

In section 13.2.2.3 reference is made to work completed by URS in 2000 (URS 2001e), further details should be contained in this section. However, here it is simply stated that 'there had been a recovery of the benthic organisms and that this recovery would continue'. This statement says nothing. Information which should be presented includes what taxa recovered, what did not; over what time period would the recovery take, etc.

14.3.1.1 Biogeography

The characterisation of Melville Bay being situated in the Groote Biogeographic region needs to be substantiated (Section 14.3.1.1). What is this Biogeographic Region? What is the basis for such a narrowly-defined biogeographic entity? It is doubtful whether they would be any marine taxa endemic to this narrow region, so theoretically it has no standing whatsoever as a biogeographic region. The statement that "It (Groote biogeographic region) represents a core faunal zone traversed by a large suite of tropical indo-West Pacific fishes" is unsubstantiated.

CRC et al. 2003 is not included in the References. This is the aquatic pest survey, which the EIS states added " … significantly to the knowledge of native marine plants and animals occurring at Gove". This is a key reference document.

14.3.1.2 Regional Habitats

The report states that species in the Gove area are "generally distributed for thousands of kilometres" across northern Australia and into Indonesia, Papua New Guinea and the Philippines. This is not correct and apparently at odds with Section 14.3.1.1. The statement is apparently based upon Wells (1990),

a paper about the distribution of molluscs; Wells mentions other groups (fish, corals) in passing. The fish and other marine fauna of the Gove area do not necessarily resemble that of Indonesia etc. A number of NT coastal fish species are restricted to north-western Australia, including Gove, and many are adapted to turbid inshore habitats.

14.3.2 Southern Melville Bay

Throughout section 14.3.2 the report compares abundance of benthic fauna, and numbers of benthic fauna (see Fig. 14.3.7 also); it is unclear whether these parameters refer to species diversity (*numbers of taxa*), or *numbers of individuals* (for each taxon).

Although the EIS states that fish "avoid" the waste-water discharge plume, it is not known what species are actually present in any of the habitats described.

14.3.2.1. Subtidal Habitats.

From reading the habitat accounts, and viewing Fig.14.3.7, it appears that these accounts are interpreted from grab samples, as fish and mobile animals such as crustacea, are barely mentioned. Grab samples do not allow observation of resident fish for example, which form assemblages linked to habitat types.

14.3.2.3 Threatened Marine Species

As fish species are not addressed in the surveys completed it cannot be definitively addressed whether any are EPBC Act threatened species (e.g. sawfish, whipray) or are significant species in any other way (e.g. undescribed or rare).

The EIS says that there are no rare or significant marine habitats, but there is no information that would support this statement.

14.5.2 Benthic Macrofauna

The report does not discuss at all the effects on the benthic fauna of the expanded refinery on the area adjacent the RDS;

14.5.5. Other Marine Habitats

The report does not discuss at all the effects on the benthic fauna of the expanded refinery on the area adjacent the RDS;

Section 15 Terrestrial Biology

This document lacks detail on small, cryptic terrestrial fauna that can only be obtained through comprehensive, multi-seasonal surveys. The recent faunal survey of the construction site only totalled six days in duration, over one dry season period. Nonetheless, from a terrestrial vertebrates perspective the proposed expansion appears to be impacting mainly upon sites that have

been revegetated following earlier impacts. This should not adversely affect any threatened or endangered species and/or communities.

Judging by the fauna survey results (and lists from surrounding areas) the site does not contain any highly significant biological units (habitats or rare/endangered species) and has already been significantly degraded. Additionally, the areal extent of the project is relatively small and is contained within a much greater area of similar surrounding habitat. If the proposed conservation measures are adhered to, there should not be a lasting effect on local terrestrial fauna.

Overall, this Draft EIS adequately addresses issues relating to the status, impacts and conservation of the terrestrial vertebrate fauna of the Project area.

15.2.7.3 Rehabilitation of disturbed areas

Disturbed sites should be landscaped to be free draining, to prevent potential mosquito breeding on rehabilitated surfaces.

15.3.5.7 Introduced Species

It should be added in this section that the dengue vector mosquito species *Aedes aegypti* and *Aedes albopictus* have the potential to be introduced into the Gove area, with potentially serious human health implications. Both of these species can be transported to Gove from vessels arriving from overseas destinations where these species are endemic. *Aedes aegypti* could also be transported to Gove by sea and land transport originating from Queensland, where this species is endemic.

The NT had previously been free of dengue vectors since the late 1950's. Recently however, the dengue mosquito *Ae. aegypti* has been found in Tennant Creek, with the extent of infestation indicating that the mosquito had probably been in the town from at least December 2003. Surveys by health officers in late February and early March 2004 have indicated that *Ae. aegypti* is firmly established in Tennant Creek. The mosquito species may have been brought into Tennant Creek as eggs in a receptacle from Queensland in the wet season of 2002/2003.

To prevent the potential spread of dengue fever, the dengue carrying mosquito species must be kept out of the NT, which includes currently attempting to eradicate *Ae. aegypti* from Tennant Creek, and on-going vigilance using quarantine procedures at ports. Quarantine procedures for overseas vessels should also apply to vessels and vehicle transport arriving from Queensland. Increased traffic as a result of the mine expansion is likely to increase the risk of exotic mosquito importation, therefore increased vigilance would be required to keep Gove free of dengue vector mosquitoes. The Medical Entomology Branch of the NT Department of Health and Community Services requires notification if any mosquito species are found on vessels from overseas, and vessels and road transport from Queensland.

If *Ae. aegypti* or *Ae. albopictus* were introduced into Gove, full co-operation by all people of Gove would be required in an eradication campaign.

The importance of preventing the establishment of dengue vector mosquito species can be seen with the current dengue outbreaks in north Queensland, which has infected hundreds of people. *Aedes aegypti* breed in artificial containers in urban areas, therefore live in close association with people and are very hard to control without the co-operation of every household, which provides all the more reason to prevent their establishment.

15.4 Biting Insects

In general, in this section;

'Mosquitos' should be spelt 'mosquitoes'.

'Culex' should be abbreviated to *'Cx.',* not *'Cu'.*

Anopheles farauti should be referred to as *Anopheles farauti s.l.*¸ a species complex that includes three different species that can not be separated morphologically. The species complex includes *An. farauti,* which breeds in brackish water, and *An. hinesorum* and *An. torresiensis*, which breed in freshwater.

Virus nomenclature and abbreviations have recently changed. Ross River is now referred to as Ross River virus (RRV), Barmah Forest is now referred to as Barmah Forest virus (BFV), Kunjin is referred to as Kunjin virus (KUNV), Murray Valley encephalitis is referred to as Murray Valley encephalitis virus (MVEV) and Japanese encephalitis is referred to as Japanese encephalitis virus (JEV).

Table 15.4.1

Anopheles farauti s.l. is not known to breed in containers. It should be added that preferred breeding sites include coastal and brackish reed swamps, and freshwater swamps.

Culex annulirostris also breed in extensive freshwater and coastal reed swamps, stormwater drains, sewage effluent and organic wastewater.

Section 15.4.4.3 Construction Camp and Borrow Pits

Dot Point 1 – All drainage channels and spoon drains should be maintained annually to remove excess silt and vegetation that can lead to water pooling. They should be constructed to contain no depressions, and if subject to the dry season low flow of water, should contain a concrete low flow invert. Erosion prevention structures should be constructed at all drain end points, and at all potential erosion sites within the drain.

Dot Point 2 – Rock bars should be constructed to drain trapped upstream water within five days. This can be achieved by installing several small pipes within the rock bar to allow water to drain, therefore preventing upstream ponding and subsequent potential mosquito breeding.

The construction workforce accommodation facility should be designed appropriately to minimise potential biting insect problems. This can include appropriate landscaping around any personnel facilities to allow the effective use of the biting insect barrier spray Bistar (active ingredient bifenthrin). The use of shrub type vegetation and/or black lining on fences around personnel areas would provide suitable biting insect resting places, which can then be treated with bifenthrin to kill biting insects that rest on the treated surface. If demountable type housing is to be used, bifenthrin should be applied under the demountables to kill biting insects that harbour there.

15.4.4.4 Worker Education and Personal Protection

Insectocution devices should not be relied upon for protection from biting insect attack (Whelan 1998, cited Mitchell 1992). When used in outdoor situations it is possible that they can increase local problems by attracting insects to the vicinity of people (Whelan 1998). Workers should be provided with a copy of the Medical Entomology Branch Handout 'Personal Protection from Mosquitoes and Biting Midges in the NT'. This has been provided as Attachment 1.

EXOTIC MOSQUITOES

Add a new section titled 'Exotic Mosquitoes'. See 'Section 15.3.5.7 Introduced Species' paragraph above for details.

17.8.2 Visual Impact

The earthworks and excavation required for the haul roads accessing the calcination area will be clearly visible from the sea north of the refinery but this does not seem to be addressed in the report.

20.6.3.2 Sites of Significance

Paragraph Two

The *Northern Territory Aboriginal Sacred Sites Act 1989* (*NTASSA*) also gives the AAPA powers to prosecute (Section 39) and issue Authority Certificates (Part III Division 1).

The AAPA is charged with the responsibility for consulting relevant Aboriginal custodians of sites about development projects. This service is activated on the request of developers who are entitled to make an application for an Authority Certificate for the works proposed. If there are no sacred sites that will be affected, the Authority will issue an Authority Certificate without any site-specific conditions.

If there are sacred sites in the vicinity, an Authority Certificate may still be issued, but with conditions attached intended to protect the site. Once a developer holds an Authority Certificate, the works described may proceed in the area defined by the Certificate without fear of prosecution for site damage as long as the developer does not breach the conditions of the Certificate.

This provides the developer with a significant level of certainty with regard to sacred sites.

There is no indication that Alcan is intending to apply for an Authority Certificate or understands the Certificate process. This requires clarification in the statement.

Paragraph 3

This paragraph is misleading in that it infers that sites that are not registered are not 'sacred sites'. This is not the case. This paragraph also infers that areas of significance are not sacred sites. There is no such distinction under the *NTSSA* with any area of significance according to Aboriginal tradition, being classified as a sacred site (Section 3).

21.3.1 Nhulunbuy

Preliminary discussions have been held between Alcan Gove and Government officers about the status of the town, but these discussions should not be characterised as "steps are being taken to provide a more normalised town".

21.4.7.3 Land Availability

The refinery expansion will be contained within the current site.

The report indicates that there is sufficient land for accommodating the construction work force and permanent workforce available through in-fill development. The DIPE concept plans for these in-fill areas provided to Alcan provide a mix of single dwelling allotments and several higher density sites. Our assessment is that there is more than sufficient land available for development within the existing lease to cater for the construction and operational phase of the development.

A number of infrastructure issues briefly mentioned in the EIS have been raised separately by Alcan and are considered more to do with the desire for normalisation of the town.

21.4.9 Harmony Djamamirri Mala Group

Eden Gray Spence chairs this group and advises that although it may have been an early initiative of Alcan's Community Reference Group to do something about alcohol and anti-social behaviour , the Harmony Group is not a subcommittee of the Community Reference Group as stated in 23.5.2

21.7.2.1 Construction Workforce Accommodation

It is noted that the EIS refers to a single workers village on Melville Road. It is noted however that the site is bisected by Defence Land, hence technically it

would be more correct to refer to two villages in close proximity on Melville Bay Road. A Plan would be useful to delineate this.

Work is progressing to amend the town plan to cater for two construction worker villages on Melville Bay Road. Servicing of the sites will be undertaken by Alcan and there are no issues from a land development perspective.

21.7.2.2 & 21.8.9 Operational Workforce Accommodation

The report indicates that there is sufficient land available through in-fill development. The DIPE concept plans for these in-fill areas provided to Alcan provide a mix of single dwelling allotments and several higher density sites. Our assessment is that there is more than sufficient land available for development within the existing lease to cater for the construction and operational phase of the development.

21.7.3.2 Health Services

The Department is concerned about the ability to cope (within existing resources) with the additional population growth of up to 1,200 workers between 25-55 years of age during the construction phase. Areas where it could create additional pressures include mental health, alcohol and other drugs and sexual health services over and above their current capacity and resource level. The Department will require further discussions with ALCAN regarding these issues.

21.8.7 Pre-fabrication

The report indicates that as much prefabrication for the plant as possible will be undertaken offsite and transported to Gove in a semi-fabricated condition. If the prefabrication or transhipment is to occur in the Territory the report should address fabrication sites within the Territory then they should be at least nominate the site.

23.5.2 Community Reference Groups

The Harmony Djamamirri Mala Group while it may have been an early initiative of Alcan's Community Reference Group to do something about alcohol and anti-social behaviour , the Harmony Group is not a subcommittee of the Community Reference Group as stated in this section.

Section 25 Environmental Management Plan

The project has many environmental benefits including reduction of caustic to ground and the incidence of contamination from the evaporation circuit. Section 25 is welcomed. How does Alcan plan to place responsibility on the contractors? Presumably, the first part of Section 25 will be part of the tender documents and contracts.

Construction impacts are short term in nature. However, the environment on the site as well as off the site should be protected. For example, the target for Section 25.4.3.2 considers both but Section 25.4.3.4 does not.

Will contractors be required to be specific about their mitigation remedies?

Cost and time pressures can lead to contractors only giving lip service to mitigation unless the mitigation is auditable. Does Alcan plan a formal audit of the mitigation?

Section 25.4 Third Stage Expansion Construction Environment Management Plan

Will Alcan require the contractors to specifically measure or monitor any aspect of their work? The construction plans are not specific.

25.5.3.12 Mosquito Management Plan

Objective: It should be added under the objectives 'to prevent importation of dengue vector mosquito species from mining related activities'.

Actions: It should be added that all overseas vessels, as well as vessels and road transport from Qld, be inspected as per AQIS guidelines and the MEB guideline 'Exotic *Aedes* surveillance and exclusion from the Northern Territory of Australia' (Attachment 2), to prevent the importation of dengue vector mosquito species.

Actions: Workers should be educated about **all** the early symptoms of mosquito borne arbovirus disease, as well as the early symptoms of malaria.

Monitoring: It should be added that Alcan Gove will work with the NT Department of Health and Community Services, Nhulunbuy Corporation and AQIS to prevent the importation of dengue vector mosquito species into Gove.

Appendix C Noise Impact Assessment

Has Alcan considered the use of small acoustic barriers for use between the noisy equipment such as jackhammers and Galupa?

Noise levels at Galupa are already a little high for a quiet remote area. While the increase in noise from the expansion is not large, (less than 1 dB) it should be pointed out that a 3dB increase is a doubling of the noise energy. A 1 dB increase is very audible.

Has Alcan considered this opportunity to reduce noise levels at Galupa during the expansion?

Appendix D Surface water data

Many ANZEEC water quality guidelines are exceeded in the water discharged into the sea, especially alkalinity (caustic which then precipitates and smothers the marine substrate), suspended solids and nitrogen.

A chlorophyll “a” monitoring program should be commenced as soon as possible (not “considered” as stated in the text).

Appendix E Fauna lists

The species listed are mostly terrestrial, with a few marine vertebrates included. There is no mention, however, of other significant marine taxa being present in the area, sawfish for example. Are there any EBPC Act species present?

Appendix H Groundwater

H.1.2 states that the monitoring program has been “rationalised and modified on several occasions” – what does this mean? How can monitoring be carried out accurately if the methodology has been changed? There is also a statement that monitoring could not be completed on occasion because of “logistical and access restrictions”. This is not acceptable and could lead to the conclusion that there might be problems. Monitoring is an integral and essential part of any project such as this, and it is surely in the best interests of the Alcan project to allow monitoring to continue unimpeded.

Appendix J Groundwater Supply Report

Did Alcan consider coupling a contaminant component to the model? The benefit of reducing the caustic to ground incidents in reducing the source term should be considerable, but is it? How fast is groundwater contamination likely to reduce? Monitoring could pick up new source terms. How much effect is the pump back regime having on groundwater contamination levels? Is the beneficial impact only on the marine environment?

References

The majority of references supporting claims made in Sections 13 and 14 are unpublished reports – some of these are also drafts (e.g. URS reports 2001-2003; Hanley 1993; LDM 1999, 2000. The reports are not available on Alcan Gove’s website, and nor readily available in any public library. In short, the claims made in the report cannot be readily validated by the public, undermining the effectiveness of the consultation process.

Typographical Errors

The following typographical errors were noted:

1, Chapter 14, Page 7, bullet point 1: *alba* wrongly capitalised (as "*Alba*");

VOLUME 1, Chapter 15, Page 16: Gobiidae misspelt (as "Gobidae");

VOLUME 2, Appendix E2, Table E2: *Parsonsia* misspelt (as "*Parsonisa*");

VOLUME 2, Appendices 2 & 3: specific name *spiralis* misspelt (as "*spirilis*") throughout.

Northern Territory Government
Department of Health and Community Services

PERSONAL PROTECTION FROM MOSQUITOES & BITING MIDGES IN THE NT

PETER WHELAN
SENIOR MEDICAL ENTOMOLOGIST
DARWIN
NORTHERN TERRITORY
AUSTRALIA

October 2003*

Published in "Australian Mosquito Control Manual" by a panel of authors, Editors C. Morris and P. Dale. Australian Mosquito Control Association, 1998, ISBN 0-646-35310-1.

* Minor revision

For more information contact:
Department of Health and Community Services
Medical Entomology Branch
PO Box 40596
Casuarina NT 0811

Telephone: 08 89228333
Fax: 08 89228820
Email: peter.whelan@nt.gov.au

PERSONAL PROTECTION

FROM MOSQUITOES & BITING MIDGES

P. I. Whelan,

Department of Health and Community Services

Oct 2003

Adapted from paper by P. Whelan in "Australian Mosquito Control Manual" by a panel of authors, Editors C. Morris and P. Dale. Australian Mosquito Control Association, 1998, ISBN 0-646-35310-1.

1.0 MOSQUITO & BITING MIDGE BITES

Mosquitoes and biting midges (genus Culicoides and sometimes erroneously called sand flies) can reach sufficient numbers in various localities to be considered serious pests. The bites themselves can be painful and extremely annoying, and people suffer varying degrees of reaction to bites (Lee 1975). However the possibility of the spread of various diseases by their blood sucking habits to either humans or animals is a more serious outcome. Mosquitoes can carry viruses such as Murray Valley encephalitis, Kunjin, Ross River, and Barmah Forest virus which cause human disease (Russell 1995). Biting midges do not carry any pathogens in Australia that cause human disease.

Female mosquitoes or biting midges bite to take blood from their hosts, which is necessary for the development of eggs.

Mosquitoes and biting midges show considerable variation in their preference for hosts. Some species feed selectively on cattle, horses, marsupials, amphibians, birds or humans, while other species are relatively indiscriminate feeders.

The time of feeding varies for different species. Many mosquitoes feed just after sunset while others are more active at other times including late in the night, in the late afternoon, or in the early morning. Biting midges are most active in the evening and early morning.

The place of feeding by mosquitoes or biting midges is varied. Some species, such as the brown house mosquito, readily entering houses to feed on people, while others will only bite people outdoors.

When a mosquito or biting midge bites, fine stylets sheathed in the proboscis are inserted into the skin. Blood is sucked up through one of the channels in the stylets, while saliva is injected down an adjacent channel. This saliva contains substances that the human body recognises as foreign and often stimulates a bite reaction. Sometimes the saliva can contain viruses or other pathogens that can cause disease.

Some people can become very sensitive after being bitten and suffer a general reaction from further bites. The bites may itch for days, producing restlessness, loss

of sleep and nervous irritation. Scratched bites can lead to secondary infections and result in ugly scars. On the other hand, some people become tolerant to particular species and suffer little after-effects from repeated bites.

Biting insects create problems in the enjoyment of outdoor activities, causing a reluctance to enter certain areas after sundown or forcing people to be confined to insect-proof areas at certain times of the year. Personal protection and avoidance measures can offer considerable protection from bites, as well as offering protection against mosquito-borne disease.

2.0 MOSQUITO & BITING MIDGE AVOIDANCE

A sensible precaution to prevent biting insect attack is to avoid areas which are known to have high biting insect activity.

The upper high tide areas near creeks or low lying areas, particularly near salt marsh habitats, can be significant sources of salt marsh mosquitoes (particularly *Aedes vigilax* and various other pest mosquitoes (Russell 1995). The period of high salt marsh mosquito activity is usually during the late dry season and early wet season in tropical latitudes. Generally they are prevalent for one to two weeks after the highest tides of the month or significant rain. Dense vegetation near the breeding sites should be avoided during the day over this period. Pest problems during the evening and night can occur within 3 km of productive breeding sites (Whelan, Merianos et al., 1997).

Other areas of high mosquito activity are the large seasonally flooded areas associated with rivers or drainage lines, flooded coastal swamps, extensive reed swamps and lagoons, ill defined or poorly draining creeks, extensive irrigation areas, and waste water disposal facilities. Densely shaded areas near these habitats should be avoided during the day, and accommodation areas should be at least 3 km from extensive areas of these habitats.

Extensive areas of mangroves or estuarine areas with sandy beaches are potential sources of biting midges. These midges have seasonal and monthly population peaks with the monthly peaks usually associated with the tidal regime. When camping or choosing a permanent living site, a separation distance of at least 2 km from these areas is recommended unless specific biting insect investigations indicate there are no seasonal pest problems (Whelan 1990, Whelan, Hayes et al., 1997).

If camping or selecting house sites near creeks, rivers or lagoons, choose localities of the water body which have steep margins or little marginal emergent vegetation, have swiftly running water with little marginal pooling or vegetation, or do not arise from or empty into a nearby swamp area. Exposed beaches or cliffs away from mangrove or estuary areas are preferred sites to avoid both mosquitoes and biting midges. In more inland areas, locations on hills or rises at least 3 km from ill defined drainage lines, poorly flowing creeks and seasonally flooded areas should avoid the worst mosquito problems.

In residential areas, a local source of mosquitoes may be the cause of the problem. Check nearby potential artificial sources of mosquitoes such as disused swimming pools, receptacles such as tyres and drums, blocked roof gutters, old fish ponds, or

localised ponding of drains. Sites with mosquitoes breeding can be rectified by physically removing the source or through the use of insecticides.

3.0 SCREENING

The best method of avoiding attack at night is to stay inside insect-screened houses. Screens can be made of galvanised iron, copper, bronze, aluminium or plastic. Near the coast, iron or copper screens are not recommended because of the corrosive action of salt sprays. Homes near biting midge breeding sites require either fine mesh screens or light-proof curtains.

Screens should be of the correct mesh, fit tightly and be in good repair. Biting insects frequently follow people into buildings and for this reason, screen doors should open outward and have automatic closing devices. Insecticides such as permethrin or deltamethrin sprayed on or around screens may give added protection against mosquitoes or biting midges, but care is needed as some insecticides affect screens.

It is advisable to use an insect proof tent when camping near potential biting insect areas. Coastal areas subject to attack by biting midges require tents to be fitted with a finer mesh screening.

4.0 MOSQUITO NETS

Mosquito nets are useful in temporary camps or in unscreened houses near biting insect breeding areas. Generally standard mosquito nets are not sufficient to prevent biting midge attack. White netting is best as mosquitoes accidentally admitted into the net are easily seen and killed. The net is suspended over the bed and tucked under the mattress. An aerosol pyrethrin spray can be used to kill mosquitoes that enter the net. Care is needed not to leave exposed parts of the body in contact with the net, as mosquitoes will bite through the net. Nets can be made more effective by impregnation with permethrin (Lines et al. 1985).

5.0 INSECT PROOF CLOTHING

Head nets, gloves and boots can protect parts of the body which are not covered by other clothing. Head nets with 1-1.5 meshes to the centimetre are recommended for good visibility and comfort, and additional treatment of the net with a repellent will discourage insect attack. Thick clothing or tightly woven material offers protection against bites. Light coloured, long sleeved shirts and full-length trousers are recommended. For particular risk areas or occupations, protective clothing can be impregnated with permethrin or other synthetic pyrethroid insecticides such as bifenthrin to give added protection (Burgess et al. 1988). Sleeves and collars should be kept buttoned and trousers tucked in socks during biting insect risk periods. Protection is very necessary near areas of salt marsh, mangroves, or large fresh water swamps where the various species of mosquitoes may be very abundant during the day in shaded situations, as well as at night.

6.0 REPELLENTS

Relief from biting insect attack may be obtained by applying repellents to the skin and clothing (Schreck et al. 1984). Many repellents affect plastics and care is needed when applying them near mucous membranes such as the eyes and lips.

Repellents with the chemical diethyl toluamide (DEET) or picaridin give the best protection. Brands of repellents, such as Aerogard, which are formulated to repel flies are not efficient against mosquitoes or biting midges. Brands such as Rid, Tropical Strength Aerogard, Bushman's, Muskol, or Repel* are more effective. Those with higher amounts of DEET or picaridin are usually the most efficient.

Application of repellents over large areas of the body or on extensive areas of children is not reccommended, particularly those repellents with high concentrations of DEET. Protection from mosquito penetration through open weave clothes can be obtained by applying a light application of aerosol repellent to the exterior of clothing. Repellents should be supplementary to protective clothing and should not be regarded as substitutes.

Personal repellents are available as sprays, creams or gels. The creams or gels usually last longer than the aerosol formulations. Repellents can prevent bites from 2 to 4 hours, depending on the repellents, the species of biting insect, or the physical activity of the wearer.

Electronic insect repellers that emit ultrasonic or audible sounds do not offer any protection against mosquitoes or biting midges. They are based on a false premise and have been found to have no repellent effect under scientific testing (Curtis 1986). Electronic ultrasonic repellers do not repel mosquitoes or biting midges and should not be relied upon for personal protection (Mitchell 1992).

Plants with reported insecticidal properties such as neem trees and the citrosa plant have not been shown to act as mosquito repellents just by growing in the vicinity of people (Mitchell 1992, Matsuda et al. 1996). Growing or positioning these plants near evening activity areas will not prevent mosquito attack.

7.0 ANIMAL DIVERSION

Camping upwind near congregations of stock or domestic animals will serve to divert mosquitoes or biting midges to alternative hosts. Similar considerations can be made when planning residential sites and animal holding areas in a rural situation. Dogs of darker colour tend to attract some species of mosquitoes more than lighter colours and can divert some pest problems from people in close vicinity in outdoor situations in the evening.

8.0 LIGHTING DIVERSION

Many mosquito and biting midge species are attracted to light. This can cause pest problems in unscreened houses or when camping. The use of yellow or red incandescent bulbs or fluorescent tubes rather than white light will reduce the attractiveness of lights to insects. An incandescent or ultra violet light placed at a distance from a house or camp can serve to attract insects to an alternative area. This is more effective if the light is close to the breeding site, or between the breeding site and the accommodation area. The attractive lights should not be close to

accommodation or directly down wind of accommodation areas. Light proof curtains or similar screening can be very effective in reducing the attraction of biting insects to areas that are illuminated at night.

9.0 ADULT INSECT CONTROL

If mosquitoes or biting midges have entered a screened area they can be knocked down with pyrethrin aerosols. Care should be taken by reading the label to ensure only knockdown aerosols suitable for spraying in the air are used in proximity to people or food.

Other devices that can be effective at killing and/or repelling biting insects include mosquito coils (Charlwood & Jolley 1984) and electric insecticide pads. These devices are only effective in relatively closed areas such as inside buildings or where there are only slight breezes. They should be backed up with other measures such as suitable protective clothing or repellents

Large scale adult biting insect control can be achieved for short terms (hours) by using portable or industrial fog generators, backpack misters, or heavy duty ultra-low-volume aerosol generators to knock down active adult insects. The insecticides of choice in these machines are Maldison or Bioresmethrin. Control relies on good access, open vegetation, and light breezes in the direction of the breeding or harbouring sites. Application should only be during the peak biting insect activity period of those insects actually causing the problem, which is usually the late evening and early night.

There are some synthetic pyrethroid aerosol products available as outdoor yard or patio repellents. Control will only be temporary (hours) and re-invasion will usually occur within hours or from one to a few days, depending on the species, nearby vegetation, proximity to breeding sites, environmental conditions and times of activity of the pest species.

Application of residual insecticides such as maldison, permethrin or other synthetic pyrethroids sprayed as a mist spray to point of run off on building surfaces or nearby vegetation can sometimes give short term (a few days) relief. This method is useful as a barrier protection when large numbers of mosquitoes or biting midges are present near accommodation or outdoor use areas (Helson & Surgeoner 1985). There are some longer term residual synthetic pyrethroids such as bifenthrin that can be used as barrier sprays and provide a number of weeks protection (Standfast et al 2003). These residual insecticides can be applied according to label recommendations with the aid of a garden sprayer. Care must be taken with all synthetic pyrethroids around fish ponds, fish tanks and other nearby fish habitats to avoid spray drift or run off, as these insecticides are efficient fish poisons.

10.0 INSECTOCUTORS AND INSECT TRAPS

Electric insect insectocutors and other trap or killing devices utilising an attracting light or carbon dioxide have been claimed to clear areas of biting insects and thus protect people. These claims have not been substantiated in outdoor situations with

people nearby. While trap devices can attract biting insects, as well as a range of other insects, these devices can not be relied on for protection from biting insect attack (Mitchell 1992). When used in outdoor situations it is possible that they can increase local problems by attracting insects to the vicinity of people. Attractive odours and carbon dioxide emitted by humans then divert the insects from the trap device to the people.

11.0 TREATMENT OF BITES

Relief from bites and prevention of secondary infection can be obtained by the application of various products, either to the skin or internally. The effectiveness of various products is variable, depending on individual reaction. Skin application products include proprietary products such as Eurax, Stingose, Medicreme, Katers lotion, Dermocaine and Paraderm creme, and non-proprietary products such as tea tree oil, eucalyptus oil, aloe vera gel, ice, or methylated spirits.

Ice packs to the general bite site will give usually give immediate relief for painful and itchy bites and swelling or blisters from of mosquitoes and biting midges in particular. The sooner the ice pack is applied after bites or reactions, the better the relief, and can often avoid more intense reactions.

Other products for internal application for more general symptoms include antihistamine products such as Phenergan, Telfast and Vallergan. Check with your doctor or pharmacist for any products for the latest product and safety information.

12.0 EMERGENCY BITING INSECT PROTECTION

There are a number of emergency measures that can be taken when exposed to biting insects with no protection. Sheltering downwind next to smoky fires can offer considerable protection. Burning* dung or aromatic and oil producing foliage from plants such as Hyptis (horehound), Calytrix (Turkey bush), Melaleuca species (Paper bark) and Eucalyptus species (gum trees) can make the smoke more effective. Climbing relatively high trees or choosing locations exposed to the wind can offer protection from some species.

Other emergency protection measures include coating the skin with mud, rubbing exposed areas with the leaves of certain plants such as eucalypts or tea-trees that contain volatile oils, or burying yourself in shallow sand with some form of head protection. If all else fails, keep running. The best form of protection, and the most comfortable, require an awareness of the potential problems and adequate preparation.

REFERENCES

Burgess, N., Carter, S., Dodd, G., & Shirley, C. (1988), 'Permethrin fabric treatment for the protection of personnel from biting insect and other arthropod attack', *International Pest Control*, vol. 30, no. 6.

Charlwood, J. D., & Jolley, D., (1984), 'The coil works (against mosquitoes in Papua New Guinea), *Trans Roy Soc Trop Med Hyg*, vol. 78.

Curtis, C. F. (1986), 'Fact and fiction in mosquito attraction and repulsion', *Parasitology Today*, vol. 2, no. 11.

Helson, B. & Surgeoner, G. (1983), 'Permethrin as a residual lawn spray for adult mosquito control', *Mosquito News,* vol. 43, no. 2.

Lee, D. J. (1975), 'Arthropod bites and stings and other injurious effects', *School of Public Health & Tropical Medicine, University of Sydney.*

Lines, J. D., Curtis, C. F., Myamba, J., Njau, R. (1985), 'Tests of repellent or insecticide impregnated curtains, bednets and anklets against malaria vectors in Tanzania', *WHO* VBC/85.920.

Matsuda, B. M., Surgeoner, G. A., Heal, J. D., Tucker, A. O., Maciarello, M. J. (1996), 'Essential oil analysis and field evaluation of the citrosa plant *Pelargonium citrosum* as a repellent against populations of *Aedes* mosquitoes', *Journal of the American Mosquito Control Association,* vol. 12, no. 1, pp. 69-74.

Mitchell, L. (1992), 'Mythical mosquito control', *Wing Beats*, vol. 3, no. 2, Florida Mosquito Control Association.

Russell, R. C. (1995), 'Arboviruses and their vectors in Australia: an update on the ecology and epidemiology of mosquito borne viruses', *Review of Medical Veterinary Entomology*, vol. 83, no. 4.

Schreck, C. E., Haile, D. G., Kline, D. L. (1984), 'The effectiveness of permethrin and deet alone or in combination for protection against *Aedes taeniorhynchus* ', *Am J Trop Med Hyg,* vol. 33, no. 4.

Standfast H., Fanning I. Maloney L., Purdie D. and Brown M. "Field evaluation of Bistar 80SC as an effective insecticide treatment for biting midges (Culicoides) and mosquitoes infesting peri-domestic situations in an urban environment" Bulletin Mos Cont Assoc Aust Vol 15 ;2 2003.

Whelan, P. I. (1990), 'Biting midge investigations near Darwin and their implications for urban planning', *Proceedings of the National Conference on Biting Midge, Surfers Paradise,* February 1990.

Whelan, P. I., Hayes, G., Montgomery, B. L.(1997), 'Biting midge surveillance in Darwin harbour, *Culicoides ornatus* (Diptera: Ceratopogonidae) abundance and dispersal', *Proceedings of the Seventh Symposium "Arbovirus Research in Australia, Second" Conference Mosquito Control Association of Australia*, Surfers Paradise.

Whelan, P. I., Merianos, A., Hayes, G., & Krause, V.(1997) , 'Ross River virus transmission in Darwin, Northern Territory, Australia', *Proceedings of the Seventh Symposium "Arbovirus Research in Australia", Second Conference Mosquito Control Association of Australia*, Surfers Paradise.

TERRITORY HEALTH SERVICES
Northern Territory Government

Exotic *Aedes* surveillance and exclusion from the Northern Territory of Australia

P.I. Whelan [1] and Garry Tucker [2]

[1] Medical Entomology Branch Territory Health Services, Darwin, NT.

[2] Australian Quarantine and Inspection Service, Darwin, NT.

Presented at the 3rd Mosquito Control Association of Australia Conference

Sept 23-25 1998 Gold Coast, Queensland.

For more information contact:

Territory Health Services
Medical Entomology Branch
PO Box 40596
Casuarina NT 0811

Telephone: 08 89228333

Fax: 08 89228820

Email: peter.whelan@nt.gov.au

EXOTIC *AEDES* SURVEILLANCE AND EXCLUSION FROM THE NORTHERN TERRITORY OF AUSTRALIA

P.I. Whelan [1] and Garry Tucker [2]

1, Medical Entomology Branch, Territory Health Services, Darwin, NT.

2, Australian Quarantine and Inspection Service, Darwin, NT.

Presented at the 3rd Mosquito Control Association of Australia Conference

Sept 23-25 1998 Gold Coast, Queensland.

1.0 INTRODUCTION

Dengue, a human arbovirus disease, is carried primarily by the dengue mosquito *Aedes (Stegomyia) aegypti* and closely related mosquitoes such as *Aedes (Stegomyia) albopictus.* The disease causes high fevers, severe headaches, and muscle and joint pains, with some cases presenting with internal or external bleeding. A more dangerous manifestation includes haemorrhagic symptoms and shock, which can lead to mortality, particularly among children. Dengue is an emerging potential public health problem, particularly in South East Asia and the Western Pacific, including Queensland (QLD) in Australia, (Kay et al 1990).

The Northern Territory (NT) of Australia is one of the few large areas in the tropics that does not have indigenous transmission of the mosquito borne disease dengue.

The dengue free status of the NT is due to the absence of the mosquito vectors, (Whelan 1991). While Australia is free of *Ae. albopictus*, *Aedes aegypti* is present in QLD, (Kay et al 1990). Both species are present in neighbouring Indonesia and the island of New Guinea.

Aedes aegypti is widespread in QLD, with reported occurrences close to the NT border in the inland town of Mount Isa, and Mornington Island in the Gulf of Carpentaria, (Sinclair 1992). *Aedes aegypti* is closely associated with human settlement and breeds in a variety of water filled containers such as old tyres, tins, drums, jars, rain water tanks and other containers used to store water. The drought resistant eggs can be easily transported in containers that have held water. There have been instances of the interception of importations of *Ae. aegypti* and *Ae. albopictus* from containers on overseas vessels arriving in Darwin, and of *Ae. aegypti* in a container carried by road transport from QLD, (Whelan 1991).

The NT is both vulnerable and receptive to the importation of this species and other exotic *Aedes* species from QLD and overseas, (Russell et al 1984; Whelan 1981; Whelan & Laskowski 1984). The NT has maintained a dengue free status by both Federal and Territory programs designed to intercept and eradicate any importation of the vectors, and to reduce the receptivity at vulnerable locations. This paper outlines

the various elements of the surveillance program, details of the eradication procedures and information on the current vulnerability for the importation and establishment of exotic *Aedes* mosquitoes.

2.0 HISTORY OF *AEDES AEGYPTI* AND DENGUE IN THE NT.

Aedes aegypti was recorded as early as 1903 in Port Darwin, (Lee et al 1987). *Aedes aegypti* was reported from a number of towns from 1911 to 1943, and was common in a widespread survey in 1956, with collections made from Darwin, Point Charles, Howard Creek, Koolpinyah, Adelaide River, Roper River, Pine Creek, Brocks Creek, Katherine, Anthonys Lagoon, Daly Waters and Roper River (O'Gower 1958). The past mosquito distribution in the NT largely followed the course of the railway, with its associated rainwater tanks and fire buckets, and the road links to QLD, (Marks 1973, Lee et al 1987).

Dengue cases occurred in various towns in the NT and were often reported from Darwin during World War 2. The last reported outbreak in the NT was in 1955, which coincided with a large epidemic in QLD. *Aedes aegypti* disappeared from the NT sometime between 1956 and 1969. It was absent in Darwin at least in 1969, when it was reported that it had not re-established after adults were detected flying from the hold of a cargo ship from Japan, (Marks 1973).

The Territory Health Services (THS) has confirmed the absence of this mosquito in the NT between 1974 and the present, (Whelan 1991). It is thought that the move to reticulated water supplies, the introduction of the diesel locomotive, the domestic lawn mower, fire extinguishers and a general improvement in sanitation with the removal of disused drums, tyres and old rain water tanks has been responsible for its disappearance, (Marks 1973).

3.0 EXOTIC *AEDES* SURVEILLANCE PROGRAMS IN THE NT.

There are essentially two surveillance programs in the NT to detect the importation of exotic *Aedes* mosquitoes. The first line of defence is provided by the Federal program carried out by the Australian Quarantine and Inspection Service (AQIS) around points of first entry. This is backed up by a more widespread surveillance organised by the Medical Entomology (MEB) of Territory Health Services. There is considerable cooperation between these two agencies in the NT.

3.1 AQIS Surveillance

The AQIS surveillance for exotic *Aedes* is conducted around the Darwin airport and port area. The program has three main elements, namely overseas aircraft surveillance, overseas vessel surveillance, and *Aedes* ovitrap surveillance.

3.1.1 Aircraft surveillance

All overseas aircraft arriving in Darwin are subject to cabin and hold disinsection procedures. The monitoring of these procedures is performed by AQIS. A number of airlines including QANTAS, have residual applications of insecticide and are not routinely sprayed on arrival. All other international aircraft are subject to pre-flight disinsection in their country of departure and top of descent cabin disinsection.

Aircraft arriving without disinsection are sprayed on arrival in both cabins and holds with an aerosol knockdown insecticide. The arriving aircraft are inspected by AQIS officers for any flying insects, and any seen are collected for identification by an entomologist.

There have been instances of recovery of flying and freshly killed insects, including mosquitoes, collected from aircraft arriving in Darwin from Indonesia, (Russell et al 1984).

3.1.2 ***Overseas vessel surveillance***

All legal overseas vessels arriving in the NT are directed to designated first points of call including Darwin, Gove, and Alyangula. The latter two largely receive bulk ore and oil carriers, with Gove receiving some yacht traffic. Darwin receives a range of vessels including yachts, small coastal vessels and general cargo vessels as well as large carriers.

In general the vessels are subject to general quarantine inspections, including inspection for exotic insects, after the vessel has tied up at the wharf.

Illegal fishing vessels or refugee vessels are generally brought to Darwin by the Australian Navy and processed in the Harbour at a special quarantine area approximately 1 km offshore.

The first element of the inspection procedures is to look for any flying insects. If any are seen, there is an application of knockdown insecticide throughout the vessel and knocked down insects are collected for identification.

The principal part of the inspection is a search for any water holding containers, or any container used for transporting or storing water. This can include bulk water tanks, down to 200 litre drums, Jerry cans, and clay jars. Each container is inspected for the presence of mosquito larvae, pupae, or their remains. Any insects or remains are collected and identified within one day of collection. Any possible exotic mosquito specimens are forwarded to the MEB for confirmation..

Any container with mosquito larvae or any container suspected of or capable of breeding mosquitoes is filled with water and super chlorinated at the rate of 1/2 cup (125 ml) of granular pool chlorine per 20 litres of water.

If pupae or pupal skins are found in containers on a vessel, adult mosquitoes are assumed to be on board and the entire vessel is fogged with aerosol knockdown spray.

There has been a number of interceptions of exotic mosquitoes including *Ae. aegypti* and *Ae. albopictus* from vessels arriving in Darwin, (Kay et al 1990; Whelan 1991). The number of interceptions from various types of vessels, the species intercepted, and the types of containers with larvae on the vessels arriving in Darwin over a 20 year period are shown in Table 1-3. Illegal fishing vessels are by far the most frequent vessels with exotic mosquitoes, with *Ae aegypti* most frequently intercepted and most commonly found in containers used to transport drinking water.

The interceptions from illegal fishing vessels showed a sharp increase from 1994. Most of the vessels were from Indonesia, and most are processed in Darwin, followed by Broome. The number of foreign vessels apprehended in Australia by year and the number apprehended at the various ports of processing is shown in Figure 1 and Figure 2 respectively. The vessels originated from a wide area of South East Asia, with a relatively large number from the Indonesian island of Roti near Timor. The origin of these vessels from 1994 to 1998 is shown in Figure 3.

Illegal fishing vessels pose an increasing threat for the importation of exotic mosquitoes into Australia and Darwin in particular. These vessels are primarily from Indonesia and increasing overfishing in Indonesian waters is encouraging more illegal fishing within Australia's economic zone.

3.1.3 ***Ovitrap surveillance at ports and airports***

AQIS has a comprehensive ovitrap or egg trap program at Darwin's seaport and airport. The ovitraps consist of black glass jars filled with water with a "masonite" paddle dipping into the water. These ovitraps are very attractive places for container breeding *Aedes* to lay eggs.

The ovitraps are placed on the main wharves, and around the small boats facilities in the wharf area where coastal and overseas barges and yachts arrive or are moored.

The ovitraps are inspected weekly for larvae and all larvae are collected. The ovitrap paddles are collected on inspection, conditioned by drying, and flooded to initiate the hatching of any mosquito eggs. All hatched larvae are reared to 4th instar and identified. Any possible exotic mosquito specimens are referred to the MEB for confirmation.

There has been only one instance of an ovitrap interception in Darwin, (Whelan 1991). In June 1989, two *Ae. albopictus* larvae were recovered from an ovitrap located at the small ships facility near the wharf area. This recovery triggered a rapid response by both AQIS and THS. Additional ovitraps were positioned by both the Quarantine and Health authorities. The MEB undertook an inspection and treated all possible water holding receptacles around the wharf area with a super chlorine solution. No additional larvae were recovered. From the follow up investigations it was concluded that the interception was a result of the recent importation of a single female mosquito from a container on an arriving overseas vessel.

3.2 THS Surveillance

The THS surveillance program carried out by the MEB consists of an ovitrap program, a vulnerable points container survey, a general container survey in Darwin and other towns in the NT, a container survey of all properties near the road connection routes to QLD, adult mosquito monitoring at major towns, a public awareness program to prevent road importations and reduce receptivity, and the development and implementation of onshore eradication measures.

3.2.1 ***MEB Ovitrap program***

The MEB ovitraps are similar to the AQIS ovitraps, utilising a 'masonite' paddle, but differing in detail with a glass jar inside an outer black plastic container. Ovitraps are placed in the general Darwin port area at alternative sites to the AQIS sites.

Ovitraps are also placed at residential sites in most of the suburbs of Darwin, and at vulnerable points of importation of exotic mosquitoes from QLD, such as yacht facilities, caravan parks, removalists, and trucking companies. Ovitraps are also set in conjunction with local authorities in Nhulunbuy and Alyangula.

The traps in Darwin are inspected once per fortnight. The exposed paddles are exchanged for clean ones, with any larvae and all the water collected from positive traps. Any eggs present on the paddles are hatched after conditioning and reflooding, with larvae reared to maturity (fourth instar) in a mosquito proof insectary for identification. The ovitraps in Gove and Alyangula are positioned near the airport and port areas, and are inspected monthly in Alyangula and fortnightly in Gove, with any collected larvae placed in labelled vials of alcohol and the collected paddles sent to MEB for hatching and rearing. There have been no interception of exotic mosquitoes from the MEB ovitraps. Most of the ovitraps have been positive for *Ae. notoscriptus*, with a number of other species including *Ae. tremulus* and *Culex quinquefasciatus* also collected. The results are reviewed annually and under-performing traps are repositioned.

3.2.2 ***Darwin vulnerable points container surveys***

Vulnerable points for the importation or establishment of exotic *Aedes* from overseas or QLD, including shipping and yacht facilities, caravan parks, removalists, trucking companies, plant nurseries, tyre yards and tyre dumps, are inspected on average every three years during the wet season. All containers with water are sampled for larvae and all or most of the larvae present are collected. Early instar larvae are raised to later instars. There have been no detection of exotic mosquitoes from this program.

3.2.3 ***Queensland road connection survey***

Towns, station properties or road houses on the road routes between the NT and QLD are inspected at least every three years. The places inspected include Borroloola, Barkly Homestead, Three Ways, Larrimah, Mataranka and Katherine. For locations such as cattle stations and road houses along the Barkly Highway, all containers are

inspected for larvae. In the smaller towns of Larrimah and Mataranka, all of the residential properties and business locations are inspected. In the larger towns of Borroloola and Katherine, all vulnerable sites and a selection of residential properties are inspected.

There has only been one interception of an exotic species from this program. In 1980 *Ae. aegypti* larvae were discovered in Larrimah during a routine survey, (Whelan 1991). They had been introduced from QLD as eggs in an old 20 litre drum which was off-loaded from a truck and subsequently filled by rain. As soon as the larvae were discovered, a thorough survey of the town was carried out to determine if any other exotic larvae were present. After sampling every tin, tyre, rain water tank or other water holding container likely to be breeding mosquitoes, the containers were either treated with insecticide, sealed, holed or taken to a sanitary rubbish disposal site. Follow up surveys have shown that *Ae. aegypti* did not become established in Larrimah.

3.2.4 General town surveys throughout the NT.

Inspections for container breeding mosquitoes are also carried out at various towns and communities throughout the NT Surveys are on an ad hoc basis as time permits, and are generally carried out in the wet season. Particular attention has been placed on coastal communities from the Western Australian border to Groote Eylandt, where possible illegal vessel landings from overseas or coastal vessels from QLD may have introduced exotic species. Darwin, as the principal port and largest town, has received the most scrutiny. The surveys in Darwin have established a profile of potential breeding places for exotic species, and has demonstrated that Darwin and the surrounding rural areas are receptive to container breeding *Aedes* species.

Surveys in the suburbs of Darwin in 1981 showed that of 460 houses searched, there were 760 containers holding water in backyards and over 20% had mosquito larvae in them. The most frequent breeding places were pot plant bases, old tyres, old tins and drums, old ice cream containers, containers of plant cuttings, buckets and building materials, (Whelan & Laskowski 1984).

In a survey of the rural area of Darwin in 1983, over 32% of premises were breeding mosquitoes in containers. Many rainwater tanks in the rural area were not adequately screened but few larvae were found in them. This was because most tanks were actually water holding tanks rather than rainwater tanks. They are filled by bores on a routine basis and regular water surface agitation makes them unsuitable as breeding sites, (Whelan & Laskowski 1984).

An extensive container survey during a clean up campaign in urban Darwin in 1984 revealed there were, on average, 5 containers holding water per premise, and 30% of premises breeding mosquitoes,(Whelan & Laskowski 1984).

3.2.5 ***Adult mosquito monitoring***

Adult mosquito monitoring is carried out on a routine basis at all of the major towns in the NT. This includes Darwin, Nhulunbuy, Alyangula, Katherine and Tennant Creek. These towns are either relatively close to the QLD border, on the road route between QLD and Darwin, or are ports where importations of exotic *Aedes* could

occur. The monitoring is carried out at most towns on a weekly basis using CO_2 baited EVS traps. The location of trapping in Darwin includes sites at creeks and swamps near the airport, as well as in residential areas. The locations in Nhulunbuy and Alyangula include sites near the port areas.

Other adult collections are carried out at least for the first 12 months, on a monthly basis, at all new mining developments in the NT. New mining developments have a relatively high potential to import *Aedes* eggs in machinery and equipment, including large tyres, if equipment is transported into the NT from QLD or overseas.

Additional mosquito trapping is carried out at smaller communities as part of ongoing general mosquito surveys, or in urban or rural residential areas as part of mosquito complaint investigations or arbovirus and malaria case investigations. While CO_2 baited traps are not the ideal method to detect* Ae. aegypti *and* Ae. albopictus*, these species have been frequently recovered from these types of traps in other areas. Adult mosquito monitoring, either near sites of possible importations, in residential areas, or near more vulnerable sites, is an additional method to detect possible importations of exotic mosquitoes.

3.2.6 ***Public Awareness program***

The THS conducts various public awareness campaigns to alert people to the need to prevent breeding mosquitoes on their premises. The program includes paid television, radio and print advertisements with messages detailing potential backyard breeding places, news stories and media releases after detection of importations of exotic mosquitoes, the publication and dissemination of conference papers, and public talks and exhibitions.

The message of the risk of importation of exotic mosquitoes is also disseminated by THS and MEB annual reports to participating local governments and other organisations, and the Darwin based Mosquito Control Advisory Committee. All of these programs alert people to the possibility of accidental importation of *Aedes* eggs from QLD or overseas, and encourage people to reduce the possibility of the establishment of importations by reducing the availability of local breeding sites. The programs include seasonal alerts at the start of the wet season targeting rain filled container breeding sites.

4.0 ON SHORE ERADICATION PROCEDURES

If onshore ovitraps, CO_2 traps, or water holding containers are positive for exotic mosquito species, the MEB of THS is responsible for eliminating the introduction. This responsibility is currently under review. In the past the Quarantine responsibility has ended once onshore detection has been confirmed.

However onshore surveys and eradication procedures are also initiated by MEB if a risk assessment of collections from overseas vessels indicates a possibility that adult mosquitoes could have escaped from an arriving overseas vessel. Generally this will be initiated if pupae, pupal skins or adults are detected on board vessels tied up at the wharf or other vessel facilities.

The MEB has drawn up detailed procedures and recommendations for the inspection and eradication of exotic mosquitoes, (Whelan 1998). These procedures include vessel inspection procedures, eradication procedures on vessels, and onshore eradication procedures. The mainstay of the on shore eradication recommendations has been thorough container surveys, filling of all containers with water and applying a super chlorine treatment, and follow up container surveys after rain.

5.0 CONCLUSIONS

Airports and seaports in the NT which receive overseas traffic are vulnerable to the importation of exotic *Aedes* species. The Australian Quarantine Inspection Service is responsible for surveillance at major ports and international airports. They however do not monitor Australian coastal vessels or internal aircraft flights from QLD. The AQIS ovitrap program at the ports and airports, and the MEB ovitrap program around the port area in Darwin and other ports should however detect vessel importations of *Aedes aegypti* from QLD.

Darwin, closely followed by Broome in WA, has the highest demonstrated risk in Australia for the importation of exotic *Aedes* species from overseas. The greatest risk of importation into the NT is from illegal landings or the interception of illegal fishing vessels. Small fishing vessels from Indonesia with drinking water carried in makeshift containers pose the greatest threat. *Aedes aegypti* was most frequently intercepted, but *Ae. albopictus* is also a considerable threat.

The NT is also vulnerable to the importation of *Ae. aegypti* from QLD by road. The potential mode of importation of desiccant resistant eggs includes the transport of machinery, spare vehicle tyres, rain-filled boats, garden ornaments, pot plant bases, and other containers capable of collecting rain water during mining, defence, or household equipment relocation. Particularly vulnerable points of importation are truck and caravan stopover facilities on the Barkly and Stuart Highway between QLD and Katherine. Importation from QLD is also possible by sea, via prawn and fishing vessels, and on ocean going yachts. Vulnerable points of importation are the yacht facilities on the Gove Peninsula, and at the small boat and yacht facilities near Darwin.

Darwin in particular, and other towns in the NT, are receptive to the importation of exotic *Aedes* species. Continued public awareness campaigns warning of container breeding situations in backyards or other premises has not eliminated these containers. There needs to be more effort at reducing this receptivity in Darwin and other receptive parts of Australia by publicising the danger of providing potential mosquito breeding sites for exotic *Aedes* mosquitoes.

AQIS and THS surveillance programs assist in ensuring that the NT remains free of exotic *Aedes* mosquitoes. The expenditure on these programs, and any immediate response when required, is small compared with that required if exotic species became established and eradication measures or routine dengue control measures became necessary. Mining, fishing, road and sea transport personnel, and the general public, should continue to be encouraged to prevent the inadvertent importation of exotic mosquitoes or their eggs into the NT. The present review of AQIS mosquito

detection procedures around ports and airports in Australia should strengthen the quarantine surveillance programs and establish surveillance in those areas that have been lacking effective surveillance.

The NT would be less vulnerable to the importation of *Ae. aegypti* from QLD if that State could reduce the distribution of this species away from the NT border. This appears to be feasible but requires a national program as there is no priority for QLD to do this alone. Australia, and QLD in particular, face a grave threat of severe outbreaks of dengue and dengue haemorrhagic fever, if the distribution of *Ae. aegypti* is not reduced or the populations controlled. The eradication of *Ae. aegypti* in QLD is feasible but also requires a national program with support from all States and Territories. The impetus for this effort must come from the health and scientific community. The eradication of *Ae. aegypti* in Australia would have enormous public health benefits for present and future Australians.

6.0 ACKNOWLEDGMENTS

The assistance, and ready cooperation of the Nhulunbuy Corporation, the Groote Eylandt Mining Company and the people in Darwin who have supported the ovitrap placements in their property is gratefully acknowledged.

The staff of the Medical Entomology Branch and AQIS personnel in Darwin have maintained surveillance of the NT for very long periods with often negative results. Their dedication, vigilance and perseverance is gratefully acknowledged.

Gwenda Hayes, Senior Technical Officer of the MEB has ably supervised the daily operations of the *Aedes* surveillance program. Her contributions are gratefully acknowledged.

7.0 REFERENCES

Kay, B. H., Barker-Hudson, P., Stallman, N. D., Weimers, M. A., Marks, E. N. M., Holt, P. J., Muscio, M.,. Gorman, B. M., (1984), 'Dengue Fever - Reappearance in northern Queensland after 26 years', *The Medical Journal of Australia* vol. 140, pp. 264-268.

Kay, B. H., Ives, W. A., Whelan, P. I., Barker-Hudson, P., Fanning, I. D. & Marks, E. N. M., (1990), 'Is *Aedes albopictus* in Australia?', *MJA,* vol.153, pp.31-34.

Lee, D.J., Hicks, M. M., Griffiths, M., Debenham M., L., Bryan J., H., Russell R. C., Geary M., and Marks, E.M. (1987)) *The Culicidae of the Australasian Region.* Monograph Series, Entomology Monograph No 2., Volume 4. Commonwealth Department of Health, School of Public Health and Tropical Medicine,

Marks, E. N., (1973), '*Aedes aegypti* in Queensland', *NH&MRC* report for the Ad. Hoc. Sub. Committee on the control of *Aedes aegypti*.

O'Gower, A. K., (1958), 'The mosquitoes of north western Australia', *School of Public Health & Tropical Medicine,* Commonwealth Govt. Service Pub. No 7.

Russell, R.C., Rajapaksa, M., Whelan. P.I. & Langsford, W.A. (1984) 'Mosquito and other insect introductions to Australia aboard international aircraft, and the monitoring of disinsection procedures.' In Laird, M. (Ed.) (1984) 'Commerce and the spread of pests and disease vectors'. Praegaer Int., New York.

Sinclair, D. P., (1992), 'The distribution of *Aedes aegypti* in Queensland, 1990-1992', *Bull. Mos. Cont. Assoc. of Aust.*, vol. 4, no. 2, pp. 17-24.

Whelan, P. I., (1981), 'The vulnerability and receptivity of the NT to mosquito borne disease', *Trans. Menzies Found.,* vol. 2, pp. 165-171.

Whelan, P. I. & Laskowski, M. M., (1984), 'Container survey of Darwin', Report of NT section of the Commonwealth Mosquito Eradication Campaign, Northern Territory Department of Health 1984.

Whelan, P.I., (1991) 'The Northern Territory Remains free of dengue fever vectors' *Bull. Mos. Cont. Assoc. of Aust.*, vol. 3, (1), pp 7-9.

Whelan,P, I, (1998) 'Exotic mosquitoes arriving on seagoing vessels; recommended inspection and eradication procedures. *Bull. Mos. Cont. Assoc. of Aust.*, vol 10, (2).

Tables

Table 1. Quarantine interceptions from vessels NT 1978-98

Table 2. Exotic mosquitoes intercepted NT 1978-98

Table 3. Vessel Containers Positive 1978-98

Figures

Figure 1. Foreign vessels apprehended by calendar year in Australia

Figure 2. Foreign fishing vessels apprehended by port of processing

Figures 3. Location of origin of fishing vessels

Table 1. Interception of exotic mosquitoes. Darwin 1978-98

Quarantine interceptions from vessels by type	
Illegal fishing vessels	24
Refugee vessels	1
Yachts	2
Coastal Barges	2
Large vessels	1

Table 2. Interception of exotic mosquitoes. Darwin 1978-98

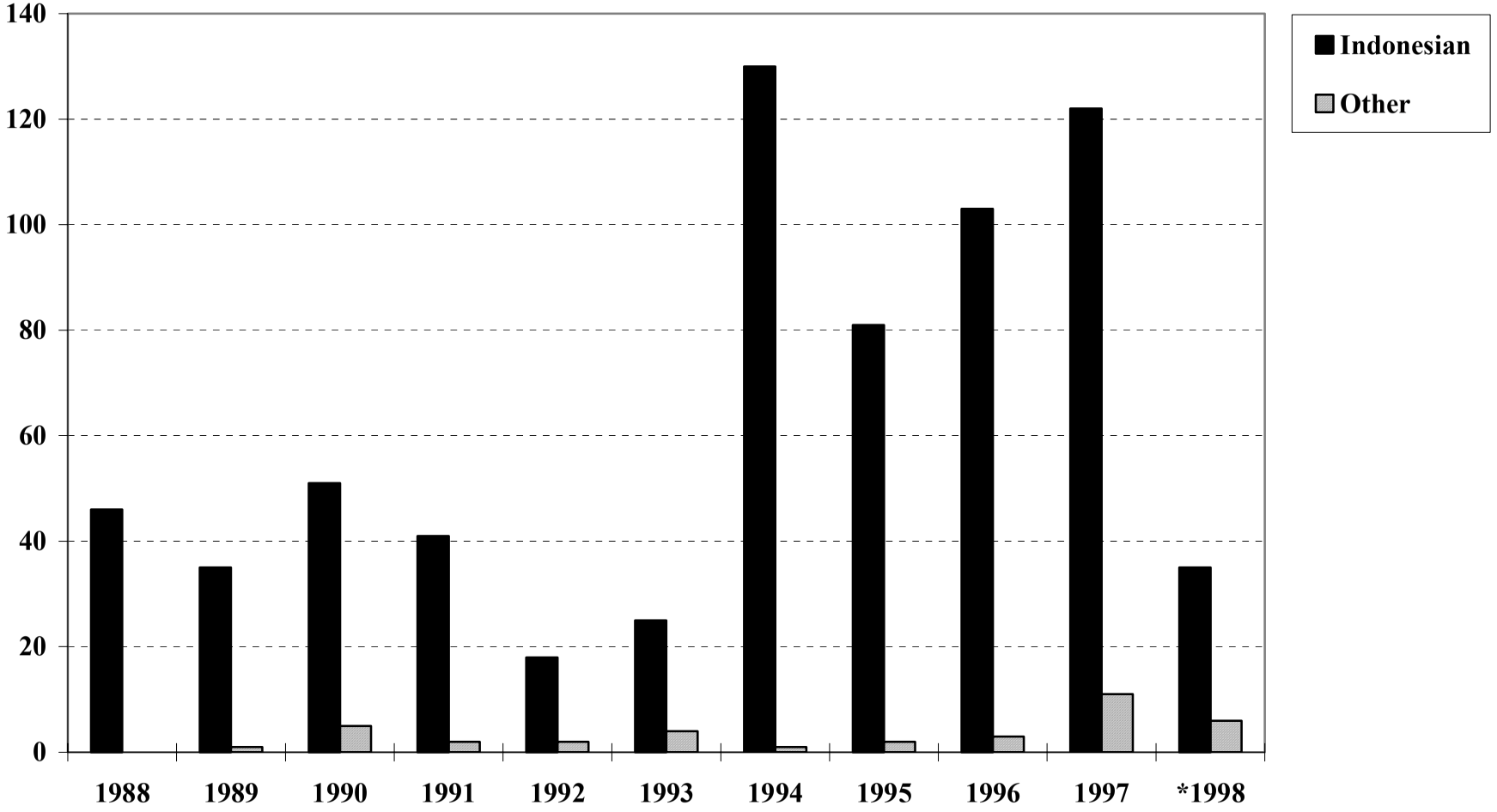
Exotic mosquito species intercepted from vessels	
Aedes aegypti	26
Aedes albopictus	5
Anopheles farauti	1
Culex fragilis	1

Table 3. Interception of exotic mosquitoes Darwin 1978-98

Intercepted Vessel Containers Positive for Larvae	
Water drums 200 litre	22
Water drums small	8
Water jerry cans	2
Tyres	2
Water clay jars	1
Machinery	1

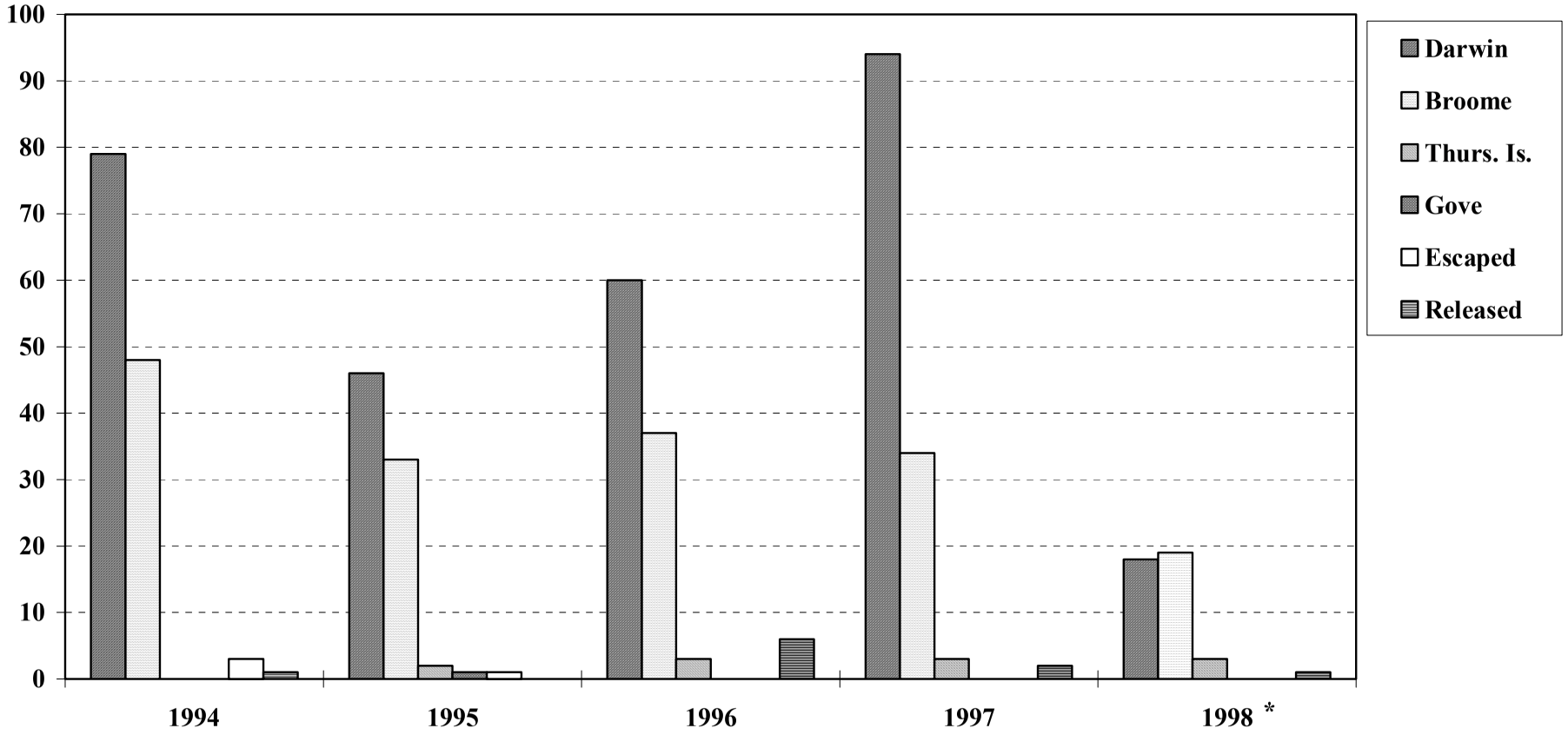
Attachment 2

Figure 1: Foreign vessels apprehended by calendar year in Australia



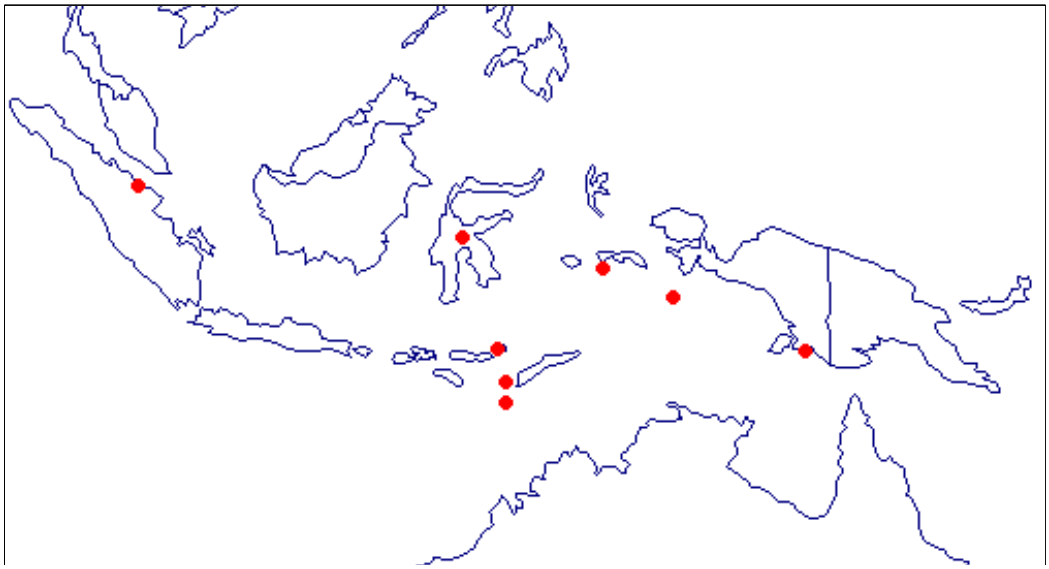
*1998 figures to 9/9/98

Figure 2: Foreign fishing vessels apprehended by port of processing



1998 figures to 9/9/98

Figure 3. Location of origin of illegal fishing vessels 1994-98



OEH COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR THE PROPOSED EXPANSION OF THE ALCAN GOVE ALUMINA REFINERY

Expanded Operation

Section 4.5 - Waste Water Inventory Reduction - The waste water neutralisation process needs to be explained in more logical terms or illustrated in a diagram. It is not clear whether all waste water and residue passes through the neutralisation plant before being transferred to the Residue Disposal Area (RDA). Section 4.5.4.2 states that the overflow from the neutralisation plant will return to the discharge channel via the labyrinth. This is not the case and the statement should be amended. Once the full-scale neutralisation process reduces the inventory of alkaline water in the RDA, water will no longer be available for use in the washer train. How will this shortfall be addressed? How will the system partially work in the short term given that there will be a mixture of neutralised and non-neutralised material being transferred to the RDA at any one time?

Infrastructure

Section 5.1 - Water Supply
Section 5.1.8.5 indicates that the Yirrkala bore may be affected by expanding the existing wellfield. The available drawdown could potentially be reduced to a level where users of this bore are affected and mitigative measures should be included to address this issue.

Section 5.1.9 - More information is required on the location of observation bores, and the program to monitor the aquifer performance and stream flows of surface water systems.

Section 5.2 – Energy
More detailed discussion is required on the continued use of fuel oil if a gas supply is not secured in the short or medium term. This should account for oil spill potential through increased shipping, control of air emissions and strategies to offset increased greenhouse gas production.

Section 5.4 – Sewerage
Details of the intended refinery sewerage treatment upgrade are requested.

Section 5.5 – Transport
Further consideration should be given to site access via the Katherine to Gove Road. If the potential impacts of the upgrade and use of this road for the Alcan Gove expansion are to be assessed in the Trans Territory Pipeline EIS process then this should be clearly stated.

There needs to be some assurance that potential impacts associated with the barged transport of pre-assembly modules (PAMs) are being addressed by Alcan Gove or by the responsible contractors. These assurances need to be included in the Environmental Management Plan.

Alternatives

Section 6.5.5 provides very little information on air pollution control technologies. Additional information should be included in the EIS.

Waste Management

Information is required on the fate of wastes removed from the site to ensure that the end uses or disposal of these wastes are appropriate.
If Alcan Gove is responsible for the management of wastes produced off-site during the assembly of PAMs, provide details of how this will be managed.

Some discussion of the nature and fate of biological and corrosion inhibitors from cooling water pipes is required.

Air Quality

Section 4.4 Liquor purification – A monitoring program should be undertaken to ensure that the relevant environmental and health standards for air emissions from the liquor purification process are met.

Section 4.4.4 refers to Section 8.7 for results of an assessment of the plant's emissions, particularly of organic carbons and particulates. The referred section does not include an assessment of organic carbon in the modelling results.

An explanation of how stack height can control air emissions should be included to supplement Section 8.5.3.

It is requested that the Health Risk Assessment be made available for review by this Office.

There has been no mention of the risk of odour from Volatile Organic Carbons (VOCs) from the liquor purification process and as these were not included in the modelling, some account should be made of this risk.

Greenhouse

Information on the estimated greenhouse gas emissions from the existing operation and two expanded alternatives is clearly detailed in the draft EIS as a total for each alternative, for each greenhouse gas present and for each component of the refinery. The draft EIS states that emissions have been calculated according to National Inventory Guidelines using industry standards. However, the source of greenhouse gases at each stage of production remains unclear. A brief description of, or value for, each of the processes resulting in emissions in each of these stages would demonstrate that all of the emissions have been accounted for. In addition, although implied, the document would benefit from having a statement which indicates that there are no emissions of hydrofluorocarbons, perfluorocarbons or sulphur hexafluoride.

The EIS should also account for any additional greenhouse gases emitted as part of the construction phase and as additional energy consumed due to the planned increase in housing. If these emissions are already included in the draft EIS estimates this should be made clear.

The primary source of greenhouse emissions from the site comes from energy. In the draft EIS Alcan has demonstrated an ongoing commitment to improve energy efficiency ultimately resulting in the minimisation of greenhouse emissions. However, there is little discussion about any efforts to reduce greenhouse gas emissions from industrial (chemical) processes. If the opportunity for this is limited, this should be clarified in the EIS.

In providing information about proposed offset programs Alcan has not demonstrated the environmental, economic and social aspects of the programs nor has it identified the financial and other costs associated with the programs. However, representatives of Alcan have recently met with the Greenhouse Unit with an aim to identifying and pursuing more significant greenhouse offset programs. The Greenhouse Unit has agreed to provide Alcan with the outline of an offset proposal by mid April.

Minor errors

- The emission rate per tonne of alumina will decrease by 28% only if production reaches 3.8 Mt/y. Consideration should be given to including a percentage decrease in the emission rate per tonne for the initial production rate of 3.5MT/y.
- In Table 9.3.6 the greenhouse gas emissions per tonne of alumina are 0.81t (1.62/2.0) for the existing refinery and not 0.79t as recorded. This is important because it shows that there is almost a 2% reduction in greenhouse emission per tonne of alumina in the expanded refinery without a change in fuel source.
- The ultimate emission rate per tonne of alumina would appear to be 0.58t (2.22/3.8) not 0.59t.

Noise

The terrain shielding effect at Galupa should be tested to determine whether the noise exceedences from the use of concrete saws and jack hammers during refinery construction might be mitigated. Some detail of the type and design of noise attenuation shields could be provided for improved understanding.

Surface Water

Sections 11.3.1.2 and 11.7.4 should be supplemented with a detailed description of the measures to prevent “caustic to ground” including the current improved method of scale removal and the planned implementation of the new washer system as outlined in discussions with Alcan Gove. Improvements to the previous methods of scale transfer have been made in which scale material is not placed on the ground prior to RDA disposal. This Office is of the opinion that Alcan Gove should commit to continue with this system despite the use of concrete hardstands and bunds and the overhaul of the washer system.

Describe any improvements planned for the interception of stormwater and its treatment prior to discharge following rainfall events. Although stormwater management is generally covered in the draft EIS, there appears to be a high potential for fugitive discharges of contaminated stormwater to the environment.

In the event that rainfall volumes exceed the capacity of the tank farm bunds, detail the procedures employed to prevent hydrocarbon contamination of the adjacent marine waters in Melville Bay.
How is the occasional storage of hydrate undertaken to prevent contamination of surface water runoff?

Section 11.3.1.3 refers to current bunding and containment around majore storage tanks. This section makes reference to continuous improvement to current bunding and containment measures where they do not meet Australian Standards or where considered to be insufficient to contain a spill. The timeframe in which these works are proposed to be completed needs to be provided.

Section 11.9.2 – The reasons for an increase in precipitate and dissolved metal loads in the discharge from waste water neutralisation are not clear. A closed circuit evaporative cooling system is proposed for Stage 3 of the refinery (Section 6.5.4). If there are no commitments to upgrade the cooling system for Stages 1 and 2 to remove the need for marine discharge of cooling water, and given that Alcan Gove is committed to achieving a zero mixing zone for its discharge, what measures will be implemented to prevent any further caustic contamination of discharge water and flocculation of precipitate in Melville Bay?

Groundwater

Groundwater abstracted in the groundwater recovery program appears to be discharged directly into the refinery discharge channel without any form of treatment. This implies that to improve the quality of groundwater through-flow to the northern and southern beaches, the quality of discharge water to Melville Bay is being compromised.

Marine Water and Sediment Quality

Impacts sustained by the flocculation of precipitate over the substrates in Gove Harbour need to be addressed.

Provide an indication of what the “current good practices in managing ballast water” are in Section 13.7.2.1.

To allow this Office the opportunity to assess the adequacy of the oil spill response management of the expanded operation, including details of the spill management and containment strategy that is currently in place for the expanded refinery, details from the updated GOVEPLAN should be included in the EIS.

Marine Habitats

Section 14.3.2.4 includes a comment on the ability of migratory species to avoid environmental conditions that could be injurious to their health, due to their mobility. Whilst this might be true in some instances, there are potentially harmful conditions that are not easily detected by organisms and such a statement should not be used as a reason to allow environmental damage to continue.

Section 14.4 does not include mention of the ban on the use of Tributyl tin (TBT) as an anti-fouling agent in vessels under 25m in length or the Australian Government commitment to phase out TBT application on all ships by 2008, in line with the International Maritime Organisation's adoption of an International Convention on the Control of harmful Antifouling Systems on Ships.

The reference cited in the first line of page 14-2 has not been included in the References section of the draft EIS.

Terrestrial Biology

The reference cited as Wooranski (2002) has not been included in the References section.

Section 15.2.5.1 discusses historic die-back events in the early 1990s and states that "similar events have occurred from time to time in the past" but includes no details of when or where these incidents occurred. The section also states that after defoliation, the trees either died or recovered. Was the survival of some trees and the death of others due to the variation in severity of die-back? Is there on-going monitoring of these areas? This event could be explored in more detail and the reference document made available to this Office.

Within Section 15.2.7.2, the second paragraph lists *Chloris gayana* (Rhodes grass) as a weed that could spread further, yet this species is used in the initial stages of mine rehabilitation. On further inspection, *Chloris gayana* is listed in an Australian Government resource document, Weed Categories for Natural and Agricultural Ecosystem Management, as naturalised and known to be a minor problem warranting control at 4 or more locations within a state or territory. However, as stated in the draft EIS, the species may not persist in competition with native grasses within the rehabilitated areas. This should be made clear in the EIS.

Vetiver grass, though apparently sterile, may also have the capacity to become a weed due to its resilience. There is potential for the sterile variety to spread vegetatively, during heavy rainfall for example. This species should be monitored and carefully managed to ensure that its potential to spread into the downstream environment is minimised.

Rehabilitation and Decommissioning

The final paragraph on page 19-10 Section 19.5.1 indicates that the goal of final RDA landform is to prevent contact between residue and the external environment and to accomplish this erosion will need to be prevented. Erosion is a natural process and over time all landforms, including rock, are subject to weathering and erosion. There is a high probability that in the future residue will be eroded into the surrounding environment and monitoring of a decommissioned RDA will need to be very long term to account for this.

The EIS should account for the possible exploitation of the RDA resource if it becomes viable to do so in the future.

Cultural Heritage

Section 6.3.1 of the EIS Guidelines required Alcan to provide a detailed description of the past and present uses of the site (Aboriginal and non-Aboriginal) and archaeological places and objects protected under the *Northern Territory of Australia Heritage Conservation Act 1991*.

Section 20.6.2 of the draft EIS fails to address this requirement in any substantive manner. Some discussion of heritage legislation within the Northern Territory is provided below.

Note that *Northern Territory Aboriginal Sacred Sites Act 2000* is not discussed in any detail as this Act is administered by the Aboriginal Areas Protection Authority.

- ***Northern Territory of Australia Heritage Conservation Act 1991.***

The principal object of the *Heritage Conservation Act 1991* is to provide a system for the identification, assessment, recording, conservation and protection of places and objects of prehistoric, protohistoric, historic, aesthetic or scientific value.

Two types of heritage places within the Northern Territory are protected under the provisions of the Act:

- Declared heritage places; and
- Prescribed archaeological places and objects.

Declared heritage places**:**

These places are considered to possess special significance to the Northern Territory. Declaration of these heritage places or objects follows a formal process of nomination, assessment, recommendation and declaration by the Minister under Part 4 of the Act. The criteria for assessing whether a place possesses special significance provide for cultural and natural heritage values. These criteria provide for both Aboriginal and non-Aboriginal cultural heritage values.

There are no nominated, proposed or declared heritage places recognised under Sections 21, 23 or 24 of the *Heritage Conservation Act 1991* situated within the vicinity or footprint of the mine or refinery. The proposed expansion will not, therefore, have any adverse effects on places recognised under Sections 21, 23 or 24 of the *Heritage Conservation Act 1991.*

The Draft EIS therefore satisfies the requirements of the Heritage Conservation Act with regard to places protected under these sections.

Prescribed archaeological places**:**

Regulation (3) of the Heritage Conservation Regulations identifies the following places as prescribed archaeological places:

- Places containing painting or rock carvings;
- Prehistoric or proto-historic occupation places; and
- Places containing human remains or burial artefacts (not being cemeteries as defined by the *Cemeteries Act*).

Prescribed archaeological places are places containing archaeological materials or evidence resulting from Aboriginal occupation or visitation in the past. These types of places are protected under sections 29 and 39 of the Act.

These sections effectively provide a 'blanket' form of protection for all prescribed archaeological places regardless of whether these places have been recorded or not. Under the Act, it is an offence to alter, disturb, damage, destroy or carry out works of any kind to a prescribed archaeological place without the written consent of the Minister for the Environment.

Consent is granted through the issuing of a permit to disturb or destroy a prescribed archaeological place or object. Permits issued by the Minister may be subject to conditions such as the undertaking of mitigative works.

It is also important to note that some prescribed archaeological places or objects protected under the *Heritage Conservation Act* may also be protected under the *Northern Territory Aboriginal Sacred Sites Act 2000*. Such places might include places containing objects, paintings or rock carvings, art of particular cultural significance and places containing human remains or burial artefacts.

Appropriate consideration and management of Aboriginal cultural heritage places protected under either of these Acts does not in itself ensure the proponent has covered all the legal requirements of both Acts.

Register of the National Estate: *Australian Heritage Council Act 2003*

Section 20.6.1 identifies three places recognised on the Register of the National Estate (RNE). An online search of the Australian Heritage Database of the Gove (6273) 1:100,000 Map sheet for all lists, including the RNE, Commonwealth, Natural and World Heritage list, identifies five indicative places and a registered place listed on the RNE.

Alcan should liaise directly with the Australian Heritage Council and or Commonwealth Department of the Environment and Heritage to identify whether the heritage values of these places may be affected by the proposed expansion of the mine.

- ***Cultural Heritage places within the Alcan Gove Mine and Refinery.***

The Notice of Intent submitted to this Office in March 2003 states that an archaeological survey was undertaken of the residue disposal area by Dames and Moore in 1974 (Alcan 2003:4-2). A number of sites were located by this survey along the coastal fringes and water courses in the area.

In 1974 such sites within the Northern Territory were protected under the Commonwealth legislation, the Native and Historical Objects and Areas Preservation Ordinance administered by the Commonwealth Government.

This Ordinance was replaced by the *Heritage Conservation Act in 1991* and administered by the Conservation Commission of the Northern Territory. The Act is now administered by the Office of Environment and Heritage.

A search of our records reveals that this office does not hold a copy of the report detailing the 1974 survey or record of the sites located during this survey. No records of archaeological surveys within the mine lease boundary are known of since 1974 and no record of prescribed archaeological places protected under the *Heritage Conservation Act* is recorded on our database.

Section 20.6.2 of the draft EIS has not addressed the possibility that previously undiscovered or unrecorded prescribed archaeological places or objects may occur within the footprint of the mine lease boundary and may be impacted upon by the expansion of the mine operations.

Archaeological surveys for developments in subsequent years have recorded numerous archaeological sites in surrounding areas of the Gove Peninsula and indicate a moderate level of Aboriginal occupation in the past. Whilst the majority of sites have been recorded in coastal areas and may reflect occupation preferences for Aboriginal people in the past, this pattern may also reflect the trend of development on the Gove Peninsula and corresponding surveys.

The absence of previously recorded prescribed archaeological places and objects within the Alcan Gove mine lease boundary is therefore likely to reflect the absence of archaeological survey as opposed to the absence of those tangible remains resulting from Aboriginal occupation.

A number of major rivers, associated tributaries and numerous small coastal creeks occur within the footprint and mine lease area. These include the Latram and North Rivers, and Yirrkala and Shady Gum Creeks. Gorges and a variety of coastal environments are also present within the lease. From previous archaeological research within the Northern Territory it is understood that these environments were often a focal point for Aboriginal occupation.

Archaeological sites and objects also occur within the intermediate zone between two land systems such as along the margin of coastal and woodland environments where access to a diverse range of food resources was abundant. These places are therefore considered to possess a high potential to contain archaeological places or objects resulting from Aboriginal occupation.

Whilst it may be that mining activities will not directly impact upon these areas, archaeological remains or evidence is unlikely to be limited to these places alone. Aboriginal people were often highly mobile and it is probable that people in the past moved across the Gove Peninsula landscape for cultural reasons and to utilise the resources of different zones. It is therefore probable that a more or less continuous scatter of archaeological evidence has been deposited across the landscape in the past. The distribution of materials across the landscape may vary in density according to the type and intensity of activities that occurred at any location over time. While it may be that the majority of Aboriginal occupation occurred along the coastal regions, there exists a moderate to high probability that inland zones will also contain evidence of Aboriginal occupation or visitation.

The archaeological probability across the Gove Peninsula is considered highest within the following zones:

- coastal environments and particularly within estuarine environments at the mouth of rivers and creeks;
- along rivers, creeks and associated tributaries or at waterholes;
- within gorges where rock shelters or suitable surfaces for painting may occur; and
- at the junction of two landforms.

The existing Alcan Gove mining lease boundary and footprint contain all of these environmental features. Areas between these features on the Gove Peninsula are considered to possess a moderate potential.

The proposed expansion of the Alcan Gove mine therefore has the potential to impact upon archaeological places and objects resulting from Aboriginal occupation in the past.

Alcan should note that all prescribed archaeological places and objects are protected under the *Heritage Conservation Act 1991*, regardless of whether or not sites have been previously identified and reported to this Office.

On the basis of a moderate to high archaeological potential, it is recommended that Alcan undertake an archaeological survey program of the existing mining lease to identify archaeological places and with the view to develop management strategies that will mitigate the impact of mining activities on these places. This survey program should be undertaken in two stages.

- **Stage 1** should involve an archaeological survey of those areas that will be impacted upon in the short to medium term future and possess some potential to contain prescribed archaeological places or objects resulting from Aboriginal occupation activities and protected under the *Heritage Conservation Act 1991*. These areas include the Eldo deposit and that part of the refinery construction access road located on Wargarpunda Point. A survey of the existing mining fringe should also be undertaken.

- **Stage 2** should involve a series of stratified and random archaeological surveys to further define the nature of Aboriginal occupation on the Gove Peninsula. These surveys should be also target areas proposed for mining in the medium to long term future.

All survey work should be undertaken in consultation with the Yolngu Aboriginal people and Heritage Conservation Services. This Office is happy to provide Alcan with an archaeological scope of works as well as a list of archaeological consultants that may be available to undertake the works.

This survey should be undertaken prior to any earthworks, clearing or ancillary activities that may disturb prescribed archaeological places or objects and constitute a breach of the *Heritage Conservation Act 1991*.

Hazard and Risk

Section 24.4.4.5 of the draft EIS contains an emergency response plan for stormwater that does not contain adequate detail with regards to the emergency management of stormwater egress to the environment as inferred in Section 11.3.1.2.

Generally, the emergency response plan information provided in Section 24 of the draft EIS contains insufficient detail to determine what actions will be undertaken during the response or to assess the adequacy of the implemented response measures in preventing or mitigating environmental harm.

Errors

It should be noted that the quality of some sections within the draft EIS has been compromised by the frequency of typographical errors or inaccuracies. For example, Section 15 Terrestrial Biology contains a relatively high number of errors including references cited in the text that have not been included in the References section, the misspelling of names of people (Yunupingu, Whelan) and animals/plants (yellow crazy *fire* ant, siratro, *atropurpureum*, *annulirostris*), and incorrect references to a methodological term (foliage projective cover [FPC]). Corrections to these and other errors in the draft EIS could be included in the EIS as an erratum.

Northern Land Council

ABN 56 327 515 336

Address all correspondence to:
CHAIRMAN
PO Box 42921
CASUARINA NT 0811

9 Rowling Street, Casuarina NT 0810
Phone: (08) 8920 5100
Fax: (08) 8945 2633
Freecall: 1800 645 299

Our Ref: N29:2004/0224

1 April 2004

Mr Rod Johnson
Office of Environment and Heritage
GPO Box 1680
DARWIN NT 0801

Dear Sir

ALCAN GOVE ALUMINA REFINERY EXPANSION PROJECT: EIS

Please find attached the Northern Land Council's submission regarding the Environmental Impact Statement (EIS) submitted by Alcan Gove.

The NLC's submission identifies a number of significant concerns regarding the potential impact of the proposed expansion. The chapters of the EIS assessed by the Northern Land Council are chapters 7, 8, 10, 12, 13, 14, 15, 19, 20, 21, 23 and 25.

I note that, due to a death and major ceremony during the public comment period, the Northern Land Council has not had sufficient time to comprehensively consult with the traditional owners regarding the EIS and potential impacts.

Yours sincerely

Norman Fry
CHIEF EXECUTIVE OFFICER

BORROLOOLA
PO Box 453
Borroloola NT 0854
Ph: (08) 8975 8848
Fax: (08) 8975 8745

JABIRU
PO Box 18
Jabiru NT 0886
Ph: (08) 8979 2410
Fax: (08) 8979 2650

KATHERINE
PO Box 396
Katherine NT 0851
Ph: (08) 8972 2894
Fax: (08) 8972 2190

NGUKURR
PMB 85
via Katherine NT 0851
Ph: (08) 8975 4755
Fax: (08) 8975 4601

NHULUNBUY
PO Box 820
Nhulunbuy NT 0881
Ph: (08) 8987 2602
Fax: (08) 8987 1334

PALMERSTON
PO Box 1249
Palmerston NT 0831
Ph: (08) 8931 1910
Fax: (08) 8931 1875

TENNANT CREEK
PO Box 55
Tennant Creek NT 0861
Ph: (08) 8962 3729
Fax: (08) 8962 1084

TIMBER CREEK
43 Wilson Street
via Katherine NT 0852
Ph: (08) 8975 0789
Fax: (08) 8975 0664

Alcan Gove Expansion Environmental Impact Statement

Public Comment

The Northern Land Council (NLC) is a statutory authority established under the *Aboriginal Land Rights Act (Northern Territory)* 1976 (ALRA), and a representative body under the *Native Title Act* 1993. In relation to the proposed Alcan Gove expansion the NLC represents the traditional Aboriginal owners and other interested or affected Aboriginal persons or groups regarding the area affected by the proposed expansion.

The NLC has assessed chapters of the Alcan Gove Environmental Impact Statement where it may have the potential to provide an impact regarding the interests of the traditional owners regarding their traditional land . The chapters assessed by the NLC are chapters 7,8,10,12,13,14,15,19,20,21,23,24 and 25.

The Environment Impact Statement (EIS) should acknowledge that all of Alcan's leasehold areas are (already) Aboriginal land under the ALRA, freehold title to which is being held by the NLC in escrow for the Arnhem Land Aboriginal Land Trust. However, Alcan's leasehold interests prevail over the Land Trust's title.

The EIS also fails to adequately address the potential for social impact on the Aboriginal people of the region.

General Overview (Chapters 7, 8 and 10)

Given the amount of consultation undertaken to incorporate Aboriginal interests in the land within the framework of the Department of Industry, Planning and Environment Environmental Impact Study (DIPE EIS) guidelines with the selected sections on waste, air and noise, the Draft EIS is inadequate. There is no discussion of what the Aboriginal interests in the land may be or reference to what the potential impacts on these interests may be.

The report assumes that Aboriginal interests are limited to impacts on communities as sensitive receptors rather than on their spiritual and physical interests in the land

In terms of the scope of the required project assessment, the absence of such a discussion makes the task of reporting on the scale and extent of potential impacts on Aboriginal people and lands as a result of the proposed expansion of the alumina refinery, a meaningless and largely impossible task. Therefore the required project assessment will focus on a standard appraisal of the quality of the Draft EIS with respect to methods and techniques used to determine impacts from the expansion.

Chapter 7 - Waste

Generally EIS assessment of waste management is routinely underestimated relative to impact, and this is considered to be the case with the Alcan Gove EIS. Although Alcan Gove should be commended on their intended actions towards best practice waste management in the future, very little information is provided about the current impacts from waste management practices.

In both the section on air quality and noise data has been collected on impacts of current operations and extrapolated using information about the anticipated performance of the expanded plant to provide an expectation of what the impacts from the expansion are likely to be. However, the section of waste section largely consists of an:

1. overview of how Alcan Gove are meeting commitments of their ISO 14001 obligations through a waste management program;
2. generic statements about waste generation by type from the current facility;
3. a description of future and current actions being undertaken to avoid, reuse and recycle selected waste streams.

It is clear that a considerable proportion of waste generated in relation to the current refining operation is disposed of to land at either the Residue Disposal Area (RDA) landfill or into the community landfill. No information is provided about the amount of waste being disposed of to these landfills, impact (if any) to date of disposal of wastes to land, the suitability of these sites and the potential impact of the expansion on these sites.

The report makes mention of a waste audit conducted by Wastemaster but the results and recommendations are not provided. It would be anticipated that such an audit would have provided indicative quantifiable data about the composition of all waste streams generated by weight or volume and type over a given time period for the operation of the current refinery. This data could then have been extrapolated out and by using information about anticipated quantitative performance of future waste avoidance, reuse and recycling programs the impact on the land as a result of the expansion could have been estimated.

Although the report focuses on current and future programs it makes no mention of quantitative targets for the waste streams of interest. It is assumed (but not explicitly stated) that Alcan Gove intends to provide this information in 'site wide waste management strategy' mentioned for completion in the future, but the future provision of this information is of little use in determining the impact of waste from the expansion.

In general terms Alcan Gove should be commended for there efforts to reduce waste resulting from the construction phase. However, the same comment applies as to what the actual impacts of the waste generated during that phase may be. Particular attention should be made to the additional impact of wastes placed in the new community landfill (volume etc). It should be stressed that this landfill is located on Aboriginal land and was assessed on the basis that it was a necessity for the sustainability of the community and not to service Alcan Gove or its expansion.

Recommendations
Properly describe the impacts of waste. For example:

1. Provide an estimate of the quantity of waste generated (by weight or volume and characterised by waste stream) from current operations, construction activities and from expanded operations.

2. Estimate the quantity of wastes likely to be diverted to landfill as a result of initiatives described.

3. Describe the impacts of waste disposal to land with respect to waste quantity and type from current operation and describe predicted future impacts resulting from the construction phase as well as the expansion with respect to waste quantity and type. This should include impacts on the community in relation to noise, odour and amenity.

Chapter 8 - Air Quality

Ambient Air Quality
The assessment of air quality undertaken in the EIS is generally representative of best practice methods. There are a few comments relating to the appropriateness of using long term ambient air quality standards for ground level concentrations from single source emissions, the use of single year data to predict long term trends, accuracy of trend modelling in providing site specific predictions and the absence of historical air quality ground level concentration monitoring data. However, these points are largely arguable in terms of the effect of these issues on the overall conclusions and have generally been acknowledged by the consultants in preparation of this section.

A community monitoring station was placed at Gunyangara community approximately 3 km to the south east of the refinery from December 2002 – April 2003 for the purpose of validating the air dispersion model. Using the data from the monitoring station over a period when wet season winds were blowing in the direction of the community, no exceedence of the National Environmental Pollution Monitoring (NEPM) 1 hr Average SO_2 ground level concentrations were recorded. It should be noted that although there were no exceedences of the NEPM, for a small portion of the time during the short monitoring period the 1 hour SO_2 concentrations were elevated.

Although no graphical depiction is provided, the report states that there were also no exceedences of the NEPM 1 day SO_2 concentration in the Gunyangara community over the period the monitoring was conducted.

The dispersion model was used to predict ground level concentrations from the current refinery operations as well as from the proposed refinery expansion at the following sites:

- Galupa;
- The yacht Club;
- Gunyangara;
- Wallaby Beach;

- Nhulunbuy;
- West Melville Bay.

Current emission rates from the existing refinery, expected emission rates from the expanded refinery under different scenarios and specifications, expected emissions from the proposed Liquor Purification plant and 2002 meteorological data were used to model the air quality impacts at the above sites. The data from the monitoring station at Gunyangara validates the air dispersion modelling results.

For SO_2 from the existing Refinery:

- Ground level concentrations at West Melville Bay are likely to exceed the NEPM 1 hr 10 year Air Quality Goals, however, although not a non compliance elevated levels are noted at Gunyangara (confirmed in the monitoring) and elevated levels are noted at Galupa.

- No non-exceedences were modelled for NEPM 1 day 10 year Air Quality Goals. However, although not a non-compliance elevated levels are noted at Gunyangara and West Melville Bay and elevated levels are noted at Galupa.

For SO_2 from the expanded refinery (gas fired model):

- No non-exceedences were modelled for NEPM 1 hr 10 year Air Quality Goals. Although not a non-compliance, elevated levels are noted at Gunyangara and West Melville Bay.

For SO_2 from the expanded refinery (oil fired model):

- No non-exceedences were modelled for NEPM 1 hr 10 year Air Quality Goals. Although not a non-compliance, elevated levels are noted at Gunyangara and West Melville Bay.

For Carbon Monoxide, Nitrogen Dioxide and Lead from existing refinery operations:

- No exceedences of NEPM standards. There appears also to be no elevations in ground level concentrations of note at the selected sites.

For Carbon Monoxide, Nitrogen dioxide and Lead from the expanded gas fired and expanded oil fired refinery model:

- No exceedences of NEPM standards. There appears also to be no elevations in ground level concentrations of note at the selected sites.

Conclusion

The conversion to natural gas will generally reduce the ground level concentrations at the selected sites although there may still be SO_2 elevations elevated levels at Gunyangara and West Melville Bay.

As fuel oil is the major source of sulphur it is proposed that switching to a fuel with lower sulphur content should reduce all SO_2 ground level concentrations when gas is not available.

Dust
Particulate emissions were identified from both point source and fugitive sources. The expansion includes a range of initiatives to reduce particulate emission from the existing refinery operation and additional sources of emissions associated with the expansion. Both fugitive and point source were included in the model.

For PM10 from existing refinery operations:

- No exceedance of NEPM standards. Although not a non-compliance, elevated levels are noted at Galupa and some elevations are noted at Gunyangara, Wallaby Beach.

For PM10 from the expanded gas fired and expanded oil fired refinery model:

- No exceedance of NEPM standards, however elevated levels are noted at Galupa and some elevations are noted at Wallaby Beach.

Ground level concentrations should remain largely unchanged as a result of the expansion at Galupa and Wallaby Beach but considerably improved at Gunyangara.

Health Risk
A health risk assessment was undertaken of between 60 – 98 different emission compounds.

However, little information is provided in the EIS about the dispersion modelling results other than a statement that "at all the receptor locations there would very little likelihood of adverse acute or chronic health effects or irritation. Furthermore, the calculated risks were all within or below acceptable risk band used by regulatory authorities around the world."

Odour
Odour impact statements usually make interesting reading however URS (Alcan Gove's primary environmental consultants) have appeared to have handled it well and taken it seriously as a significant nuisance trigger. Dispersion modelling suggests that there will be an increase in odour at all receptors from the expanded refinery. At West Melville Bay the % increase is relatively high. At Galupa, Wallaby Beach and Gunyangara the % increase is very slight.

However, Alcan suggest that at all (including at West Melville Bay) the nominated receptor sites the relationship between odour intensity and concentration is such there is unlikely to be detectable as a change from current odour levels.

Recommendation
1. Provided more details about the modelling conducted for the health risk assessment

2. Recommend a comprehensive ambient air quality program to be put in place to prove the modelling results for the scenarios proposed.

Chapter 10 – Noise

Noise is a major source of annoyance and complaint in the community. Often regulatory standards provide little comfort to affected persons.

Alcan has used the NT Governments Draft Waste Management and Pollution Control (Environmental Noise) Regulation for determination of lawful noise levels from operational, construction and road traffic scenarios. The World Health Organisations criteria have been used for determination of sleep disturbance noise levels.

Some allowance has been made for Tropical NT conditions (housing ventilation and wet/dry seasons). Modelling was validated using monitoring data for background (LA90) and continuous (LAeq) noise.

Sources of dominant noise from the refinery were identified (17 areas) and significant sources of low frequency noise specified (low frequency noise travels further and tends to be picked up more readily as nuisance noise).

Sound power levels of alarm and sirens were identified (sound power levels are the maximum instantaneous noise level emitted by a particular source at a given distance).

However, only very limited attended noise monitoring was undertaken. The monitoring assumes insect noise dominates refinery noise.

Refinery Noise

Attended monitoring of noise from the existing Refinery show that noise at monitoring sites exceeded the NT regulation for maximum levels at residential areas from 10pm to 7am. The consultants identified insect noise as the predominant noise source contributing towards the exceedences at all sites.

Although the impact of insect, frog etc noises on the noise environment is a reality care needs to be taken to ensure that such noises aren't providing temporary masks which understates the true impact of the underlying noise of interest (in this case the refinery).

With the exception of Galupa, Wallaby Beach and to a lesser extent Gunyangara, noise levels measured were generally pretty low overall. Noise from the current refinery operation was only identified at Galupa and maybe at Gunyangara.

Noise from expanded Refinery (modelled) is likely to be higher at Galupa and at Gunyangara in both wet and dry season scenarios. However, the increase is so slight that it is unlikely to be detectable (generally needs to be 4 dBA or greater).

No discussion of the impact (if any) of low frequency noise sources identified. Given that low frequency noise generally contributes to the annoyance factor (it is often

described as intrusive noise) travels further and is often audible to some people and not to others, it is probably worthy of comment.

All new equipment associated with the refinery expansion will have a sound power level at 1 mt of 85 dB(A) LAMax . Contractual requirements for plant and equipment with maximum sound power levels can be an effective means of remedy if noise nuisances are detected post construction.

Alcan Gove has committed to a sound attenuation barrier to reduce noise impacts to Galupa from current refinery operations but no details are given on its anticipated performance.

Road traffic noise
Additional traffic movements will increase noise levels at the nearest effected roadside residence such that the change should not be noticeable.

Construction noise
Construction noise levels have probably been handled the least sympathetically by the consultants.

Alcan have identified sources of equipment noise, sound power levels of the equipment and modelled predicted noise levels at Galupa as the nearest effected community.

Alcan conclude that such machinery will not exceed current background levels with the exception of jackhammers, pile hammers and concrete saws. It is unclear what this statement is meant to mean in terms of audible impact. Surely the impact is that construction noise will now dominate the background noise environment (previously described as predominated by insects) which will be, from time to time, further intruded upon by jackhammers, pile hammers and concrete saws.

Similarly Alcan has not properly described the impact from jackhammers, pile hammers and concrete within the noise environment. Alcan acknowledges that the maximum noise levels will exceed the regulatory limits but dismisses it as an impact when building and terrain effects are considered. No evidence is presented to support this and in the absence of such evidence the impacts on the community must be properly described (irrespective of whether or not the max regulatory limit is exceeded).

Finally no discussion of impacts from plant commissioning has been presented. Plant commissioning tends to be a major source of community annoyance. As plant and equipment becomes available for commissioning testing begins. Phased commissioning tends to occur before all noise attenuating materials and equipment have been installed resulting in vastly higher than predicted impacts in the community for long periods of time.

Recommendations

1 Conduct a wider range of attended monitoring to determine the seasonal predominance of insect noise at sites with relatively high noise levels (if insect noise drops off refinery may be more audible at other sites)

2. Make comment on impacts of low frequency noise.

3. Insist on a more sensitive assessment of construction noise impacts on sensitive receptors and include an assessment of plant commissioning noise impacts (ie, include noise level reduction of sound buildings, terrain and sound attenuating barrier etc).

4. Recommend a comprehensive noise monitoring program to be put in place to prove the modelling results for the relevant scenarios (construction, commissioning and operation of expanded refinery).

Chapter 12 - Groundwater

There are 2 major groundwater components addressed in the EIS. The first is primarily associated with groundwater contamination in the Refinery and RDA areas, while the second is the assessment of potential impacts from a proposed increase in groundwater pumping. As these issues are largely independent, this assessment has been split into two parts with stand-alone conclusions for each.

Part A – Refinery And RDA Groundwater Issues

Refinery

Significant degradation of groundwater in the vicinity of the Refinery by caustic and associated dissolved metals is extensively documented and acknowledged in the EIS The major source of contamination is work practices involving regular though temporary storage of caustic materials and wastes on unsealed surfaces, known as 'caustic to ground' practices.

The contamination has resulted in caustic groundwater seepages along Northern Beach, which are monitored on a regular basis. The EIS report states that investigations have shown that there is 'no measurable impact' on the marine environment from these seepages. Given the hydrogeological regime at the refinery site presented in the EIS, there is the potential for additional interaction with the marine environment in intertidal or below sea level elevations, but this is not addressed in the EIS assessment.

A program of groundwater recovery and treatment has been in place since 1994 in an attempt to remediate the existing contamination. However, regular and extensive monitoring has shown that the aerial extent and concentration of key contamination indicators have been constant in shallow and deep groundwaters except for a "general decline in concentrations of key indicators in some bores" in shallow sediments. This suggests that the amount of contaminants removed from the groundwater system by the recovery program have been balanced by ongoing contamination from the refinery site.

Attempts to reduce these ongoing inputs during the proposed expansion are mainly focussed on reduction of 'caustic to ground' practices through changes to operating

procedures, proposed site wide bunding and containment, and ongoing study/monitoring and implementation of study recommendations.

While these are appropriate amelioration strategies (and should be adopted irrespective of if an expansion proceeds), the main groundwater issue at the refinery site is the pre-existing contamination. What is lacking from the EIS is a commitment to long-term groundwater remediation targets, which was a requirement under Section 5.4.10 of the DIPE Part B Guidelines for the EIS. Although Section 2.1.3 of the report states that site specific groundwater quality triggers will be developed by December 2004, it is obviously not possible to review the appropriateness of these targets in terms of the EIS. In any case, it would appear that the targets would likely relate to Northern Beach or any other environmental discharge sites.

What is required is a commitment to measurable minimum groundwater quality standards that are acceptable to regulatory agencies and traditional owners that will need to be achieved to meet decommissioning environmental requirements. The setting of such targets will provide the incentive for implementation of appropriate groundwater amelioration and rehabilitation strategies.

Some minor hydrocarbon contamination is also present, though this is not considered a problematic issue due to the high bio-degredation potential of hydrocarbons in environments such as Gove. It is common practice at remote sites with major oil powered utilities to separate and treat or dispose of "tank bottoms" (dirty fuel which accumulates at the bottom of bulk shipments and storage tanks). This practice has lead to significant groundwater contamination at similar sites. There does not appear to be any reference to this issue in the waste management sections of the EIS report. Indeed, this may not be an issue at Gove, but should be confirmed as part of the EIS process.

RDA Areas

The EIS report (Section 12.2.4.2) states that the groundwater flow regime in the vicinity of the RDA has been modified from pre-development to a state where the dominant flow is radial flow away from the impoundments. This flow regime indicates ongoing leakage from the ponds to the groundwater system that has lead to the development of a groundwater mound under the RDA. As per the refinery situation, the EIS acknowledges significant existing caustic and associated contamination of groundwater. While the report attributes mangrove dieback to increased groundwater levels as a result of hydraulic loading, insufficient evidence has been presented to rule out the probability of groundwater contamination from the RDA as a contributing factor.

It is noted that a range of other wastes are also disposed of in the RDA (e g tyres). Some assessment of the leachate potential of all RDA wastes as a result of exposure to the caustic environment should be undertaken to refine the suite of analyses undertaken in the groundwater monitoring program.

Some minor benefits in terms of contamination potential will accrue if proposed changes in operational procedures are implemented as a result of expansion. However, it is difficult to justify the statement that "a reduction in the volume of wastewater stored" will reduce groundwater risk "due to lower hydraulic pressure

(from the wastewater inventory reduction project)". The RDA ponds will always be wet when operational due to the moisture content of the waste, rainfall and some wastewater input. The potential to drive contaminants from the ponds into underlying aquifers is related to the head difference between the two, not the volume of water stored in the ponds. Even if water levels in the RDA were reduced by 2m as a result of the wastewater inventory reduction process, this head reduction is proportionally small compared to "the large head differences between the stored residue / water and the groundwater level" cited in the EIS.

New ponds will eventually be required if expansion proceeds, however these are not addressed in the EIS, and therefore cannot be assessed. Better construction methods would be required to avoid duplicating the current difficulties, and would likely require appropriate permeability reduction methods for construction of pond floors and walls, as opposed to the current construction where very little work appears to have been undertaken to reduce pond floor seepage.

Refinery and RDA Conclusions

The major groundwater issue at the refinery site is that of pre-existing and ongoing contamination. The EIS needs to include a commitment to long-term groundwater remediation targets (a requirement under Section 5.4.10 of the DIPE Part B Guidelines for the EIS). Such commitments should include measurable minimum groundwater quality targets that are acceptable to regulatory agencies and traditional owners, which will need to be attained to meet decommissioning environmental requirements. The setting of such targets will provide the incentive for implementation of appropriate groundwater amelioration and rehabilitation strategies. Probable improvements to RDA groundwater contamination potential as a result of expansion are small, and the overriding issue is similar to that for the refinery area – i.e. the need for a commitment to acceptable decommissioning groundwater quality standards. Such standards would provide a commercial incentive to instigate appropriate remedial and ameliorative strategies. These issues are potentially more significant for the RDA because, unlike the refinery, the major contamination source will remain in place after decommissioning and could therefore continue to be a source of groundwater contamination in the longer term unless appropriately addressed.

Part B - Groundwater Supply Study Assessment

Preliminary review of the groundwater supply studies contained in the EIS identified numerous anomalies and issues requiring clarification. A list of these queries was forwarded to Alcan for supplementary assessment by their consultants. Queries and responses are included as an attachment, with individual concluding remarks. A synthesis of all information provided by Alcan in the EIS and supplementary responses follows. While there is some repetition of points made in the attachment, it is considered important to include a verbatim copy of the Alcan responses. The responses variously demonstrate a degree of reluctance to provide information that would qualify assertions made in the EIS, concessions of major inadequacies identified in the preliminary review, and presentation of further unqualified, demonstrably misleading or irrelevant arguments in an attempt to avoid conceding some inadequacies.

Base Data and Modelling Approach

Geological and Groundwater Level Control

The most significant deficiency in the data used as a basis of the modelling is the lack of available geological and groundwater level information. Many of the Figures presented in the report are restricted to the existing borefield area, or show bores RN30042 to RN30045 and proposed bore locations which give the impression of a spatial distribution of base datapoints. In reality, groundwater level and aquifer geometry data used as a basis of model set-up and calibration is restricted to the central northern and northern parts of the model domain around the existing borefield. This leaves about 75% of the model domain (including the proposed borefield area) without any significant geological or groundwater level control. 'Calibration' to the south of the existing borefield has limited relevance given that there are no observed groundwater levels against which to compare model results.

In modelling terms, this investigation has a high degree of specific outcomes - i.e. a specified extraction from specific locations conforming to agreed and tight 'critical' head constraints. To undertake an assessment of this scale and with such outcome requirements, with no geological or groundwater level control in the majority of the area (and particularly in the major area of impact) would not normally be considered an appropriate level of scientific rigor. Relatively minor variations from the adopted assumptions could invalidate the assessment findings. At the very least, some form of sensitivity analysis to test possible outcomes over a reasonable range of input parameters would normally be required to assess the potential risk of the assumed parameters. Alcan partially acknowledge these inadequacies on the "Investigation Requirements" section of the EIS report, but fail to highlight the uncertainty in conclusions drawn from the modelling as a result of the limitations.

Groundwater levels are available for RN30042 to RN30045, however Alcan assert that they were not used because of a lack of survey data. Considering the resources obviously made available to the compilation of the EIS, surveying of these bores would appear to be a relatively minor undertaking. This is particularly relevant given that they are the only current monitoring points to the south and east of the proposed borefield expansion, and as such would significantly augment the spatial coverage of base data across the model domain.

Model Structure

There are significant concerns regarding the appropriateness of the layers adopted for modelling. These are mainly related to data limitations. While the sub-division of the sequence appears reasonable from a purely geological perspective, there is extremely limited or no hydraulic information available on which to justify some of the assumptions incorporated into the model layer structure.

In particular, layers 3 and 4 have been simulated as commandable aquifers. As there is no groundwater monitoring of these aquifers, there is no way of calibrating their actual response against model outputs. Yet, they have been simulated as confined/unconfined aquifers. In effect, when groundwater heads are lowered in the major aquifer (Layer2), Layers 3 and 4 can contribute to the volume of groundwater extracted through upward leakage. No data has been presented to justify making such an assumption. Depending on the level of assumed confinement, the model could, in

effect, be harvesting groundwater throughflow that in reality discharges to sea, thereby overestimating the amount of groundwater available, and underestimating the actual impact on the groundwater regime and environmental discharges. The statement that these layers could not be assumed to represent a no flow boundary is contested. In the absence of sufficient evidence to suggest otherwise, an appropriately conservative approach would be to exclude the lower layers from the model.

Model Calibrations

As previously discussed, the calibrations have limited application since observed groundwater levels on which to base a comparison with modelling results are confined to approximately the northeastern 25% of the model domain. Moreover, the model calibrations that are presented do not demonstrate a level of accuracy sufficient to give confidence in the prediction of groundwater levels, particularly at key locations such as OB1. The assessment for this particular location is premised on an 11m "warning" level and a 10m "critical" level, therefore requiring a minimum accuracy of 1m in terms of groundwater head. However, the calibration results demonstrate that the model returns an accuracy of poorer than 1 m for the majority of the time.

Transient calibration results are confined to the presentation of 2 observed/modelled hydrographs. Alcan assert that the plots "represented the spatial range observed". However, there is simply no data presented to back these claims, despite a request for provision of additional calibration results. A level of doubt must be assumed when only 2 out of 17 calibration points are presented, and even these are shown to be for the wrong bores (see attachment). If the steady state calibration is used as a guide, one of the presented hydrographs achieved the highest correlation between observed and modelled results, and approximately half of the calibration bores exhibited poorer calibration results than the other. It is reasonable, then, to question the validity of the transient calibration.

Predictive Modelling

The predictive modelling undertaken to assess the potential impact of the proposed borefield expansion is steady state type modelling This is considered an unusual approach, particularly given that a transient version of the model is claimed to have been calibrated. There is a significant risk in the application of steady state modelling as it effectively applies average annual borefield extraction and recharge as opposed to simulating the seasonal variations. The main risk factors contributing to the vulnerability of the groundwater regime (and groundwater dependant systems such as Yirrkala Lagoon) coincide at the end of the Dry Season. This is the time of year when 9 months of borefield usage has occurred with little recharge, groundwater extraction is at its maximum, and there is little likelihood of surface flows to augment groundwater discharges.

Alcan contend that average annual extraction rates were used due to insufficient data to characterise pumping at a smaller time scale. However, Figure 5 clearly demonstrates significant variation in borefield discharge, both on a seasonal basis and between years. The claim of insufficient data appears misleading. In addition, to justify not simulating discharge variation on the basis that it would require longer

simulations appears inadequate given the relatively basic model described in the EIS compared to modern computing capabilities. Alcan's response declined to address the issue of seasonal recharge variation. Variation in recharge responses are apparent both between different monitoring bores and on a temporal basis, but this has not been discussed in the conceptualisation component of the report, and does not appear to have been considered for application to the model.

Given that the preferred Scenario 6 has a safety margin of only 0.4m above the 'critical' level of 10mRL in OB1 (using average annual pumping), the likely result of modelling time variant extraction is depression of groundwater levels below the critical level at the end of a significant number of dry seasons.

Alcan's contention (based on the modelling results) is that groundwater levels will not fall below 10.4mRL at OB1 under the preferred Scenario 6 conditions pumping 14,000ML/annum. However, groundwater levels in OB1 have fallen to (or at least very close to) 10.4mRL in 4 years out of the 32years of monitoring when average borefield extraction was only 9,200ML/annum. Groundwater levels will obviously fall below 10.4mRL minimum in OB1 far more regularly if extraction is increased to the proposed 14,000ML/annum.

A more effective approach is considered to be to re-run the transient model over the calibration period at both 12,000ML/a and 14,000ML/a to give a perspective of how groundwater levels would have been effected at the higher extraction rates compared to the historical observations and to account for:

- Variation of pumping and recharge rates; and
- Assessment of the transient effect of the scenarios on groundwater discharge to the major watercourses in terms of both volumetric and environmental impacts as per NT Government's guidelines for the EIS

Assessment of Discharges to Groundwater Dependant Surface Water Systems

The assessment of the potential impact of the proposal on groundwater dependant surface water systems has received very superficial treatment. The simulated groundwater discharges to the rivers are accessible through the water budget/RIVER package of Modflow. Analysis of this data would enable at least a comparative assessment of discharge volumes for the major watercourses for existing usage, 12,000 ML/a and 14,000 ML/a scenarios.

Alcan state that this was not undertaken "due to the lack of sufficient data that would enable defendable calibration ... of the RIVER package". It is agreed that there is probably insufficient data on which to defend calibration of RIVER components, and in truth of groundwater levels across the modelling domain. However, the RIVER results are one of the only available means of assessing environmental groundwater discharge impacts of the proposal, either in an absolute or comparative sense. Failure to evaluate environmental discharge implications of the proposal is a failure to address the Terms of Reference for the EIS.

Management Strategies

The report does not address proposed strategies that would be implemented at warning or critical groundwater levels, apart from a proposed spearpoint groundwater system to augment flow in Yirrkala Lagoon that would only be effective for "2 to 4 months". It is apparent that natural variations in groundwater level can operate on a time scale far in excess of 2 to 4 months. The effectiveness and appropriateness of such a system is therefore disputed. While the report states that the 11m warning level gives "... at least 3 years lead time before water levels dropped to the critical level of 10m...", it is difficult to accept this as a valid argument when groundwater levels have never dropped to 10m, and the quoted lead time will be significantly reduced by the proposed additional groundwater extraction.

The only event that can reverse groundwater level decline is rainfall/recharge. Therefore, if warning levels are reached, the appropriate management strategy would be to prolong the period during which recharge can occur before the aquifer reaches critical levels. The only practically effective action within human control is restrictions on borefield pumping, but this is not addressed in the report

Alcan have responded to questions concerning issues with rationales which are considered inadequate (see attachments). One proposition advanced was the construction of man-made enhanced recharge works. While in theory artificially increasing recharge would have a beneficial effect on groundwater levels, this has not been addressed in the EIS report. In reality, such works are major undertakings that require capture and storage of alternate water sources (usually surface water or overland flows). Approval of such a scheme would require a separate EIS process, and would almost certainly be prohibitively expensive.

Groundwater Supply Assessment Conclusions

The groundwater supply assessments presented in the EIS are insufficient to demonstrate that the groundwater regime could sustain any significantly increased extraction. It is possible that some of the supplementary information that was requested but not provided by Alcan would further influence any increased usage. The fundamental cause of concern is the current lack of basic data on which to base an assessment.

The proposed increase in usage may be sustainable. However extensive investigation, monitoring and additional assessment would be required to demonstrate this with an acceptable degree of certainty. Approval of an increase to 14,000ML/annum based on the current information would carry a risk of over-usage of the resource.

Where similar situations have arisen in Australian states, agencies have sometimes granted provisional approvals in acknowledgment of the importance of a major project in relation to the potential risks to groundwater. In such cases, provisional approvals have included conditions such as remediation of existing groundwater contamination, significant investigation and monitoring requirements, strict management plans/strategies, and commitments to measurable water demand reduction and/or recycling strategies. Such conditions may even be appropriate to increase extraction from current levels to the existing 12,000ML/annum limit considering the significant volume of groundwater this represents. If successful, conditional water demand reduction and/or recycling strategies may obviate the need for any increase over the current licensed limit. Alternatively, the results of ongoing

investigations and monitoring may prove sufficient to demonstrate the sustainability of increasing the limit to 14,000ML/annum, but if not, the proposed increase would be shown to be inappropriate.

Attachments Supplementary Information Requested by NLC and Alcan Responses

General

Issue	Alcan Response
Please provide updated page 7.2 with appropriate text substituted for "***"	Words are the following: • Implications • Impact

It is agreed that the current level of aquifer geometry and recharge data are a significant impediment to the construction of a defendably robust model, and that further studies should be undertaken to refine these model inputs. The need for better geological and groundwater level control is of particular concern. However, the modelling used to justify the proposed increase in usage steady state, and therefore did not even take into account temporal variation in the major control on recharge (i.e. rainfall). It is therefore suggested that there is an amount of more basic model refinement that should be included in the "Investigation Requirements" section.

Base Data and Modelling Approach

Issue	Alcan Response
What is the cause of large changes in groundwater levels shown in the latter portions of Appendix A hydrographs for O4, OB12 and OB16?	The sudden and large increase in SWLs in these and other observation wells is due to the significant rainfall event, which occurred in April 1999. The erratic fluctuation of SWLs, which continues in OB4 since that event, probably reflects silt-up of these bores. Historically, cleaning out bores that have exhibited erratic SWLs has eliminated this type of response. Regardless, it seems that the SWL for OB4 has stabilised by Feb 2002.

The variation in recharge response between these and other monitoring bores has not been discussed in the conceptualisation component of the report, and does not appear to have been considered either in the assessment of spatial recharge variability, nor its application to the model.

Issue	Alcan Response
Sec. 4.4.2 states that the saturated part of Layer 1 is approximately 30 m thick, however the presented cross section (Figure 10) indicates a minimum thickness of approximately 45 m – please clarify	It should have been stated that the minimum saturated thickness of Layer 1 was 30 m ("pump intake level") as shown on typical well-field cross-section. The 45-m-thick saturated Layer 1 in Figure 10 corresponds to the assumed water table position as shown on typical well-field cross-section).

To undertake an assessment of this scale and high degree of specific outcomes, with no geological or groundwater level control (investigation bores) in the major area of impact would not normally be considered an adequate level of scientific rigor. Relatively minor variations from the adopted assumptions could invalidate the assessment findings. At the very least, some form of sensitivity analysis to test possible outcomes over a reasonable range of input parameters would normally be required to assess the potential risk of the assumed parameters.

Issue	Alcan Response
While not explicitly stated, it is assumed based on the conceptual discussion that groundwater extraction was simulated from Layer 2 only – please confirm	Refer Table 2, Pumping Wells – Input
On what basis was interaction between the modelled layers assigned? What roles do layers 3 and 4 play in the simulations?	According to our understanding of the geology and hydrogeology of the area the aquifer system comprises several hydraulically connected units of various permeabilities. Upper units were assumed to recharge directly from rainfall infiltration in the areas of outcrop, lower units - by the leakage from the upper units. The aquifer system was assumed to discharge into surface waters (such as Yirrkala Lagoon), via pumpage and offshore. Layers 3 and 4 represent the lower portion of the aquifer system. This portion, though less permeable, could not be assumed to represent no flow boundary in the model.
The report discusses hydraulic parameters applicable to the production zones of the aquifer, corresponding with Layer 2. Please present information relating to the range of input hydraulic parameters ultimately adopted for the numerical model for all layers, and an explanation of how these were derived/assigned	Refer Table 2, Hydraulic Parameters. Based on pumping tests and background information (refer Section 3 31).

The above issues relate to whether the model appropriately simulates the extraction of groundwater from the aquifer system. A major concern is that layers 3 and 4 have been simulated as commandable aquifers. As there is no groundwater monitoring of these aquifers, there is no way of calibrating their actual response against model outputs. Yet, they have been simulated as confined/unconfined aquifers. In effect, when groundwater heads are lowered in the major aquifer (Layer2), Layers 3 and 4 can contribute to the volume of groundwater extracted through upward leakage. No data has been presented to justify making such an assumption. Depending on the level of assumed confinement, the model could, in effect, be harvesting groundwater throughflow that in reality discharges to sea, thereby overestimating the amount of groundwater available, and underestimating the actual impact on the groundwater regime and environmental discharges. The statement that these layers could not be assumed to represent a no flow boundary is contested. In the absence of sufficient evidence to suggest otherwise, an appropriately conservative approach would be to exclude the lower layers from the model.

Steady State Calibration

Issue	**Alcan Response**
Please present a revised Figure 11 calibration correlation including observed and simulated values for the NT Government RN bores	The RLs for these bores were not available. Only Water levels were available for RN030042, 030044 & 030045. Surface elevations are accurate to only +/- 5m, which was not considered sufficiently accurate for inclusion in the model.

Considering the resources obviously made available to the compilation of the EIS, surveying of these bores would appear to be a relatively minor undertaking given that they are the only monitoring points to the south and east of the proposed borefield expansion. The steady state 'calibration' to the south of the existing borefield is speculative at best given that there are no observed groundwater levels against which to compare model results.

Transient Calibration

Issue	**Alcan Response**
Were recharge rates and simulated groundwater pumping varied to match the wet/dry season variations discussed in the report?	The pumping rate for each bore is not subject to wet/dry season variation. Rather, the total pumping rate of the wellfield varies only due to town usage, and this is not a big percentage (though it is growing). The greatest use of groundwater is for mine processes, which varies seasonally only due to variations of dust suppression and water reclamation. Therefore, average annual pumping rates were used for each year (Sec.4.4.3) (insufficient data to define pumping rates on a scale smaller than annual averages, time constraints prevented using smaller stress periods which would require longer

Issue	Alcan Response
	simulations)

Figure 5 clearly demonstrates significant variation in borefield discharge, both on a seasonal basis and between years. To claim insufficient data appears inadequate for the purpose of this EIS. In addition, to justify not simulating discharge variation on the basis that it would require longer simulations is a nonsense given the relatively basic model described in the EIS compared to modern computing capabilities. In addition, the response does not address the issue of recharge variation.

Issue	Alcan Response
Groundwater level information presented for OB1 and OB18 in Figure 12 appears to be in error. Actual observed groundwater levels presented in the Appendix and Figure 4 indicate that OB1 varies between approximately RL10m and RL18m, however the transient calibration comparison shows observed levels varying between approximately 14m and 25m head, indicating a discrepancy in both range and actual head levels. Similarly, observed groundwater levels for OB18 presented in the Appendix vary between approximately RL12.5m and RL22m, however Figure 12 shows heads varying between about 10m and 18m head. Please provide a comparison using appropriate groundwater levels	Figure 12 was inadvertently mis-labelled: plots marked as actual/predicted OB18 are actually plots of results for OB1; while plots marked actual/predicted OB1 are actually results for OB8.
Please also provide hydrographs of the actual versus transient calibration simulated groundwater levels for the remaining observation bores	*This can be supplied, however, the plots presented were selected on the basis that they represented the spatial range observed.*

While the assertion that the plots "represented the spatial range observed", there is simply no data presented to back these claims. A level of doubt must be assumed when only 2 out of 17 calibration points are presented, and even these are shown to be for the wrong bores. If the steady state calibration is used as a guide, OB1 achieved the highest correlation between observed and modelled results, and approximately half of the calibration bores exhibited poorer calibration results than OB8. It is reasonable, then, to question the validity of the transient calibration. Although requested, these hydrographs were not supplied.

Predictive Simulations

Issue	Alcan Response
It appears that predictive simulations were undertaken on a steady state basis – please confirm	Yes

There is a significant risk in the application of steady state modelling under the climatic conditions at Gove as it effectively applies average annual borefield extraction and recharge as opposed to simulating the seasonal variations. The main risk factors contributing to the vulnerability of the groundwater regime (and groundwater dependant systems such as Yirrkala Lagoon) coincide at the end of the Dry Season. This is the time of year when 9 months of borefield usage has occurred with little recharge, groundwater extraction is at its maximum, and there is little likelihood of surface flows to augment groundwater discharges.

Given that the preferred Scenario 6 has a safety margin of only 0.4m above the 'critical' level of 10mRL in OB1 (using average annual pumping), the likely result of modelling time variant extraction is depression of groundwater levels below the critical level at the end of a significant number of dry seasons. This is demonstrated by the fact that even at the current relatively low level of pumping (9,200ML/annum average), groundwater levels in OB1 have fallen to (or at least very close to) the 10.4mRL in 4 years out of the 32years of monitoring. The exceedance of the Scenario 6 10.4mRL minimum in OB1 would obviously be far more regular if extraction was increased to the proposed 14,000ML/annum.

Issue	**Alcan Response**
The simulated groundwater discharges to the rivers should be accessible through the water budget/RIVER package of Modflow. Please present comparative discharge volumes for the major watercourses for existing usage, 12,000 ML/a and 14,000 ML/a scenarios	*This can be done, however, due to the lack of sufficient data that would enable defendable calibration, any running of the RIVER package would in our opinion not add to assessing the impacts to the creek/river systems. The assessment on groundwater head change has proven to be a sufficient gauge on base flow.*

It is agreed that there probably is insufficient data on which to defend calibration of RIVER components, and in truth of groundwater levels across the modelling domain. However, the RIVER results are one of the only available means of assessing environmental groundwater discharge impacts of the proposal, either in an absolute or comparative sense. Failure to evaluate environmental discharge implications of the proposal is a failure to address the Terms of Reference for the EIS.

Issue	**Alcan Response**
Notwithstanding the above comments on the predictive simulations presented in the report, the simulation of future conditions on a steady state basis is considered inadequate. This is because steady state simulation basically applies average conditions, and cannot take into account the annual variation in pumping conditions and the variations in rainfall/recharge over the extended time periods which are the major influences on minimum groundwater levels. It is suggested that a more meaningful	Steady state flow conditions were used for predictive scenarios to represent the average conditions over the remaining mine life of about 30 years. Such average conditions were assumed to be acceptable, and conservative for long-term modelling purposes, disregarding climatic changes. Recharge used for the predictive simulations (300 mm/a) was assumed to be conservative, being less than the average annual recharge applied during transient calibration (350 mm/a) which was based on historical

Issue	Alcan Response
approach would be to re-run the transient model over the calibration period at both 12000ML/a and 14000ML/a to give a perspective of how groundwater levels would have been effected at the higher extraction rates compared to the historical results. It is recommended that this assessment be undertaken and presented prior to finalising EIS assessment and that the assessment include: • Variation of pumping rates to account for the annual Wet/Dry cycle; and • Assessment of the transient effect of the scenarios on groundwater discharge to the major watercourses in terms of both volumetric and environmental impacts as per NT Government's guidelines for the EIS.	rainfall).

These issues are, in the main, addressed in previous sections. The recharge rate used for the predictive steady state model runs appears to be the same as that used for the steady state calibration. The likely reason that the recharge rate was increased for the transient calibration is that the transient model simulation simply would not calibrate satisfactorily unless this variation was made.

Other Major Concerns

Issue	Alcan Response
While detailed comments will be provided following the review of supplementary data requested above, the major concern is that model calibrations do not demonstrate a level of accuracy sufficient to give confidence in the prediction of groundwater levels, particularly at key locations such as OB1. The assessment for this particular location is premised on an 11m "warning" level and a 10m "critical" level, therefore requiring a minimum accuracy of 1 m in terms of groundwater head. However, the calibration results demonstrate that the model returns an accuracy of poorer than 1 m for the majority of the time.	Overall steady-state calibration results were considered acceptable. Predicted heads generally matched the majority of bores. For the transient calibration, predicted heads mimicked the observed hydrograph trends rather than matching the absolute water levels. However, where critical and warning levels are concerned (that is, for periods of below-average recharge), the predicted heads were generally within 1m of the observed heads. In addition, predicted heads matched the observed heads more closely during the more recent periods of time, where detailed information was available with regards to pumping regime for individual wells. Such data was not available to enhance the calibration during the early periods of time. Furthermore, for periods of above-average

Issue	Alcan Response
	recharge, higher recharge results in higher natural discharge to streams and offshore.

The inadequacy of the predictive modelling approach has been dealt with previously. Discounting technical inadequacies, the argument against the predictive accuracy of the modelling is reiterated. Alcan's contention (based on the modelling results) is that groundwater levels will not fall below 10.4mRL at OB1 under the preferred Scenario 6 conditions pumping 14,000ML/annum. However, groundwater levels in OB1 have fallen to (or at least very close to) 10.4mRL in 4 years out of the 32years of monitoring when average borefield extraction was only 9,200ML/annum. Groundwater levels will probably fall below 10.4mRL minimum in OB1 far more regularly if extraction is increased to the proposed 14,000ML/annum.

Issue	Alcan Response
The report doesn't address proposed strategies that would be implemented at warning or critical levels, apart from a proposed spearpoint groundwater system to augment flow in Yirrkala Lagoon that would only be effective for "2 to 4 months". It is apparent that natural variations in groundwater level can operate on a time scale far in excess of 2 to 4 months. While the report states that the 11m warning level gives "... at least 3 years lead time before water levels dropped to the critical level of 10m ...", it is difficult to accept this as a valid argument as groundwater levels have never dropped to 10m and the quoted lead time will be significantly reduced by the proposed additional groundwater extraction.	

No response received.

Issue	Alcan Response
The only event that can reverse groundwater level decline is rainfall/recharge. Therefore, if warning levels are reached, the appropriate management strategy would be to prolong the period during which recharge can occur before the aquifer reaches critical levels. The only practically effective action within human control is restrictions on borefield pumping, but this is not addressed in the report	Historical annual rainfall (since 1970) has been less than 800mm (minimum to result in groundwater recharge) only twice, once in 1991 and another in 1997. Also, Bureau of Meteorology predicts that during the next several decades rainfall will increase in this portion of Australia. Because the remaining mine life is only 30 years, it is anticipated that recharge will increase, which will reduce the impact on seasonal water levels in Yirrkala Lagoon. Reduction of pumping is one approach to controlling water levels. However, another

Issue	Alcan Response
	approach would be to increase recharge, such as within the capture zone of the borefield.

Monitoring presented in the report demonstrates that even under the relatively lower historical extraction rates, groundwater levels have approached the adopted critical levels on several occasions despite the consistency of rainfall above recharge thresholds. This situation will only be exacerbated in the context of proposed increased extraction rates. The contended increase in rainfall over the next several decades will be accepted as a scientific basis when the proponent can secure forecast rainfall scenarios from the Bureau of Meteorology. Even under conditions of increased rainfall, it is doubtful if an appreciable increase in recharge will occur as opposed to increased runoff.

Finally, while in theory artificially increasing recharge would have a beneficial effect on groundwater levels, this has not been addressed in the EIS report. In reality, such works are major undertakings requiring capture and storage of alternate water sources (usually surface water). Approval of such a scheme would require a separate EIS process, and would be prohibitively expensive. These arguments are therefore irrelevant in terms of advancing appropriate management strategy.

Chapter 13 - Marine Water and Sediment Quality

General Overview:
The NLC considers that the draft EIS does not adequately consider Aboriginal interests in their land or sea country. The focus of the report is on meeting statutory requirements or National guidelines and justifying current emissions/discharges in terms of these requirements. In view of the extended life of the operation with the proposed expansion it is not unreasonable to expect that Alcan will strive to minimise their emissions/discharges, not just aim to comply with the relevant statutory requirements as the companies commitment to ISO14001 implies. The EIS presents limited data on current water or sediment quality and the data that has been presented is compared against national guidelines, not local reference data.

13.2.2.1 to 13.2.2.4.
A number of scientific investigations are described and commented upon in the NLC's reply to the EIS under sections 13.2.2.1 to 13.2.2.4. However the main findings of a number of these investigations have not been provided to assess the current state of knowledge or impacts

13.3.1 Water Quality Standards
An important component of the ANZECC Water Quality Guidelines is to define the primary management aims, including the environmental values to be protected. It is noted in the EIS that the values to be protected are 'Aquatic Ecosystems, Recreation and Aesthetics'. The framework of ANZECC recognises that there can also be 'cultural and spiritual values' to be protected. However the EIS does not acknowledge that these values exist. In view of the location of the refinery recognition of Aboriginal interests and cultural values in the sea country is critical (this is something we are also striving to have recognised in the Alligators Rivers Region). For example the water may have spiritual significance to the local groups or there

may be sacred sites in close proximity which Aboriginal Owners need to ensure are protected. This may mean striving to keep variations close to background.

The EIS refers to default trigger values in ANZECC but briefly mentions the development of locally applicable triggers by December 2004 (though how these triggers are being derived is not discussed). The ANZECC guidelines provides default trigger values in instances where there is no local biological effects data or local reference site data. It is hard to believe that baseline data or locally derived triggers are not available for a refinery that has operated for such a long period. Given the predicted life of the project (with the expansion) Alcan should be requested to develop these local triggers as a priority and also look at ecotoxicological data for key parameters (eg Arsenic, Aluminium and Vanadium).

Furthermore it appears that the EIS focuses on chemical and physical stressors. Given that the company is relying on default trigger values (which are not tailored to local conditions) it would be recommended that the company perform regular biological monitoring to assess the impact on the ecosystem. Once off surveys (particularly after incidents) would not seem adequate. Furthermore such monitoring may be needed to reassure Traditional Aboriginal Owners that the fish, mussels, oysters etc are not being impacted and are safe to eat.

13.3.2 Sediments

ANZECC 2000 recognises that sediments are important, both as a source and as a sink of dissolved contaminants. Given the nature of contaminants from the refinery outfall (vanadium, arsenic and aluminium) sediment monitoring is considered critical Again such monitoring should be part of a regular monitoring regime, to assess the scale and extent of accumulation of contaminants and its possible remobilisation. Furthermore such monitoring may be needed to reassure Traditional Aboriginal Owners that the fish, mussels, oysters etc are not being impacted and are safe to eat.

13.4.2 Gove Harbour Water Quality

Given the scale and extent of the operation and the predicted life of the project it is unacceptable that the background data is derived from 2 sites which are acknowledged as being impacted by the outfall. A true reference site should be used, not an impacted site. Furthermore only the last five years of data has been included in the development of 'background' data. For a site that has operated for as long as Alcan there needs to be some justification for why it has only reviewed the last 5 years of data.

Also in Table 13.4.1 the median and 95th percentile values for background and refinery outfall have been presented. To undertake a proper assessment the stakeholders should be provided with more statistical information than just the median and 95th percentile. That is, the table should include the number of samples, the mean, standard deviation, minimum, maximum as well as the median. It is hoped (although not stated anywhere) that the full data set has been use to model the effect of the discharge on the harbour. Otherwise the modelling may not include variations in water quality.

13.4.3 Drimmie Arm Water Quality

The EIS states that there were no exceedences of relevant water quality guidelines and metal values were undetectable in water. Firstly it is questionable whether sampling in April-May would detect contaminants which have been discharged intermittently during the wet season. Secondly, water quality should be compared to background, as well as values derived from the ANZECC water quality guidelines.

13.5 Existing Marine Sediment Quality

Using data from 'one-off surveys' to establish background conditions is not considered scientifically robust. However even though the company has collected this data it is not presented anywhere in the report. This data is critical to assess the current and predicted impacts. Furthermore whilst the report acknowledges that arsenic values at one site exceed the ANZECC lower trigger value, there is no further investigation, despite the ANZECC guidelines clearly stating that the next step is to compare to background levels and if repeated to perform bioavailability testing. Given the predicted life of the project efforts need to be made to understanding the outfall plume, the deposition of a number of contaminants and their possible bioavailability. Furthermore it is of concern to read that the within a 700m radius of the refinery outfall the seafloor is blanketed with a layer of flocculant which prevents establishment of benthic macrofauna. Clearly an impact is being sustained and there needs to be some discussion about the long-term implications for this flocculant if the expansion goes ahead.

13.5.2 Drimmie Arm Sediment Quality

The summary of sediment analysis does not indicate how 'elevated' levels of aluminium, arsenic, gallium and vanadium were, nor how much they had 'declined' by 2000. It is unclear whether these levels approached or were above the ANZECC 2000 sediment trigger values or how far above background the results were. This is basic information to assess the impact. Perhaps further monitoring is warranted.

13.7 Impact Assessment

The model predicts that there will be little difference between the impacts caused by the discharges from the existing or expanded refinery. That is the mixing zones will remain very similar to present. As such Alcan believes that there will be a small change in water quality impact. However there is no discussion of the impact of the LOAD of contaminants on the ecosystem. The old saying 'dilution is the solution to pollution' does not recognise that impacts may be chronic or cumulative. Although the EIS states that 'Alcan Gove will manage discharges to minimise the release of metals no matter what their toxicity rating' again the company has compared the predicted water quality with the ANZECC default trigger values. This is inappropriate, as it does not take into account local conditions. Locally derived trigger values need to be developed as a priority.

13.7.2.3 Other Shipping Risks

This section discusses the nature of import and export products and the outcome if there was a spill. Given the history of small spills it would be expected that best practice would be applied to the management of such risks. In particular, the application of the National Plan, as implemented by the Australian Maritime Safety Authority as it applies to the Port of Gove should be examined.

Chapter 14 - Marine Habitats

General Comments

Throughout this section there is mention of the lack of impact on associated fauna in relation to the refinery discharge and refinery marine operational area. However, there is no mention of the potential impact on these areas through recreational use by the construction and expanded permanent workforce. There is also no mention of microscopic fauna or zooplankton and planktontic cycles in the mangrove section, which are of importance to the primary production capability of mangrove ecosystems.

14.2.1, Refinery Outfall

- Querying the relevance of the Hanley, 1993 reference, as the report was never completed, and the Museums and Art Gallery of the NT (MAGNT) never had a copy of the draft lodged with them. Since no copy of this report is publicly available, this is an uncheckable reference.

14.2.2

- Need a definition of "significant' or removal of word.
- Survey report conclusions should be included as an appendix.

14.2.3

- There is no mention on what effect the leak did have, so cannot assess on what terms the recovery included.

14.3.1.1

- Reference required for last sentence.

14.3.1.2

- First paragraph: too general, and the last sentence is very doubtful, so a reference to support this statement should be included.

14.3.2.1,

- Page 14-3. Paragraph 3: only large animals are discussed. Microbiota in sediments should be included.
- Page 14-5. Paragraph 6: "seagrasses...are not considered to be under threat in the region" does not allow for or mention the possibility and associated affects if there are any caustic discharges.
- Some listing of the small fish species should be included.
- No signathids are discussed. These are important occupiers of seagrass habitats, although often difficult to find, and may be detrimentally affected by alterations to the seagrass communities.
- Page 14-6 – Benthic Macrofauna. This section is too general, and the acknowledgment that considerably more work is required on affects of metals on the benthic biota should be included. It is also of concern to read that there is an area of 70ha where no benthic macrofauna are found.

Page 14-9.

- Paragraph 6: In relation to the groundwater discharge "this discharge, which is naturally dark-coloured from the organic materials in the ground ...", this has not been determined, although is probable. This statement requires qualification.

14.3.2.2

- Page 14-8, Mangrove Fauna. Paragraph 1: there is no mention of grapsid crabs in the crustaceans. These should be included, especially as they are such highly visible in this habitat.
- The last sentence of paragraph 1 requires a reference.

- The entire section of mangrove fauna is too brief and is does not mention many important issues. There is no mention of microfauna which are essential to mangrove ecosystem health, and there is no consideration of this system as a nursery habitat for a wide range of fauna.
- Page 14-9, Paragraph 1: Last sentence is too general, as does not discuss the plethora of coral species which colonise this habitat.

14.3.2.3

- The fluted giant clam (*Tridachna squamosa*) is not discussed in the EIS. Although common in the Top End region this genus is placed on the (CITES) list.

14.3.2.4

- Suggest remove or define "significant impact".

14.3.3.2

- There is no mention of elevated Cadmium levels in local rock oysters or the potential health threat to Traditional Owners.

14.4

- There is no mention of the chemical foam AFFF which is stored on the tanker wharf. Standards for this, and potential risks to the marine environment should be included.

14.5.1.2

- In regards to the acknowledged increase in spill risk, existing strategies are discussed as being mentioned in Section 13.7.2.4, the GOVE PLAN. This should be listed also within the Management Plan, and included as an appendix.

14.5.1.3

With increased shipping movements there is a significant threat that introduced marine pests could be introduced via ballast water or on ship hulls. The survey reports a current absence of marine pests. What measures will be put in place to regularly check for and control establishment of marine pests with the expected increase of shipping? In particular, in the case where imports of bauxite shipments are contemplated.

14.5.2

- Suggest remove or define "significant change".

Chapter 15 - Terrestrial Biology

General comments:

Suggest that all *pers comm* references be cited in reference list. Some references made in the document (ie Wilson, 2002; pages 15-20 and 15-23) are not included in the reference list. Fieldwork for both flora and fauna surveys insufficient. A wet season survey should also be undertaken to remove seasonal bias and improve species list.

15.2.5.1, page 15-5.

- Suggest throughout this section, and Appendix E, that "Yunupinu" be replaced by "Yunupingu".
- Suggest throughout this section, and Appendix E, that "Wooranski" be replaced by "Woinarski".

15.2.5.2, page 15-6.

- Current Northern Territory status for the Arenga Palm (*Arenga australasica*) should be cited, and also include Australian conservation plan if there is one

15.2.6.2, page 15-7.

- Paragraph 2: The statement "No Closed Monsoon Rainforest exists within the survey area and therefore this species is not found and not expected to occur within the project area." is insufficient. Such vegetation groups do exist very close to the current mining area, and plants may be affected by the process of mining. There is also no mention whether such communities may be present within the as yet unmined areas of the lease. Also, there is a potential for impact on such communities via the gas pipeline, and this factor should also be taken into consideration within this EIS.
- Suggest that "Riiatjinu" be replaced by "Rirratjingu".

15.2.6.3

- Coastal vine thickets outside of the refinery area are stated as being of moderate conservation value, and adjacent to the RDA as being of low conservation significance. Recent research by Parks and Wildlife Commission of the NT show that fragments of any size are useful for providing habitat.
- Aboriginal Protection Areas: states that neither of these areas will be affected by the expansion project. Consideration of any impact by the temporary construction workforce needs to be allowed, especially in regards to any potential effects from recreational use

15.2.6.4

- The statement "Therefore loss of regional connectivity will not be an issue with the project" is incorrect. Given the plethora of recent research into vegetational connectivity as very important wildlife corridors this statement should be revised (Rankmore and Price 2004).

15.2.7.2

- Rhodes grass (*Chloris gayana*) is listed as an existing weed with concern to further spread, but is deliberately placed within the seed mix for rehabilitation of the minesite. This is inconsistent.

15.2.7.4

- The statement "A visual inspection during the survey did not indicate any obvious sign of stress to the vegetation". It needs to be clarified that the survey was only done during the dry season, when vegetation is not in an active growth phase as it is during the wet season, and that this is when most vegetation will show signs of stress.
- Dust is only discussed in relation to the alumina dust from the refinery operations. No potential adverse effects of the dust from mining is mentioned. This has ramifications for both vegetation and invertebrates.

15.2.7.5

- Monitoring of and a management plan should be discussed/implemented in relation to the caustic from the cooling tower.

15.2.7.6, page 15-11

- Signs of damage – none observed are due to the seasonality bias of the observations. This is acknowledged in the next paragraph, and a wet season observation should be included (for active plant growth period).
- Doley, 2003 is referred to, with the conclusion "that SO_2 injury was very likely to occur to plant species growing in the vicinity of the refinery". However, in the same reference he states that "it is not possible to extrapolate from this data set to indicate which of the many untested species may be particularly sensitive to SO_2", and also that "No direct information is available on the sensitivity of

rainforest species...". Given the mention of the Crow butterfly in Section 15.3.6.2, and the comments regarding this species in this comment, these points should be mentioned.

- Paragraph 5: suggest that "(various authors)" be replaced by actual references.

15.2.8, page 15-12.

- Paragraph 3: quarantine measures for transport out of Gove should be mentioned.

15.3.5.2

- Paragraph 1: the acknowledgment of wet season surveys should be improved further to a recommendation that these be implemented.
- The wood frog (*Rana daemeli*) may be only known through the literature as being in "a few permanent stream locations in the Gove region...suitable habitat for this species is not present on the study area", however, please note the specific comments provided on amphibians, responding to section **15.3.6.2**, as this statement is insufficient.

15.3.5.3

- The fact that 13 species were found, while there has been 75 species recorded from the region highlights the inadequacy of the surveys.

15.3.5.7, page 15-17.

- Paragraph 2: a reference should be included to support statement of low number of feral cats, as anecdotal evidence does not support this statement.
- Mention should be made of the potential increase of spread of the yellow crazy ant with the gas pipeline to Nhulunbuy, in relation to this EIS, and hygene procedures to reduce/prevent further infestations.
- Page 15-18: the final paragraph of the cane toad section discusses that Alcan will adopt appropriate measures from the NT Parliamentary Committee report. Suggest these be listed in the final EIS.

15.3.6.2; Threatened Species

Amphibians

The wood frog is discussed as not known from elsewhere in the NT apart from the Gove area. Local knowledge has them as occurring throughout the Buckingham and Arnhem Bay regions, and in most creeks that discharge into Melville Bay, and are also known as being common in the Cape York region (Morris, *pers comm* 2004). However, no extensive surveys have yet been undertaken to discern the geographical distribution of these frogs (some surveys were conducted in the early 1990's). It appears that they have a limited geographical range in the NT, but are common where they occur. This could have direct implications for the Alcan operation. Although these frogs have not been observed in the Rocky Bay area, as they seem to occur along permanent freshwater flowing rivers, they may occur in the mining lease area and this should be acknowledged. They also may occur within areas where Alcan may want to expand their mining operations. The statement in the EIS "the lack of such habitat within the study area means that it is unlikely that this species would be present" is therefore insufficient. A specific management plan for this species is recommended.

Birds

Appendix E9 is stated as listing 5 near threatened species, and although there are actually 6 listed, these names should be included in the main document. In Brady (2004, PhD thesis) the absence of many species is discussed as possibly due to the bauxite deposit, the local geology or possibly by reduction of grass diversity. The

bauxite and reduction of grass diversity could be directly linked to the mining operation, and as such should be acknowledged. The EIS also comments that of these near threatened species, only one, the bush stone curlew is considered likely to occur within the study area. The study area is only within a section of the actual area of the existing operations, and does not allow for the future mining operational area. "within the study area" is therefore not sufficient information, and the probability of some of these other species occurring within the mining lease area and potential future areas cannot be discounted.

Mammals

The first sentence stating that " two are of particular interest" is particularly Eurocentric, as it is not specified of interest to whom, and although possibly of particular interest scientifically, the remainder are of strong cultural interest to the Traditional Owners of the area. The northern hopping mouse (*Notomys aquilo*) as mentioned in the EIS is classed as vulnerable at the NT and Commonwealth level. Given the difficulty in trapping these animals and the fact that most evidence of their presence is noted via sign (Woinarski, 2001) the fact that they may be present in the area of concern requires particular mention, not taken as lightly as discussed in the last sentence of the section. Another factor not considered within the EIS is that no potential impact on this habitat type is discussed in regards to recreational use (15.3 6.4).

Invertebrates

The Gove Crow Butterfly (*Euploea alcathoe*) is acknowledged as endangered within the EIS. Three cited threats to this species are listed, and it is also mentioned that "given the lack of tall, wet monsoon forest, it is doubtful that this species is present in the study area". This is insufficient information for an EIS, and the bias presented by the seasonality and scope of the survey should be acknowledged. As this genus is highly mobile within its reproductive cycle and tends to be long lived (Sands *pers. comm,* 2004), these further threats/actions should be addressed:

1. Dust settlement on target food plants be monitored. This has direct implications for traditional food resources, especially in regards to nectar quality of flowers (ie native bee requirements and therefore production of honey for Traditional Owners). Dust in these points relates to the mining operation.
2. Dust settlement on vegetation around watercourses be regularly sampled and monitored, especially in regards to young growth. Dust levels may increase the threat to the survival and reproduction of the species.
3. That the target key vegetation as a food source for the butterfly larvae be identified.

Given the fact that very little is known about this endangered species (Sands *pers. comm,* 2004. Wilson, D and Wilson, C *pers comm* 2004), it should be noted that these are only a few points which require further consideration.

15.3.7.3

This section is totally insufficient, and disregards the impact the alumina dust may have already had on the flora and fauna. Because an area "already has poor habitat value" is not addressing the concerns Traditional Owners have in regards to general country health.

15.3.7.5

As discussed previously in regards to habitat fragmentation, that any habitat has value and corridors should be either initiated or expanded upon would be beneficial to wildlife.

15.3.7.6

The report takes the view that the refinery expansion will not effect the distribution and abundance of feral animals within the study area, but fails to recognise that feral animals generally self-recruit into an area, particularly if that area is disturbed by anthropogenic activities such as industrial activity (eg refinery, mine, road corridor and waste treatment) or through urbanism (eg the mine township). The report goes on to say that these risks will be controlled through a regime outlined in the draft fauna management plan. In section 25 the risk controls are linked directly to the existing Environmental Management System (EMS). In **25.4.3.7** Terrestrial Fauna Management Plan a stated objective is "To prevent the spread of fauna pests". However, the report does not recognise that cane toads have recently established a presence in the area (eg at Yirrkala).

The existing EMS has manifestly failed to control spread of the cane toad The company seems to have lost out on an opportunity to demonstrate environmental best practice by being seen to actively control ferals such as the cane toad scourge and create sanctuary or refuge areas (eg in the rehabilitated areas or elsewhere), free of ferals and to help protect against localised extinction of fauna. To date, in terms of feral animal control, the EMS only achieves "ordinary practice".

Chapter 19 – Rehabilitation and Decommissioning

19.3.1 Mine Rehabilitation

Although as listed in this section that there is Yolngu involvement, and that some other species have been requested to be included in that area by the Yolngu, there is no discussion of TO concerns about inappropriate tree species being seeded in the mine area that they have not requested. This should be included. Also, there is the mention that the pasture grasses *Chloris gayana* and *Sorghum almum* fade out due to competition from native vegetation within 4-5 years and also decline in fertility. These points should be clarified, as the data from Wedd (2002 – unpublished Masters Thesis) shows that *Chloris gayana* may decline after 5 years, but is still found persisting through to 26 years after seeding. Declination may also be from other factors (such as fire); there is no reference to support the competition from native species theory. Also, there is no justification on how the decline in fertility has been determined. The comment on the groundwater monitoring has been discussed in an earlier section of this comment. The commitment to ongoing consultations with the traditional owners is commendable

19.3.2.1

Should include the mention that later work (2002) was done by CSIRO.

19.4.1 Refinery Rehabilitation

In regards to the landscaping discussed, it should be made clear that this has been done with exotic species as well as with natives Some of these exotics should not be encouraged within the Alcan operations, as there is potential for weed spread

19.4.2 Refinery Closure Criteria

Query the comment of the return to natural systems in the area, when the initial baseline studies were not undertaken by the original mining company before

operations began. If this is not the case then suggest the appropriate references be included.

19.5 Residue Disposal Area

Does not mention whether issues such as the old scale dumps will be included in the closure plan, or how they will be remediated.

19.5.1 RDA Rehabilitation

There should be included a discussion of the trials for the use of *Vetiver sp.* as to whether there is any concern for the spread of this vetiver grass into the surrounding vegetation by asexual means.

Chapter 20 – Cultural Heritage

General comments: this section is very vague, and does not adequately define the full breadth of the cultural heritage of this region, or define what region is actually under discussion.

20.1 Introduction

No geographical context provided within the overview. This needs to be clarified, especially as this may be pertinent to archaeological sites.

20.2 Historical Context

Significant events pertaining to historical context are not included, such as WWII, and there are errors within this section. The statement "The Gumatj and Rirratjingu are the traditional owners of the land in the area of the Alcan Gove leases" is unadvised. This could be reworded to the fact that these are the two main clans who live on the Alcan Gove lease areas. As per the last two paragraphs of **20.3**, any specific ethnography is unadvised and should be of a more general nature.

The final paragraph discusses permits as being required for recreational purposes. It should be clarified as to the full purpose of these permits, ie recreational areas under the control of Dhimurru require a Dhimurru permit, anyone leaving the Alcan lease area require an NLC permit. Also, the term "private land" as used is incorrect and should be replaced with "Aboriginal Freehold".

There is also no mention of the history of the Yolngu people in regards to the mining operation (for example the bark petition, or the Gove Land Rights Case 1971)

20.3 Local Aboriginal Organisations

It should be clarified in the first paragraph that the *Aboriginal Land Rights Act* transferred Arnhem Land to a Land Trust, not just to Aboriginal people as stated.

The second paragraph fails to include the Art Centre section of the Yirrkala Dhanbul Community Association or the importance of the sales of art work through this association. "Bran Bran" should be replaced with "Birany Birany or Biranybirany" as the correct name.

It also should be noted that the NLC is required by the Commonwealth's ALRA (s.23(1)(d)):

(i) "to negotiate with [Alcan, as the person] having estates or interests in [the escrow Aboriginal land at Gove] with a view to the acquisition of those estates or interests by the [Arnhem Land Aboriginal] Land Trust; and

(ii) "until those estates or interests have been so acquired, to negotiate with those persons with a view to the use by Aboriginals of the land in such manner as may be agreed between the [NLC] and [Alcan]".

20.4 Aboriginal Art and Culture of East Arnhem Land

operations began. If this is not the case then suggest the appropriate references be included.

19.5 Residue Disposal Area

Does not mention whether issues such as the old scale dumps will be included in the closure plan, or how they will be remediated.

19.5.1 RDA Rehabilitation

There should be included a discussion of the trials for the use of *Vetiver sp.* as to whether there is any concern for the spread of this vetiver grass into the surrounding vegetation by asexual means.

Chapter 20 – Cultural Heritage

General comments: this section is very vague, and does not adequately define the full breadth of the cultural heritage of this region, or define what region is actually under discussion.

Provide map. SV

20.1 Introduction

No geographical context provided within the overview. This needs to be clarified, especially as this may be pertinent to archaeological sites.

20.2 Historical Context

Significant events pertaining to historical context are not included, such as WWII, and there are errors within this section. The statement "The Gumatj and Rirratjingu are the traditional owners of the land in the area of the Alcan Gove leases" is unadvised. This could be reworded to the fact that these are the two main clans who live on the Alcan Gove lease areas. As per the last two paragraphs of **20.3**, any specific ethnography is unadvised and should be of a more general nature.

OK.

The final paragraph discusses permits as being required for recreational purposes. It should be clarified as to the full purpose of these permits, ie recreational areas under the control of Dhimurru require a Dhimurru permit, anyone leaving the Alcan lease area require an NLC permit. Also, the term "private land" as used is incorrect and should be replaced with "Aboriginal Freehold". not on lease OK

There is also no mention of the history of the Yolngu people in regards to the mining operation (for example the bark petition, or the Gove Land Rights Case 1971)

20.3 Local Aboriginal Organisations

It should be clarified in the first paragraph that the *Aboriginal Land Rights Act* transferred Arnhem Land to a Land Trust, not just to Aboriginal people as stated.

The second paragraph fails to include the Art Centre section of the Yirrkala Dhanbul Community Association or the importance of the sales of art work through this association. "Bran Bran" should be replaced with "Birany Birany or Biranybirany" as the correct name.

It also should be noted that the NLC is required by the Commonwealth's ALRA (s.23(1)(d)):

(i) "to negotiate with [Alcan, as the person] having estates or interests in [the escrow Aboriginal land at Gove] with a view to the acquisition of those estates or interests by the [Arnhem Land Aboriginal] Land Trust; and

(ii) "until those estates or interests have been so acquired, to negotiate with those persons with a view to the use by Aboriginals of the land in such manner as may be agreed between the [NLC] and [Alcan]"

20.4 Aboriginal Art and Culture of East Arnhem Land

References included in this section are insufficient, as no authorship is provided. Appears highly skewed in relation to art, rather than culture. There is also the concern with the paternalistic/European attitude presented in the "preserving" of Yolngu culture.

20.5 Cross Cultural Relationships

Query relevance of placing this section with the section on "cultural heritage". Perhaps place at end of chapter, to make consistent with what is discussed in the introduction. Community consultation of the traditional owners on the expansion has been insufficient and inadequate from the traditional owners' perspective.

20.6.1

Query relevance of the Register of the National Estate listing as placed in the document, as none of these areas are located within the mine lease region. Perhaps this could be better utilised within the general section on history to describe the breadth of Aboriginal culture in the region.

20.6.2

Although there are no sites on the Register of the National Estate for this area, this does not mean that there are none which could be affected by the expansion. This requires serious reconsideration. A commitment by Alcan to fully assess the archaeological landscape, sites and objects would be essential here. Most of the comments pertaining to this section would perhaps be clarified if the area under discussion for the chapter was properly defined.

There are many errors within this table of Sites of Significance, and many ommissions which are recorded with the Aboriginal Areas Protection Authority (AAPA) of sites within the Alcan lease area. This is a serious oversight and needs to be remedied. These errors include basic ones such as spelling "Dhuma" when it should read "Dhuwa", but are inclusive of incorrect status of sites and locations, and incorrect referencing. Many sites have not been included such as registered shell middens, Macassan sites and ceremony grounds.

20.6.3

The reference for this section is useful, but very out-of-date. As a review of Yolngu culture this is insufficient, but more importantly this section does not provide a comprehensive overview of what may constitute a site of significance.

20.8.1

Same initial comment as per **20.6.2**, there may be sites as yet unrecognised by previous registration, for example shell middens or other archaeological objects/sites. This also requires consideration, as it cannot be safely determined that there will be no affect of impact on areas of cultural significance, which at least are protected under the Commonwealth Heritage Act. It needs to be noted that such sites as discussed above have been registered through the AAPA and that more sites of significance may occur.

Chapter 21 – Social and Community Effects

This chapter does not adequately address many aspects of what the Northern Land Council perceives as important issues for Aboriginal people in this region. For example, whilst Alcan claims to have had widespread consultation over the period of a year, the analysis is lacking in an adequate assessment of the impact of the 30 years of the mine's presence on the relations within the Aboriginal population. Other areas inadequately discussed include the potential for the increased presence of drugs and

the potential for prostitution. A health profile of the Aboriginal population and the adequacy of facilities in this respect, along with an objective evaluation of the mine's effect (ie sexually transmitted diseases, diet, alcoholism) has not been discussed and it is recommended that this be included. Details of relations between local Aboriginal people and the visitors to their land are absent, and without such analysis, the ascertations about potential effects of sudden and huge additions to the transient population for the construction phase are totally misplaced.

Chapter 23 – Community Consultation

Alcan states in the introduction that for the third stage expansion that a comprehensive community consultation program was begun, and that this will continue on through the remaining phases. However, although a Regional Reference Group is listed in the document, there is no discussion of meetings held out in affected communities. With the information that the Northern Land Council has received, it is apparent that the level of consultation between Alcan and the traditional owners and affected communities has not been adequate.

The period allocated for public comment did not allow sufficient time for the Northern Land Council to comprehensively discuss the concerns the EIS raises with the traditional owners. Also, the translation of the executive summary into Yolngu Matha was provided to the Northern Land Council at the start of the public comment period as a draft copy only.

Chapter 24 – Hazard and Risk

This section identifies a risk of persons at the airport being affected by a chlorine release (Scenario 1). The likelihood estimate of sudden and total release has an estimated return period of $1x10^{-5}$/yr ie a one in 100,000 year event How has that figure been derived? Similarly the figures for Scenario 17 is not fully explained. What systems will be put in place to ensure that chlorine vessel and pipe works together with gas installations are engineered to meet required level of public protection?

There are many additional ways of looking at risk, this section has only examined hazard and risk associated with refinery process risk in relation to offsite human health risks. It has not examined environmental risk associated with expanded mine operations, refinery operations and increased shipping and waste disposal.

The Environmental Impact Statement alludes that this is addressed in the draft Environmental Management Plan which is written in reference to ISO 14001 standard. A common criticism of ISO 14001 is that it reviews compliance with an existing EMS, not necessarily risk assessment.

Environmental risk can be determined using AS/NZS Risk Management Standard 4360:1999 rather than limiting risk assessment only to process risk. This approach is supported in current NT guidelines for EIS on gas projects, which calls for an assessment of internal risks to public safety and environmental damage as well as external risks such as natural hazards. AS/NZS HB 203:2000 Environmental Risk Management - Principles and Process should also be used in assessing environmental

risk. The Commonwealth Department of Environment and Heritage now receives reports using this methodology to assess impact of mining and exploration on the environment.

Chapter 25 - Environmental Management Plan

This section regurgitates the various sections of their ISO 14001 EMS and provides draft environmental management plans for construction and expansion phases. The plans are reasonably standard and will need to be checked for compliance during such phases. However several points need to be made:

- There may be some areas (eg shipping) that may warrant individual management plans given previous management practice.
- The draft Expansion EMP for Surface Water has an objective as the 'development of discharge standards to facilitate the protection of environmental values of Melville Bay in accordance with ANZECC 2000'. The development of locally derived trigger values was described in the EIS to be achieved by December 2004, it should not be delayed until the expanded refinery is on line.
- With the Terrestrial Flora Management plan, (**25.4.3.6**), the mention of "significant clearing" needs to be defined. Is this an Alcan term of significance, or a matter of traditional owner significance? How do they intend notifying traditional owners as listed?
- **25.5.3.10/11**, define "non-essential entry".

Appendix E.2

- There are many spelling errors in this section. Being scientific names this is unprofessional, ie *Pandanus spirilis* (should read *spiralis*), *Grevillea pteridiifolia* (should be *pteridifolia*), *Calythrix exstipulata* (should read *Calytrix*) and *Alloeropsis* (should read *Alloteropsis*).

2c.

- Is not consistent with using Aboriginal or English common names after the scientific name, ie "*Buchanania obovata* green plum" should replace "*Buchanania obovata* Munydjutj", as all others are in English.

3.

- "leteritie" should be replaced with "laterite".

3ai.

- "gramineous" should be replaced with "graminaceous".

REFERENCES:

Brady, C. 2004. PhD thesis *"Birds as Indicators of Rehabilitation Success"*.

Morris, Ian. Personal communication. 2004

Rankmore, B.R and Price, O.F. 2004. Effects of Habitat Fragmentation on the Vertebrate Fauna of Tropical Woodlands, Northern Territory. To be published in *"Conservation of Australia's Forest Fauna"* 2nd Edition, Lunney, D (ed), Zoological Society of NSW.

Sands, D. Personal communication. 2004. Honorary Fellow, CSIRO, Queensland.

Wedd, R. 2002. Masters Thesis "*Vegetation Compositional and Structural Changes over 27 Years on the Revegetated Minesite, Nhulunbuy, NT*".

Wilson, C. Personal communication. 2004. Parks and Wildlife Commission of the N.T.

Wilson, D. Personal communication. 2004. Aquagreen.

"Benaim, Pauline"

<Pauline.Benaim@msexchange.pfes .nt.gov.au>

To: "Duchateau, Maria" <Maria.Duchateau@nt.gov.au>

cc:

Subject: NTPFES Response re Alcan Stage 3 EIS

02/04/2004 05:39 PM

Hello Maria

As requested, I provide below comments from NTPFES incorporated in our formal response to Paul Tyrrell -

"I am pleased to provide comment on the draft Environmental Impact Statement (EIS) relating to the third stage expansion of the Alcan Gove Alumina Refinery, as requested in your correspondence dated 19 March 2004.

After reviewing the material, the Divisional Officer responsible for Nhulunbuy, Superintendent Richard Bryson, had an opportunity to meet personally with Mr Rod Johnson from your office to discuss the proposal. From a police perspective a number of 'Disaster Management' issues were identified, particularly in the area of cyclone preparation, as well as contingencies relating to potential oil spills or aircraft emergencies. It is recognised that Alcan management has a strong history in respect of Disaster Management and Planning and police at Nhulunbuy are working with Alcan representatives, through the Local Counter Disaster Committee framework, to address these issues.

In addition to the foregoing, some potential areas of concern relate

to the social impact that a large influx of employees will have on the district during the construction phase, and the potential for flow on impacts on police resources. These concerns may be addressed through the conduct of personnel induction programs that adequately cover Northern Territory legislation, Aboriginal land, recreational permits, sacred site requirements and Aboriginal cultural considerations. Any such program should be complemented by an appropriate employee 'Code of Conduct' developed to assist in defining and regulating employee behaviour. These issues were discussed with Alcan's General Manager of Community Affairs, Mr Klaus Helms, and are currently being addressed.

The comprehensive nature of the EIS, coupled with direct liaison with Alcan representatives, assisted police in identifying the above issues. I am confident that actions currently being undertaken will enable timely contingencies to be developed for the change in operations.

Paul White
Commissioner of Police
CEO, Fire and Emergency Services"

regards

Pauline Benaim
Commissioner's Office
Northern Territory Police, Fire & Emergency Services
Ph: 61-8-89010223
Fax: 61-8-89010216
Email: pauline.benaim@pfes.nt.gov.au

Yirrkala Community Response to Draft Alcan EIS

Introduction.

This is the Yirrkala Dhanbul Community response to the Draft Alcan EIS. It contains comments on both the main report and appendices. We wish to comment that the public consultation period has not been long enough to engage active discussion within the community. With all things related to indigenous affairs, the expectations of non-indigenous time frames are often very difficult to meet, this has proven to be the case with Alcan's EIS.

These documents represent a considerable amount of data that has to be absorbed and then interpreted for the correct understanding; we have not had nearly enough time to do this on our community. The Yolngu version of the EIS was a much-abbreviated summary version, which assisted in the broad comprehension of the proposal to expand, but it was not intended as a document that could be commented upon.

With respect to the statutory time constraint placed on the EIS Proposal we have not had the time to comprehensively understand and comment upon issues to our satisfaction. During the public consultation process all local Yolngu attended a traditional funeral ceremony for a period of four weeks, which effectively limited our consultation time. We request both Government officials and Alcan to accept our late entry on the basis that consultation with traditional owners was undermined by this event. We are aware that Alcan have no statutory obligation to accept this submission, but we hope in the spirit of open communication these issues may be presented to the Alcan executive team.

Yirrkala's Gamarrwa Nuwul Landcare Dept is a department of the Yirrkala Dhanbul Community Association and has worked with local Yolngu people to protect and conserve both their community environmental interests and the specific clan interests in and around Yirrkala. The social kinship that exists in Yolngu society requires that decisions relating to land use and the social impacts brought about by development, are put before affected clans and their men's mothers clan, with whom a caretaker relationship exists on all things related to the estate of the affected clan. With this in mind the public consultation is made more comprehensive, but in this instance we have been unable to adequately consult with the community.

To assist in locating the relevant area of specific comment I have nominated the Volume, Section No and Sub Section No. This will make comprehension of our comments easier and frame our comments in the correct context.

Colin Lane
Project Officer
Mawalan (1) Gamarrwa Nuwul Landcare Dept.

Yirrkala Community Response to Draft Alcan EIS.

Vol 1; Section 4, Expanded Operation.
4.9.6 Construction EHS Environmental Management Plan
The EMP (Environmental Management Plan) covers specific areas and tasks in relation to their overall ability to meet select criteria as a form of protection to that area. The Construction EMP is the first referral to this process and it is noted that upon examination we cannot see in any EMP statement reference to Fire Regime's or Prescribed Burning, which we note may not be wholly appropriate in the Construction phase, but as an environmental consideration it is noted by its absence through out the EMP and the main report.

Reference is made to controlled burning as a guard against wildfire specifically (**Refer to 9.4.2 Contribution to Bush Fire Management**) however burn regimes are not touched upon in any of the environmental considerations through out the entire mine operation, including the revegetated areas and rehabilitation techniques. We believe that fire management at Alcan is overlooked and that trials on specific sites of undisturbed and modified landscapes would prove beneficial in generating greater awareness, and potentially reduce the risk of loss of vegetation through uncontrolled wildfire, with obvious implications to protecting life, property and assets. We would like to discuss these issues further to enhance awareness of both the points of view between Alcan Gove & Yirrkala.

Vol 1; Section 5 Infrastructure. 5.1 Water Supply
Introduction.
There are general concerns on the community in relation to water supply and the effects of seasonal availability on the surrounding creeks, especially Gunyipinya (Yirrkala billabong) and Yirrkala Creek. These concerns are mainly in relation to reduced water levels experienced at Yirrkala in 2001/02 where observations from the community suggested that the water levels were unusually low.

I have referred to a number of sections in relation to this issue as it covers a number of sites and operational tasks, but in most instances the concerns remain much the same.

Vol 1 Section 5; Infrastructure 5.1 Water Supply.
Use of groundwater during Alcan operations and for household use needs further examination and assessment to determine current and projected usage to assess potential impacts to the borefied in the future. It is of great concern to local Yolngu (local Aboriginal population) that during a particularly dry monsoon season in 2002/03 and a time of drought in other areas of Australia, some local springs and creeks in the immediate area of the mine ceased to flow. Some of the Yirrkala elders commented that in their lifetime this had never happened before.

The inference being that the load placed on the regions borefield resource does impact on its capacity, which is finite, which may not initially cause the problem but may exacerbate it during times of low monsoon rainfall.

We would like to see accurate projections of future trends for usage and the known capacity of this shared resource. We note the Aquifer Investigation in Section 7.

We note the assumptions made in the **Appendices Vol 2, Section J Ground Water Supply Report**, which contains the report **Investigation Requirements Section 7, page 7-1** which states, "***a number of key assumptions had to be made"*** which the Yirrkala community would like to see addressed as their concerns about water in the Yirrkala Creek and Gunyipinya billabong are very high. The community are keen to work with Alcan to address these concerns.

Also in Appendices Vol 2, Section J Ground Water Supply Report, which contains the report **Investigation Requirements Section 7, page 7-1** there is direct reference to key data gaps in Section No 2. ***"Recharge variance in mined areas (i.e. no vegetation cover) as compared to rehabilitated and pre-mined areas. This has obvious implications in terms of volume of recharge (recovery) to the aquifer following each dry season."*** Which the community, and specifically the Rirratjingu Clan, have previously voiced concerns about the mining occurring North of the Yirrkala access road and as this paragraph suggests, with no vegetation cover and a modified hydrology through mining, they are concerned about the potential impact on water run off to the Gunyipinya Lagoon and Yirrkala Creek. The clan has sought to protect this culturally sensitive site and it's water resources, through a deputation to the AAPA, who then extended the boundary of the administrative polygon surrounding the billabong and creek, to afford greater protection. Once again the family are most willing to continue working with Alcan to seek a mutual solution in relation to water usage.

We note the reference in Section 5.1.7 (p5-3) Wellfield Demand.
"In order to minimise the extra demand on the aquifer, Alcan Gove will implement a water demand management program ……." We welcome this initiative and ask to be included in ongoing discussions relative to the concerns voiced here. And again in the **Section 5.1.8 Wellfield Modelling** – where the same concern the community has, is raised here, **5.1.81.2 Basis for Assessment – The primary basis for determining if the extraction of additional groundwater from the aquifer is acceptable is it's effect on flows at Yirrkala Lagoon."**

We ask that these points be noted in relation to our shared concern regarding water use. The effect on water levels has two impacts in Yolngu opinion;

- The social impacts on supply, hunting for food and impacts upon the vegetation structure surrounding the billabong and creek.
- The cultural impact on a site registered with AAPA for its cultural values and sensitivity.

We note the reference made in **Vol 1; Section 11. Surface Water, Subsection 11.1 General Climate and Hydrology** which states ***"Mean monthly evaporation exceeds the mean monthly rainfall over most of the dry season resulting in a net water loss from most water body surfaces."***

To control and use this resource wisely there must be greater community participation in methods of reducing water use in all communities.

In Section 5, Main Report: Infrastructure; 5.1.3 Current Water Usage it states, ***" The town (Nhulunbuy) is the major user of buffer capacity as its evening water consumption in the dry season can reduce the town buffer to very low levels which can result in diversion of water away from the refinery."***

It is our opinion that as a locally available resource, the Nhulunbuy population freely uses water, there seems to be some ambiguity about the extent of this resource's capacity. Even with sprinkler bans in place there is little or no information about changing habits regarding water use to assist in water conservation. It may be beneficial for all community members to receive a policy of awareness regarding this resource, which may lead to implementing the use of drippers rather than sprinklers, to be used overnight when evaporation rates are lowest. The excellent drainage around the town means water is quickly removed from the soil profile, and perhaps the recommended use of mulch on gardens will reduce evaporation further which will assist in reducing the overall effects of Nhulunbuy's water usage. We believe community awareness in East Arnhem as a whole can be enhanced for beneficial outcomes.

Vol 1: Section 11. Subsection 11.3.2.3 Solid Residues

This section discusses the residue pumped as thickened mud and sand slurry and as part of the drying process, ***"the waste water leaches to perimeter drains and the residue is solar dried over a period of up to 35 days, after which time the deposited red mud has sufficient density for placement of the next layer."*** There are concerns about the overall stability of the ponds because the monsoon rains may continue to top-up the surface area with ground water, which may then not dry out within 35 days if rain is present. This may then affect the overall compaction of the residue and its relative density.

It is noted that the final or completed ponds will be shaped to be free draining as referred to in this section on Page 11.11, which will hopefully improve rehabilitation, further stabilising the surface and reduce erosion through run-off. Our concerns are that the core may become unstable if unable to dry adequately.

Vol 1: Section 12, 12.2.4.2 Groundwater.

There are a number of concerns in relation to the RDA (Residue Disposal Area) that revolve around two key issues;

- The proximity of Dimbukawuy Rocks to the Red Mud Ponds, RDA;

- The potential for this area to slip if an unusually high rainfall occurs (as happened in April 1999 - 1080mm) that may cause the rocks to be covered and the ensuing environmental damage into Drimmie Arm, Melville Bay and the mangrove area from a water treatment storage pond or residue holding pond.

The concerns are based on this incident in 1999 where run off from the ponds could not get away quickly enough before going over the wall and out into the environment. Alcan states, in **Vol 1: Section 14. Marine Habitats, Subsection 14.2.3 Drimmie Arm, *" as a result of extremely high rainfall, the bund wall was breached to allow the controlled release of stored water from a water storage treatment pond at the Residual Disposal Area (RDA) into Drimmie Arm***." It goes on to say, "***The survey report concluded that there had been a recovery of the benthic*** (bottom) ***organisms and the recovery would continue."*** The EIS describes it as ***a controlled release***, which is a positive spin on what seemed to be an inevitable outcome.

In relation to this event we feel that there could be more analytical data to provide an overview of the extent of environmental damage, and a process of analysis to conclude what exactly is meant by recovery, and to what extent recovery has occurred. This is neither qualified nor quantified.

Dimbukawuy Rocks hold a strong cultural value for Rirratjingu people, *refer to* ***Table 20.6.2****,* listing AAPA sites of significance, and they are concerned that over time the same problem will re-occur, or that the mud being placed into the ponds isn't compacting properly and may slip and breach the pond walls, escaping into Melville Bay. The community members are seeking some assurance that the Dimbukawuy Rock site is not in any danger of being swamped by residue.

We would like to see core samples taken from the earlier ponds to assess the extent of drying and compression so that a determination may be made with reference to the overall structural integrity of all the pond walls to ensure safety mechanisms.

If these areas should fill with groundwater seepage to a point that the pond walls are breached by this build up it is likely that the disposed material will slip into the surrounding environment with an extensive environmental impact. The finished height of the ponds above Melville bay is very significant, given in the data as RL51m, and if the pond walls do fail it could lead to a direct discharge into the bay.

An issue that is apparent is that whilst the drainage systems are currently managed and overseen by Alcan and YBE, any run off should be able to get away relatively easily, but upon completion of the ponds, if regrowth is proven to be successful, then the routine management regime will change and the potential for this area to soak or absorb ground water may lead to the pond core becoming unstable and breaching the walls.

The issue of ***hydraulic loading*** has also been noted, resulting in a changed vegetation structure at the base of pond 6 adjacent to it's external wall on the North East perimeter, seen clearly in **Figure 12.2.1,** which we hope you will continue to monitor as a precursor to other impacts.

We also note the inclusion of the aerial photograph, **Figure 12.2.2 Distribution of Contaminated Groundwater – RDA.** Which greatly assists in the proposed level of transparency, giving rise to greater community discussion and awareness.

Traditional owners are willing to work closely with Alcan in relation to these concerns and are considering approaching AAPA in relation to extending greater protection to these and other cultural sites affected by the expansion. They have indicated a continued open communication style in relation to these issues with Alcan's management team.

Vol 1:Section 14: Marine Habitats, Subsection: Seagrass

It is noted that the, "***densest and most developed seagrass (****Enhalus acoroides****) meadows known in South Eastern Melville Bay are those located in the Northern part of No name Bay.***" Seagrass plays an important role as an important habitat for nursery areas and in providing habitat to a range of species that may also rely on it as a food source. It is with this in mind that we would like to establish the potential importance of the No Name Bay and Creek area that is also in close proximity, downstream of the RDA site. Residue Disposal ponds 6 and 7 are located directly above the creek and any spillage or breach could potentially affect the creek and bay. Please refer also to concerns regarding the future use of the RDA site that may affect these areas.

Vol 1: Section 15: Terrestrial Biology. Subsection 15.2.2 Data Sources.
To establish an analytical research standard it is imperative that the baseline data for these areas is in place. It has been noted for many years that Arnhem Land represents a highly unmodified environment, by most other Australian standards, and has not yet been afforded a comprehensive study to assess its environmental values, ecological diversity or its ecotypes that may have evolved quite differently from surrounding populations Australia wide. It is obvious from the lack of available data that we cannot hope protect what we have if we don't know what we've got or how it interacts with its environment and other species. The sources for biological information are so scant it should be noted that there are still many species and ecological dependencies that are not clearly understood. A request for a major baseline environmental survey has been discussed for many years, but without such a survey in N.E. Arnhem Land, what limited knowledge we have may undermine our capacity to make practical evaluations and prioritise our efforts, towards the objective of a sustained level of environmental care for our natural resources.

An environmental audit is an essential component for a successful management strategy, which Alcan would benefit from, when making projections for the hand back of rehabilitated land and how local people might use that land. This work could be cooperatively arranged through both Federal and Territory governments in association with the managers of East Arnhem's Indigenous Protected areas, Dhimurru and Laynhapuy Homelands. Dhimurru Land Management and Gamarrwa Nuwul Landcare have called for a baseline study of our surrounding ecosystems so that informed decision-making will help us to better manage community lands and resources. We believe that it is everyone's best interest to undertake a methodical appraisal of this area.

The range of data given is minimal; The Draft EIS quotes from only three sources;

- a 1995 survey of fauna at Cape Arnhem as part of an assessment for the Conservation Commission of the N.T.
- Information provided in the 1974 Red Mud Ponds EIS (Dames and Moore) and,
- An assessment of the conservation status of the vegetation of the Australian Tropical Savannah. 2001.

As you can see the information is very limited and needs to be supported by further studies.

Vol 1 Section 15: Terrestrial Biology,
Subsection 15.2.5.1 Vegetation Communities
Dominant Bioregional Vegetation Types

This section discusses the Arnhem Coastal Bioregion and the interaction between its ecosystems and other limiting factors such as soils, nutrients, landform and climate, what we believe is missing from this overview and from the Draft EIS document, is any reference to fire as an agent of change, or as a requirement by some species to propagate, or it's effect on fauna species, especially rodents that may require regular burning to survive. The only reference to fire is as follows; "**Another influence on the structure and floristics of this landscape is fire**." which hardly does the role that fire plays in this region any justice. Fire can play an enormous role in species definition in floral communities, lack of fire can also have a negative impact on vibrant diverse floral communities, producing monoculture climax communities that are dense and devoid of any other species. In this vegetation overview it is clear that Alcan must enter the debate and discuss the role of fire in the area. Not to do so may see them lose valuable rehabilitation completely if young trees are burnt before they set seed.

We ask Alcan to confront the role that fire plays and to undertake trial burns under controlled conditions. Gamarrwa Nuwul Landcare invite Alcan to discuss the options and alternatives of taking action or not taking action. At least then they can make an informed decision. Australian native plants require fire, this is well documented, by burning to a regime that is scientifically sound, Alcan can protect its rehabilitation work and produce valuable ecosystems that will encourage both flora and fauna to adapt to the environment.

Vol 1: Terrestrial Biology 15.2.5.1 Vegetation Communities
Historic Die Back Events
If Cinnamon Fungus (Phytophthora cinnamomi) or Root Rot Fungus (Armillaria spp.) were present in this area to any great degree the risk of being spread by mine operations would be extremely high. It is thought that Phytophthora moves through landscapes transported by moisture, if this is the case the region should be actively investigating this pathogen to assess its presence so that counter measures can be taken to contain its spread. An action plan for the management of Cinnamon Fungus should be put together in a cooperative approach to vegetation management. There are a number of understorey (secondary succession) plants that may act as indicator species for Phytophthora to assist in early detection, if these can be identified and used to compare sites it would greatly assist in the control of this disease. If the plant disease is identified as being here, restrictions should be placed on certain vehicle movements and disturbances reduced at specific sites.

Vol 1: Terrestrial Biology 15.2.5.1 Vegetation Communities, RDA Effects
We have noted the reference to increased groundwater salinity in the vicinity of pond 5. We would like to discuss the implications of factoring this area into the future impact projections, or to discuss what options exist for rehabilitation in the future.

Vol 1 Terrestrial Biology 15.2.5.2 Vegetation Species
The last line in the last paragraph reads, " **the Acacia species (unnamed) may be affected detrimentally by altered fire regimes**." I am unable to assess whether this means too little or too much burning as both conditions have an impact on Acacia spp. and both conditions exist in Arnhem Land concurrently. Plant communities require a fire management strategy that has an impact study to determine a successful recovery plan.

Vol 1 Terrestrial Biology Section 15
Subsection 15.2.7.2 Weeds Pests and Fire
The local Miwatj Regional Weed Committee have produced a regional list of prohibited weeds and named, for priority control, locally threatening processes created by certain species. This may be incorporated into the EMP.

This paragraph also mentions existing fire regimes, which I believe must refer to the practice of burning off on clan estates in the vicinity of the Gove Peninsular. It is a continuing concern to elders at Yirrkala who have commented upon unseasonal or non-traditional burning practices as being detrimental to the structure of open woodland savannahs and other floristic communities. These concerns extend to unauthorised burning by some Yolngu who take it upon them selves to burn areas they cannot speak for. It would be beneficial for Alcan and the community to discuss burn regimes to get an understanding of each other's values.

Vol 1 Terrestrial Biology Section 15
Subsection 15.2.8 Management.
In relation to **"*all vegetation to be removed being chipped and used in mulch in landscaping,"*** It is not advisable to chip plants that have seed stock or plants that regrowth vegetatively, such as Alternanthera sp. due to the potential for portability of the seed stock and vegetation into undisturbed areas.

Also the weed management strategy might reflect the recommendations of the Miwatj Regional Weeds Committee, which Alcan has a representative in attendance at their meetings.

Vol 1: Section 16 Terrain and Soils
Subsection 16.4.5 Erosion Potential
The concern for erosion within the RDA as mentioned earlier stems from observations such as**, "** ***The lands of the Northern Tropical Region are prone to erosion due to high intensity rainfall events during the summer period (wet season) and the inherent erodibility of some of the soil landscapes.*****'**

According to a Dept of Defence GIS (Geographic Information Systems) data set Arnhem Polygons GDA94 Zone 53 the RDA falls into the following categories in land system analysis: Flood Risk; High, Depth; Low, Drainage; High, Erosion factor 3; High, Erosion 7; High with a high incidence and or susceptibility due to flooding. Land system; littoral, Soil; HY soil characteristics poor drainage. I realise that this data relates to natural land systems, but it is an indicator of the overall values of land characteristics and risk factors. It is for this reason we have asked for core samples in the RDA area to assess the integrity of the finished ponds and their ability to withstand both surface water absorption and erosion.

We have noted the following statement; " ***In the residue disposal area, minor erosion of the external pond embankments has occurred locally and some sheet and gully erosion has occurred ……..***" The ponds have erosion both internally and externally which we understand is not regarded as high risk at the moment, but this is indicative of the overall susceptibility to erosion that we have concerns about in relation to the RDA ponds. Wave action and run off have combined to form gully erosion on the internal walls of pond 6, this indicates that a problem does exist, which we believe warrants further inspection or analysis.

Vol 1: Section 16 Terrain and Soil
Subsection 16.5 Seismicity 16.5.1 Earthquake History
Community members have indicated that earth tremors have been felt at Yirrkala, but the low density of seismographs makes this difficult to assess. In relation to the concerns raised regarding the RDA, earthquake or tremors may add a level of uncertainty to the concerns raised by family members.

Vol 1 Section 19 Rehabilitation and Decommissioning
Subsection, Rehabilitation and Closure Standards,
Develop Beneficial Landscapes –Many community members have opinions based on the lack of fire regime in the mine rehabilitation area, mainly due to their concern that the fuel loads in this area are very high (esp. close to Yirrkala) but these concerns need to be quantified by establishing a range of environmental fire regime parameters which can be discussed with the community directly. One recurring comment has been that without fire the landscape will overgrow until an event occurs that sees the fuel levels used in what could be a wildfire situation. Community members are willing to discuss these issues openly with Alcan's management team.

Vol 1 Section 19 Rehabilitation and Decommissioning
Subsection 19.3.1 Mine Rehabilitation
When considering rehabilitation planning, we believe that ***Species Mix*** can be greatly determined by fire regime (frequency and intensity) amongst other elements that is integral to the overall management of any landscape in Australia today. Fire Management falls into three main categories; Suppression, Protection and Ecological burning. Suppression works include fire trails to reduce spread and burning off to reduce fuel loads, Prescribed Burns are for Public protection and asset protection though fuel reduction, Ecologically Controlled Burns are to promote environmental diversity and to stimulate habitat requirements for fauna such as small mammals. Finally wildfires are the uncontrolled elements when fuel loads are too high and the climate dictates what happens. A tropical open woodland savannah will have a set fuel load that is the target to prevent wildfire damage; fuel reduction burning will help manage these targets. We believe Alcan should develop a Fire protection Plan for it's entire lease area.

Vol 1 Section 19 Rehabilitation and Decommissioning
Subsection 19.3.2.1 Natural Vegetation
Refer to Self Sustaining Native Vegetation and compatibility issues. Is the species mix different to the natural environment, what Alcan should aim for is the species mix and structure with relatively close densities to those areas adjacent to the mine site to create a seamless connection in ecological boundaries.

Of concern is the reference to "***higher indices than the control site, which is due to the exclusion of fire."*** It is a concern because there are two main reasons that open woodland savannahs lack greater diversity;

1. As stated, the fire regime in the native area may be too frequent and understorey species are kept to a minimum, which aids hunting and gathering processes. It is debatable what the traditional regimes were, as much social protocol was observed before burning took place (Banduk Marika, pers comment) and burning was carried out for many more reasons than just hunting.

2. The unburnt area will be diverse up to a point if it remans unburned. Eventually it will become a climax community with one or two dominant species in the overstorey, but when a fire does strike, either naturally through lightning as in 2002, or by a deliberate act, the fire will be so intense that the risk to all of the flora and fauna in these areas will be very high. The intensity of the burn will determine what species returns after the fire. Many of the understorey species will be killed and may not return through seed strike.

If Alcan wishes to leave a self-sustaining native environment, it must consider the eventual impact of fire on the mine rehabilitation site and what type of fire regime is optimal for this area, be it native or rehabilitated land.

Vol 1 Section 19 Rehabilitation and Decommissioning
Subsection 19.5.1 RDA Rehabilitation
It is noted that the development of Rehabilitation at the RDA site is still ongoing and developmental. "***The optimal rehabilitation strategies for the area are yet to be decided***" (Page 19.10) but without rehabilitation at the two earlier pond sites (***Northern and Taylor's Pond Fig 12.2.2***) it is still an unknown what level of success may be achieved. We believe that the lack of proven rehabilitation techniques at the RDA sites may mean a definitive assessment of the overall effectiveness in the area. It is felt that the rehabilitation will be crucial to this areas ongoing stability, and that to prevent erosion or structural breakdown the ground coverage will play an important role.

It also noted "***the Pond 5 batter slopes are too steep for long term protection against erosion with the existing vegetated surface."***

Vol 1: Section 20. Cultural Heritage. Subsection 20.6.3.2
The area around the outfall for hot water is known locally as Bukbukbuy, it is Djapu Clan country and several members of the community believe that this area is culturally sensitive, and have asked to have it included as a site for further examination. As yet the Djapu mala elders have not been available for comment, but I am advised that they would be interested in promoting discussion about this area. Refer also to the table provided on page 20-8, **20.6.2**, listing sites of significance. It is noted that this site is not listed within the confines of the AAPA (Aboriginal Areas Consultative Committee) but from experience I have found that information regarding sites can be deliberately suppressed to enable a degree of protection, without drawing attention to the site. This may be the case in this instance; the Djapu landowners will determine the best course of action if wishing to pursue greater protection or promote awareness, in consultation with Alcan's management team.

Vol 1: Section 20. Cultural Heritage. Subsection 20.6.3.2
The Banyan Tree Rripipi
Community members have asked that the Banyan Tree (Ficus virens) located in the refinery be added to the AAPA Site register. They are willing to discuss this issue with the Alcan management team.

Vol 1: Section 21 Social and Community Effects

Whilst it is noted that Alcan have no jurisdiction in the definition of our regional and local demographic, we believe it would be remiss not to point out what we believe are inaccuracies in this projection. If the ABS believes that they have defined the figures at Yirrkala accurately, then they need to reassess their methodology.

The figures used from the 1996 and 2001 ABS Census are inaccurate when defining indigenous demographics. In the ***table 21.4.1,*** The overall demographic profile for East Arnhem is given as the percentage of unemployed people aged 15 to 64 which is given as 4.2% of the total labour force, which is calculated to be (69% of 13136) 9064 therefore 4.2% of 9064 is 380 unemployed people in East Arnhem. This figure would be reached at Yirrkala.

It is interesting to note the reference at the base of page 21-4, # 4 says that the source of employment statistics treats all people participating in CDEP as being in employment. Whilst this may be politically expedient to portray CDEP as employment, the reality is these are amongst the poorest people in the region, and it is definitely not employment. All this does is hide the true extent of the employment problems on indigenous communities.

The Yirrkala Demographic is also unreliable. Giving our population as 648 when it is closer to 1000 by Yirrkala Dhanbul estimates, and our total indigenous population is given as 493, which is inaccurate. Our total unemployed was 8% (31) being those people over 15 actively looking for work. Accordingly we had 0% of our community living in an improvised home, sleep out or tent; they obviously did not visit Rangi or Beach Camp, as it is also known, where families have lived in tents for over 5 years to my knowledge.

I believe that the ABS do not comprehend the way that indigenous communities subsist and move amongst family groups, homelands and houses, fitting in where they can, they are not as sedentary as our society and therefore less able to be pinned down during the census. The projections used for the 2001 census needs to be reviewed and if using these figures to determine resources or logistical support, then the outcomes will be off target and Alcan must take this into consideration when dealing specifically with indigenous interests and outcomes.

Ms Banduk Marika & Colin Lane
Coordinator & Project Officer
Mawalan (1) Gamarrwa Nuwul Landcare Dept
Yirrkala Dhanbul Community Association
Tel 08 8987 3237 Fax 08 8987 2304

Summary of Yirrkala's Community Submission: Alcan Gove Draft EIS Statement

This document summarise the major points of concern for ease of reference.

Vol 1; Section 4, Expanded Operation.
4.9.6 Construction EHS Environmental Management Plan
We cannot see in any EMP statement, reference to Fire Regime's or Prescribed Burning. Burn regimes are not touched upon in any of the environmental considerations through out the entire mine operation, including the revegetated areas and rehabilitation techniques.

Vol 1; Section 5 Infrastructure. 5.1 Water Supply
Introduction.
These concerns are mainly in relation to reduced water levels experienced at Yirrkala in 2001/02 where observations from the community suggested that the water levels were unusually low.

Vol 1 Section 5; Infrastructure 5.1 Water Supply.
The inference that the load placed on the regions borefield resource does impact on its capacity, which is finite, which may not initially cause the problem but may exacerbate it during times of low monsoon rainfall. The Rirratjingu Clan, have previously voiced concerns about the mining occurring North of the Yirrkala access road and as this paragraph suggests, with no vegetation cover and a modified hydrology through mining, they are concerned about the potential impact on water run off to the Gunyipinya Lagoon and Yirrkala Creek.

5.1.81.2 Basis for Assessment – The primary basis for determining if the extraction of additional groundwater from the aquifer is acceptable is it's effect on flows at Yirrkala Lagoon."

We ask that these points be noted in relation to our shared concern regarding water use. The effect on water levels has two impacts in Yolngu opinion;

- The social impacts on supply, hunting for food and impacts upon the vegetation structure surrounding the billabong and creek.
- The cultural impact on a site registered with AAPA for its cultural values and sensitivity.

Section 5, Main Report: Infrastructure; 5.1.3 Current Water Usage
It is our opinion that as a locally available resource, the Nhulunbuy population freely uses water, there seems to be some ambiguity about the extent of this resource's capacity.

Summary of Yirrkala Community Comments re Draft EIS – Alcan Gove 2

Vol 1: Section 11. Subsection 11.3.2.3 Solid Residues
There are concerns about the overall stability of the ponds because the monsoon rains may continue to top-up the surface area with ground water, which may then not dry out within 35 days if rain is present. This may then affect the overall compaction of the residue and its relative density.

Vol 1: Section 12, 12.2.4.2 Groundwater.
There are a number of concerns in relation to the RDA (Residue Disposal Area) that revolve around two key issues;

- The proximity of Dimbukawuy Rocks to the Red Mud Ponds, RDA;
- The potential for this area to slip if an unusually high rainfall occurs (as happened in April 1999 - 1080mm) that may cause the rocks to be covered and the ensuing environmental damage into Drimmie Arm, Melville Bay and the mangrove area from a water treatment storage pond or residue holding pond.

The issue of ***hydraulic loading*** has also been noted, resulting in a changed vegetation structure at the base of pond 6 adjacent to it's external wall on the North East perimeter, seen clearly in **Figure 12.2.1,** which we hope you will continue to monitor as a precursor to other impacts.

Vol 1:Section 14: Marine Habitats, Subsection: Seagrass
We would like to establish the potential importance of the No Name Bay and Creek area that is also in close proximity, downstream of the RDA site. Residue Disposal ponds 6 and 7 are located directly above the creek and any spillage or breach could potentially affect the creek and bay.

Vol 1: Section 15: Terrestrial Biology. Subsection 15.2.2 Data Sources.
The range of data given is minimal; The Draft EIS quotes from only three sources; The sources for biological information are so scant it should be noted that there are still many species and ecological dependencies that are not clearly understood.

Vol 1 Section 15: Terrestrial Biology,
Subsection 15.2.5.1 Vegetation Communities
Dominant Bioregional Vegetation Types
We believe what is missing from this overview and from the Draft EIS document, is any reference to fire as an agent of change, or as a requirement by some species to propagate, or it's effect on fauna species, especially rodents that may require regular burning to survive. We ask Alcan to confront the role that fire plays and to undertake trial burns under controlled conditions. Gamarrwa Nuwul Landcare invite Alcan to discuss the options and alternatives of taking action or not taking action.

Summary of Yirrkala Community Comments re Draft EIS – Alcan Gove 3

Vol 1: Terrestrial Biology 15.2.5.1 Vegetation Communities
Historic Die Back Events
An action plan for the management of Cinnamon Fungus should be put together in a cooperative approach to vegetation management.

Vol 1: Terrestrial Biology 15.2.5.1 Vegetation Communities, RDA Effects
We have noted the reference to increased groundwater salinity in the vicinity of pond 5. We would like to discuss the implications of factoring this area into the future impact projections, or to discuss what options exist for rehabilitation in the future.

Vol 1 Terrestrial Biology 15.2.5.2 Vegetation Species
The last line in the last paragraph reads, " **the Acacia species (unnamed) may be affected detrimentally by altered fire regimes**." Too much or too little burning?

Vol 1 Terrestrial Biology Section 15
Subsection 15.2.7.2 Weeds Pests and Fire
The local Miwatj Regional Weed Committee have produced a regional list of prohibited weeds and named, for priority control, locally threatening processes created by certain species. This may be incorporated into the EMP.

Vol 1 Terrestrial Biology Section 15
Subsection 15.2.8 Management.
It is not advisable to chip plants that have seed stock or plants that regrowth vegetatively, such as Alternanthera sp. due to the potential for portability of the seed stock and vegetation into undisturbed areas.

Vol 1: Section 16 Terrain and Soils
Subsection 16.4.5 Erosion Potential
The concern for erosion within the RDA as mentioned earlier stems from observations such as**, " *The lands of the Northern Tropical Region are prone to erosion due to high intensity rainfall events during the summer period (wet season) and the inherent erodibility of some of the soil landscapes.*'**

It is for this reason we have asked for core samples in the RDA area to assess the integrity of the finished ponds and their ability to withstand both surface water absorption and erosion.

Vol 1: Section 16 Terrain and Soil
Subsection 16.5 Seismicity 16.5.1 Earthquake History
Community members have indicated that earth tremors have been felt at Yirrkala, but the low density of seismographs makes this difficult to assess. In relation to the concerns raised regarding the RDA, earthquake or tremors may add a level of uncertainty to the concerns raised by family members.

Summary of Yirrkala Community Comments re Draft EIS – Alcan Gove 4

Vol 1 Section 19 Rehabilitation and Decommissioning
Subsection, Rehabilitation and Closure Standards,
Develop Beneficial Landscapes –Many community members have opinions based on the lack of fire regime in the mine rehabilitation area, mainly due to their concern that the fuel loads in this area are very high (esp. close to Yirrkala)

Vol 1 Section 19 Rehabilitation and Decommissioning
Subsection 19.3.1 Mine Rehabilitation
A tropical open woodland savannah will have a set fuel load that is the target to prevent wildfire damage; fuel reduction burning will help manage these targets. We believe Alcan should develop a Fire protection Plan for it's entire lease area.

Vol 1 Section 19 Rehabilitation and Decommissioning
Subsection 19.3.2.1 Natural Vegetation
Refer to Self Sustaining Native Vegetation and compatibility issues. What Alcan should aim for is the species mix and structure with relatively close densities to those areas adjacent to the mine site to create a seamless connection in ecological boundaries.

Of concern is the reference to "***higher indices than the control site, which is due to the exclusion of fire."*** It is a concern because there are two main reasons that open woodland savannahs lack greater diversity;

Vol 1 Section 19 Rehabilitation and Decommissioning
Subsection 19.5.1 RDA Rehabilitation
It is noted that the development of Rehabilitation at the RDA site is still ongoing and developmental. It is felt that the rehabilitation will be crucial to this areas ongoing stability, and that to prevent erosion or structural breakdown the ground coverage will play an important role.

Vol 1: Section 20. Cultural Heritage. Subsection 20.6.3.2
The area around the outfall for hot water is known locally as Bukbukbuy, it is Djapu Clan country and several members of the community believe that this area is culturally sensitive, and have asked to have it included as a site for further examination.

Vol 1: Section 20. Cultural Heritage. Subsection 20.6.3.2
The Banyan Tree Rripipi
Community members have asked that the Banyan Tree (Ficus virens) located in the refinery be added to the AAPA Site register.

Vol 1: Section 21 Social and Community Effects
Whilst it is noted that Alcan have no jurisdiction in the definition of our regional and local demographic, we believe it would be remiss not to point out what we believe are inaccuracies in this projection.

Colin Lane Yirrkala Dhanbul Community Assoc. 08 8987 3237

Dhimurru Land Management Aboriginal Corporation
PO Box 1551 Nhulunbuy Northern Territory 0881
Phone: (08) 8987 3992 Fax: (08) 8987 3224
Web: www.dhimurru.com.au
E-mail: dhimurru@dhimurru.com.au
ABN: 95 520 121 809

April 1, 2004 Our Ref: 0315slr0335ltr

Mr Rod Johnson
Office of Environment and Heritage
GPO Box 1680
Darwin NT 0801

Dear Mr Johnson

Re: EIS Alcan Gove Expansion

The following provides comment on the Draft Environmental Impact Statement for Alcan Gove's proposal to expand Alcan's bauxite mining and alumina processing facilities on the Gove Peninsula North East Arnhem Land.

Dhimurru has a number of concerns regarding the impact of the proposed expansion on the operations of Dhimurru and the areas managed by Dhimurru. In this submission, following a short statement regarding Dhimurru's role in the region, we concentrate on key issues affecting Dhimurru or of concern to Dhimurru's members. Dhimurru is relying on the efforts of the Northern Land Council in particular to provide a comprehensive statement regarding the proposal on behalf of Yol\u affected.

Dhimurru Land Management Aboriginal Corporation

Dhimurru Land Management Aboriginal Corporation is a community based Aboriginal organisation with membership drawn from 13 Yol\u clans with interests in or estates on the Gove Peninsula. Dhimurru was established in September 1992 charged with responsibility for managing environmental impacts primarily arising from recreational access to Yol\u land on the Peninsula. Dhimurru's charter and vision statement also tasks Dhimurru to promote Yol\u culture, Yol\u ecological, land and sea management expertise and facilitate Yol\u access and management practices. Dhimurru has adopted a "both ways" approach to actioning its objectives. Under the direction of Yol\u landowners, managers, and custodians Dhimurru seeks to engage

effectively with partner organisations to bring appropriate expertise and resources together to address issues.

Dhimurru is identified as the Yol\u landowners land and sea management agency in agreements involving the Commonwealth (Environment Australia), the Northern Territory Government (Parks and Wildlife Service), and the Northern Land Council. In October 2000 Yol\u landowners declared the Dhimurru Indigenous Protected Area covering the Gove Peninsula. In making this declaration the landowners also adopted a Plan of Management consistent with the requirements for declaration and confirming their intention to manage the area in accordance with IUCN Guidelines for Protected Area Management – Category 5. The Dhimurru IPA does not include the mine, refinery, or town lease areas however these areas are all within the boundaries of the IPA.

One of the principle mechanisms employed by Dhimurru to manage recreational impacts on the Dhimurru IPA has been the implementation of a permit system. Dhimurru issues permits and enforces permit requirements through a delegation from the Northern Land Council in accordance with provisions of the *Aboriginal Land Act 1979*. The permit system enables landowners to inform *apaki* (non *Yol\u*) about cultural and environmental concerns, designate areas to be made available for \apaki to recreate and regulate the number of \apaki utilising those areas. It also provides for the adoption and enforcement of conditions to encourage appropriate attitudes and behaviour when people are on Aboriginal land. Dhimurru is also responsible for patrolling and maintaining designated recreation areas and ensuring that Yol\u landowners, managers, and custodian's interests and requirements are met.

Comments on the EIS

1. The Guidelines for the EIS required the proponent to prepare an Environmental Management Plan (EMP). The EMP is required to address a number of key issues including management of off-site areas impacted by the project. Dhimurru understood this to include areas impacted by the recreational activities of Alcan employees and support personnel as well as those areas impacted by the operation of the mine and the refinery.

   Section 25 of the Draft EIS provides a draft EMP for the project. No comment is provided in the draft EMP regarding the management of off site recreational impacts. Dhimurru expected a section of the draft EMP to

spell out Alcan Gove's policy on minimising the impacts of offsite activity on Yol\u estates and objectives and actions to achieve specified goals. Dhimurru had indicated its willingness as the land owner's preferred land and sea management agency to assist Alcan in developing this aspect of the EIS. The draft EIS should at least have stated Alcan's continuing support for comprehensive and adequate programs to minimise recreational impacts, manage identified recreation areas, and rehabilitate those areas on completion of the mining and processing operation.

2. The draft EIS provides little in the way of specific detail regarding the actions that Alcan Gove will undertake to ensure that objectives and targets are met. For example the EMP under the objective of social and community benefit identifies an action to continue to support the Yirrkala Dhanbul Landcare group to develop a native plant and seed business but fails to provide any indication of how this might be done whether by financial assistance or the provision of expertise and/or whether by giving preference to plants produced by Yirrkala Dhanbul in Alcan's environmental programs. Not only does the EIS fail to provide detailed proposals it also fails to quantify the level of Alcan's commitment to addressing issues.

3. The public consultation period was not adequate in Dhimurru's opinion for informed Yol\u participation in the assessment process. The required Yol\u language summary of the project was not released until March 10th further limiting the period available for effective Yol\u participation. We are advised that submissions from Yol\u and Yol\u organisations will be accepted after the closing date however this does not guarantee that those issues will be addressed to the same extent as submissions received by the closing date. At no stage was Dhimurru aware of a structured approach to consulting the Yol\u community on the project ahead of the EIS.

   The Yol\u Community Reference Group process whilst a useful exercise should not be relied upon to adequately represent Yol\u interests. The Community Reference Group had a larger agenda than the expansion itself and lacked the specific focus required to review the expansion proposal. Members of the Yol\u Reference group were not resourced or serviced beyond the Reference Group meetings themselves to disseminate information nor consult on the

project proposal nor to independently investigate issues identified.

4. The EIS consideration of Social Impact appears superficial. It is unclear what consultation has ultimately been used to support statements that are made in the EIS. It appears many of the conclusions are based on a community survey with a total of six respondents. Nor is there any distinction between the Nhulunbuy residents' position on certain issues and those of the Yol\u communities. Dhimurru was not approached by URS to comment on social impacts in the course of their investigation which is further evidence of the limited nature of the social impact assessment.

   Dhimurru would support a more comprehensive attempt to understand the social impacts of the project conducted at arms length and including objectives to not only investigate likely impacts but also provide proposals for addressing those impacts.

5. Dhimurru is concerned about the possible long term impacts of the groundwater mining requirements for the project.

   Apart from the ground water monitoring program that is proposed Dhimurru would like to see a long term vegetation monitoring program implemented to determine whether the mining operations are having any impact on vegetation structure and extent. The area to be surveyed should include Rocky Bay and extend south to Daliwuy Bay. Such a survey would help to ensure that timely action can be taken if it becomes apparent that changes are occurring whether as a result of drawdown on the water table or other factors.

6. Dhimurru is particularly interested in monsoon rainforest pockets which are important habitat for flora and fauna and as Yol\u cultural resources. Dhimurru has been engaged in a project to survey for the Gove Crow Butterfly which is listed as an Endangered Species. The butterfly was previously only know to occur in four monsoon rainforest pockets in North East Arnhem Land however Dhimurru was unable to find the butterfly in one of those locations. It appears likely that the introduced Crazy Ant may be a factor in their disappearance from that location. Of the remaining three sites one was not included in the recent survey and the status of the Gove Crow Butterfly at that location is not known.

Rainforest pockets that may be affected by the project, ie water table impacts, should be comprehensively surveyed for the presence or absence of the Gove Crow Butterfly and likely habitat should be included in the long term vegetation mapping recommended above.

7. The construction period will introduce a number of challenges with respect to managing recreational areas within the Dhimurru IPA. Options for addressing these issues are under discussion with Alcan, the project contractor and the NLC. The draft EIS has not attempted to detail how these issues might be addressed but of course a satisfactory and effective model is critical to Dhimurru's analysis of the proposal.

   Options that have been discussed to date for minimising the impact of construction workers on the community and on recreational areas and which we see as important to an effective model include:

   - Staggering leave and rostered days off so that the number of people seeking access to recreation areas at any particular time is balanced and kept to a minimum;
   - Comprehensive cross cultural training for all people employed on or in connection with the project to be delivered before they commence work in Nhulunbuy. This would mean scheduling their cross cultural training to occur on their first day in Nhulunbuy;
   - Codes of conduct for construction personnel and effective procedures for dealing with concerns (note these are identified in the EIS but again no detail is provided specifying what they will contain);
   - Actions to minimise the number of private vehicles that contractors will be bringing into the region. This would mean not providing any incentives or assistance to construction personnel wanting to bring private vehicles on the barge or road, ensuring that adequate transport arrangements are in place to move personnel when they need to be moved including tours to identified recreation areas, and not providing vehicle storage facilities in the construction village;
   - Arrangements to ensure that construction personnel obtain Dhimurru permits for access to identified recreation areas;
   - Ensuring Dhimurru is adequately resourced to issue permits and to monitor and manage recreational impacts on identified recreational areas;

- Ensuring that provision is made for rehabilitating or repairing recreation areas if required;
- Increased police presence to cope with the substantial increase in population and ensure that organisations such as Dhimurru are not disadvantaged by increased demand on police resources;
- Provision of a range of recreational resources within the construction village and assistance to enhance recreational facilities in the region ensuring that adequate provision is made for recreational pursuits without exceeding the capacity of existing facilities in the region.

8. The site proposed for the construction village is adjacent to the Dhimurru Office. Dhimurru is concerned to see the activities of the construction village contained and notes the proposed sound barrier which will help to minimise disturbance. It is worth noting that many people use the shopping facilities at Captain Cook in preference to the town centre because of the distance from liquor outlets. It will be important to ensure that the provision of a wet canteen and other facilities in the construction village is contained so as not to increase general access to liquor outlets and exacerbate what is already a major issue in the region.

Please do not hesitate to contact our office if you require clarification of matters raised in this submission.

Yours sincerely,

Witiyana Marika
Chairperson

Gove Amateur Astronomers
PO Box 178
Nhulunbuy NT 0881
Ph: Ian on 0417 601490
Email:goveastronomers@yahoo.com.au

Office of Environment & Heritage
Att: Rod Johnson
Assessment Officer
GPO Box 1680
Darwin NT 0801
Fax: 08 8924 4053

Dear Rod
Please find following our comments on the Draft EIS for the "Alcan Gove Expansion"

As a growing and well-supported Astronomy Group in the community, we have an interest in preserving and enhancing the visibility of the night sky for all in east Arnhem Land.
Dark night skies being one of the things making the Gove peninsula such a great place to live.
The EIS addresses well, the issues of light spill into the surrounding communities.

What is not specifically addressed is the spill of light above the refinery, town & mine
ie: "Skyglow", which at its worst can eliminate viewing of that section of the night sky.
This is a global problem that is affecting the enjoyment & Study of the night sky worldwide.

Fortunately there is an answer to this problem & it is well addressed by the "International Dark Sky Association" of which our club is a member, and we endorse their recommendations, as world best practice for outdoor lighting.

Details of their recommendations are available on their web site
http://www.darksky.org/~ida/handbook/lc-hb-v1-14.html

Yours Sincerely

Ian Maclean
President
Gove Amateur Astronomers
Ph: 0417 601490
Email: goveastronomers@yahoo.com.au

Online Calender of Events:

http://au.calendar.yahoo.com/goveastronomers

Astronomy is …. looking up !

"Birds, Bees,

Trees & Things" To:
<roderick.johnson@nt.gov.au>
<bbtt@octa4.net. cc:

au> Subject: Social and Community
Effects Comment on EIS for Alcan

05/03/2004 19:45

Dear Rod

I am a small business man in Nhulunbuy. I started my business 6 years ago after
working loyally for 15 years with Nabalco which is now owned by Alcan.

For many years it was my job in the plant to create meaningful work and
employment opportunities for the Yolngu workers at YBE. I introduced landscaping
and created and rehabilitated the significant site within the plant known as the
Banyan tree. It has since been written up in Alcans publicity as an icon to the
mining industry. I also had yolngu working on roadwork's, fencing and liaison
projects.I worked in most areas of the plant during my career so I am familiar
with the Production, Maintenance, Engineering and Environment and Liaison
Departments.

When special guests and visitors came to the plant I was often asked to take
these visitors on a tour because I had a great deal of knowledge about this
place and feedback was always positive.

Armed with this knowledge gained from many years of personal study and a genuine
strong relationship with many yolngu who respect me I started an ECO Tourism
business and now employ Yolngu guides. We have been written up all over the
world curtesy of the sponsorship of international journalists from the
Australian and Nt Tourism development departments.

In reviewing the Section 21.0 Social and Community Effects of the Draft EIS for
the Gove Expansion. I was disappointed to find an absence of any mention

about
Tourism as an embryonic business which has been occurring on the Gove Peninsular
for over 20 years.

There was a consultant engaged by Alcan to investigate about this. She apparently made contact with the local Chamber of Commerce who gave her some information but she never contacted any tour operator or spoke to any of the Yolngu who work with me. Alcan do know I exist because I have been assessed as
an approved supplier to them. Mostly this is for half day fishing charters but I
have in 6 years had only 2 cultural bookings from this company. Most of my work
comes from interstate and overseas and my best local clients are the staff at
the Gove District Hospital. I get Aboriginal people from Darwin, Katherine and
interstate who pay for my tours but not much from the mining community.

I am the only land based tour operator who employs yolngu here and employs and
trains yolngu in seamanship and ECO tourism.

Within Alcan there are several fishing charter operators. Phoenix Charters, Reef
Builders are 2 of them. We also have Gove Diving and Fishing Charters, Iron Lady
Fishing Charters, Nomad Fishing and Diving Charters. Yothu Yindi is into tourism. Barrkira Homeland is an Nabalco set up touring destination set up for
camping by their employees.

With the introduction of the new development and influx of 1200 new tourists to
this town. These people will want to recreate and see a bit about the place while they are here or there will be a lot of social and community impacts on
the land and the Yolngu communities if they are restricted too much. We as professional tour operators can help relieve this tension.

I have a visitor book full of positive comments. My lagoon and cultural ECO tours are something that many educated professionals and small family groups seem to enjoy, I also get great feedback about my fishing skills and my clients
enjoy fishing and hunting with the Yolngu guides I employ.

One day Nhulunbuy may supported by tourism as its main industry so it is important to the future development of the region.

Noel Wright
Birds Bees Trees & Things

***Attention**: Roderick Johnson, Office of Environment & Heritage*
***Re:** Alcan Gove Expansion – Environmental Assessment, Draft EIS*

G'day Rod,

I'm pleased to have the opportunity to comment on Alcan's proposal to upgrade and expand their Gove operations. The draft statement was a large document, which quite rightly explored much detail of the proposal, however a few significant areas were starkly lacking.

Social impacts of current and expanded operations

The social impact assessment is vastly inadequate. The impression given of the impacts of the mine upon traditional communities of the area is grossly distorted. The draft statement would have us believe that the only such impacts have been the paying of royalties and the exposure of Aboriginal people to wider opportunities to participate in the mainstream economy. No attention is paid to the detrimental impacts of the mine, including the large influx of non-Aboriginal people, and the establishment of the town, with increased access to alcohol and other social risks. No mention is made of initial opposition of the local Yolngu to the mine, nor the historic protest actions which followed. By denying history, the authors have managed to ignore the need to address the inevitable exacerbation of these unwanted detrimental impacts upon the area's traditional people.

In the context of this glaring void in the draft statement, the publishing of the summary in Yolngu Mata has been exposed as a public relations stunt. Although the proponent was willing to spend money on an academic to achieve this window-dressing, they clearly neglected to spend time with Yolngu people to accurately document their relationship to the mine.

This is a significant procedural failure, which cannot be amended by a well-edited supplement. This clumsy attempt to disengage the interests of the Aboriginal stakeholders from the process can only be redressed by re-running a consultation process which makes a genuine attempt to fill these gaping holes by actively pursuing and comprehensively documenting written and oral consultation with Yolngu people, communities and organisations.

Strategic context of greenhouse emissions

Quite justifiably, much has been made of the potential for the proposed upgrade to make a positive contribution to tackling our collective greenhouse burden.

Elevated greenhouse effect due to carbon pollution is one of the greatest environmental impacts facing us, both globally and here in Australia, where the effects and implications of climate change are expected to hit hard. Conservative forecasts predict

- increased scope, frequency and intensity of cyclonic weather patterns;
- increased incidence and penetration of species invasions;
- greater fire management risks; and
- regional crop failures

among the wide range of anticipated impacts which we will have to adapt to in our lifetimes. Australia boasts the second greatest greenhouse gas emissions per-capita in the world, and the Northern Territory seems determined to become the fastest growing polluter in the country. By the measurements of both our contribution to and our impacts from climate change, the NT recognizes a significant responsibility to respond to the challenge of greenhouse pollution.

On the face of it, the proposed expansion looks like a greenhouse winner. Although projected annual emissions from the expansion are expected to boost the NT's annual greenhouse

burden, measurements of intensity per tonne of product, and most importantly, emissions over the project life-cycle, make conversion to gas look like a greenhouse saving. One clear conclusion can be drawn : given the well demonstrated superior environmental outcomes of powering the proposed expansion on gas, ***it would be unacceptable to pursue the expansion with the existing fuel type.***

Unfortunately, the carbon emissions savings evident in the proposal fall well short of demonstrating a capacity (on a corporate, NT, national or global level) to confront climate change. To simply attempt to '*reduce emissions to a level that is as low as practicable*' falls dangerously short of the real task of managing emissions at any level. By only seeking to ensure 'practicable' pollution control at the project level, with no caps, limits or targets for the proponents, let alone the NT or federal governments, we can be sure of managing ourselves into escalating greenhouse pollution and unnecessary environmental and climate impacts.

Within the context of Alcan's own business activities, it would be necessary to see a long term plan for migration from polluting fuels to renewables. This may or may not include further steps in the lifetime of this project, but given Alcan's significant exposure to the risks and responsibilities that go hand in hand with large scale fossil fuel consumption, the proponent must demonstrate some strategy for cleaning up their business activities beyond the lifetime of this project.

Within the context of the NT economic and policy environments, it is very difficult to register the reductions in carbon emissions promised by the expansion as having any impact upon managing the NT's growing greenhouse burden. The lack of emissions targets for the NT, paucity of cohesive industry planning and general lack of directed strategy for managing carbon pollution, makes it impossible to set the promised savings in a strategic context. The delay in publishing the long-promised 'Northern Territory Greenhouse Strategy' remains an obstacle for resolution of this impasse, although the draft itself offered no indication of the future pollution profile of the NT's economy, other than to state that emissions can be expected to rise. There is essentially no strategic context. Some savings may be made on this one project, but can be expected to be overrun by excessive pollution from other fossil fuel based projects which have been prophesised for the NT.

Similarly, the federal government's disregard for global trends and international agreements assures that any carbon emissions which are clawed back on one particular project such as this will be overtaken by accelerated emissions from an increasingly polluting national economy. The dirty, polluting nature of the southern states has been held up both as an example, and as a potential market, by the NT Chief Minister when promoting the development of gas industries. Unfortunately, NT policy seems set to race at meeting their bad example, and given the ready availability of cheap coal, no progress has been made in meeting their energy markets.

In this way, it can be seen that although some reductions to carbon emissions are promised by the expansion, the lack of corporate strategy, and the determined national and NT policies of promoting an increasingly polluting economy, ensure that these savings will not be built upon, but will rather be overtaken by further pollution elsewhere in the economy.

Considering other development options …

No component of the piecemeal assessment being applied to the proposal to fuel the expansion at Gove with the gas from Blacktip has yet adequately considered the full range of alternatives.

In the context of

- the NT Government's enthusiasm for a national gas grid;
- the excessive pollution burden of energy production elsewhere in Australia; and
- the inevitable increasing scarcity of fossil fuels into the future,

alternative uses for the fuel, in particular, the potential for feeding our fuel reserves into a national gas grid, should also be explored.

Given Woodside's previous enthusiasm for exploiting the stolen East Timorese fuel at Sunrise, further discussion of alternative sources of gas would also be relevant.

The draft statement repeatedly compares the proposed use of gas with the option of coal. This implication is granted no further discussion, and is certainly unsupported by any evidence. In particular, no particular source or supplier of coal is proposed. If coal is to be held up as a realistic alternative fuel, it is necessary to demonstrate where this potential fuel may come from, and to discuss the prospects of such an alternative in the current regulatory, policy and economic environments.

One other interesting proposal which has not received any attention is that of a pipeline system to power more a series of mines. An offshore Gas pipeline from Mataranka to Borroloola to Alyangula to Nhulunbuy, powering all three large mines along the way, is a much better idea than running a pipeline straight through Arnhem land against some Traditional Owners' wishes.

I look forward to following the progress of the assessment of this proposal,

Thanks,

Justin Tutty

PO Box 349
Noonamah, NT 0837

justin@audealism.com

08-8988-6063

"Sean Carroll"

<corofin@ozemail.com.au>

To: <kathy.nash@nt.gov.au>

cc:

Subject: Re: The Proposal to Extend the Gove Alumina Refinery

17/02/2004 09:19 PM

Dear Kathy,

Thank you for the opportunity to comment on the Draft EIS Guidelines For the Gove Alumina Refinery Expansion.

My question is regarding the increased demand for water at the refinery, if the demand management alone is not adequate what are the other options available and how soon can those options be identified and made public.

Will Alcan be instructed to remain within the supply capacity of the licence limits for the existing borefield ?

If the water extraction is exceeded beyond the current licensing limits, has the neighbouring community of Yirrkala been considered as their water supply comes from the same aquifer. Yirrkala community has only got one domestic production bore and dependent on this water supply, this is their only water source. I would imagine that excessive lowering of the water table through excessive demand would have grave effects on the demand at Yirrkala.

Thank you and regards

Yours sincerely

Sean Carroll

APPENDIX B

Lime Plant Emission Rates

SAMPLING RESULTS

Lime Plant Shaft 1 Stack

Test times were shortened for testing the Lime Plant Shaft 1 Stack as gases were only exhausted up the stack for 17 minute periods. Access to the Lime Plant Shaft 1 Stack was difficult due to the design of the stack and scaffolding.

Isokineticities for Particulate tests conducted on the Lime Plant Shaft 1 Stack were outside ECS's quality control criteria (± 10%). Errors have been reported with the affected results, high isokineticities will underestimate the 'true' value while low isokineticities will overestimate the 'true' value. Run 2 Errors in isokineticity do not affect the determination of Hydrogen Sulphide. Having passed all other quality controls, this error was attributed to the short sampling times available and the presence of cyclonic conditions within the stack.

Table 17 summarises the Particulate concentration and the Flow Rate results for the Lime Plant Shaft 1 Stack.

Table 17: Lime Plant Shaft 1 Stack Particulate Results.

Parameter	Run 1	Error	Run 2	Error	Units
Test Date	7/5/03		7/5/03		
Start time	14:57		16:09		
Stop time	15:45		16:26		
% Isokineticity	88.0		84.0		%
Particulate concentration	1431	±172	1447	±232	mg/m^3
Particulate Emission Rate	29	±3.5	28	±4.5	kg/hr

Table 18 summarises the Hydrogen Sulphide results for the Lime Plant Shaft 1 Stack.

Table 18: Lime Plant Shaft 1 Stack Hydrogen Sulphide Results.

Parameter	Run 1	Run 2	Units
Test Date	7/5/03	7/5/03	
Start time	14:57	16:09	
Stop time	15:45	16:26	
H2S Concentration	0.02	0.03	mg/m^3
H2S Emission Rate	0.94	0.69	g/hr

Table 19 summarises the PM_{10} test results for the Lime Plant Shaft 1 Stack.

Due to large variations in the velocity profile of the Lime Plant Shaft 1 Stack, the stack diameter was divided into three sections based on areas with similar velocities. Each section was tested individually. Runs 1 and 3 were points closest to the stack walls with Run 2 being across the centre of the stack.

Table 19: Lime Plant Shaft 1Stack PM_{10} Test Results.

Parameter	Run 1	Run 2	Run 3	Units
Test Date	8/5/03	8/5/03	8/5/03	
Start time	10:21	12:09	14:34	
Stop time	10:38	12:24	14:55	
% Isokineticity	100	100	100	%
Mean D50	4.8	10.9	4.5	µm
Cumulative %	28.3	38.7	31.7	%
PM 10 Concentration	52	262	47	mg/m^3