1. Description of Activity

The project entails the construction and operation of a primary aluminium smelter comprising of two potlines. Each potline will comprise of 336 cells located in two potrooms. Approximately 660 000 tons of aluminium metal will be produced annually using the alumina reduction electrolysis process.

The smelter will be operated using the existing AP35 smelting technology developed by Aluminium Pechiney. It will consist of three major process components namely:

- Two potlines with 336 pots each (electrolytic cells);
- A carbon plant and rodding shop for the production of carbon anode blocks; and
- A casthouse for the casting of aluminium ingots;

Other facilities associated with the aluminium smelter include:

- An electrical substation on the site to provide power to the smelter;
- Facilities for materials handling and storage including storage silos for the storage of raw materials (alumina and petroleum coke);
- Loading and unloading facilities at the port.
- A conveyor that will be used for the transport of alumina and petroleum coke from the harbour to the smelter.

The total area of the site that will be occupied by Alcan is 120ha. Of the 120ha, 42.5ha will consist of buildings and other hardened surfaces such as roads, parking and paved areas. The different components and their location in relation to each other within the smelter site are depicted in figure 1.
THE POTLINES

Each potline will consist of 2 elongated potrooms measuring approximately 1070m x 25m parallel to each other. Each room will house 168 pots aligned sequentially in two groups of 84 pots, electrically connected to each other. The two potlines will in turn be located parallel to each other. Each potline will thus have a total of 336 pots. Each one of the pots represents a large electrolytic cell (based on pre-baked anode cell technology) lined with conducting carbon blocks and insulating bricks (these make up the cathodes). The pot is supported by a steel-reinforced structure that includes the anode system, cathode shell, a hooding system and an alumina supply hopper.
The cathode assembly is contained within a rigid shell containing carbon blocks and sealed steel bars that conduct the current. Insulation is provided by layers of refractory bricks. Carbon anodes are used to conduct electricity into the pots. There are 24 anode assemblies on each pot, 12 on each side. The anode blocks are consumed during the smelting process.

An electric current (DC) is passed sequentially (in series) through the line of electrically connected pots. Inside the pot the alumina is automatically fed at several points on the axis of the pot and dissolves in a molten bath of sodium aluminium fluoride (cryolite). The direct current causes the alumina to separate into aluminium and oxygen through the process of electrolysis while the heat generated maintains the molten bath at approximately 950°C. The aluminium is tapped periodically by vacuum suction.

Two Gas Treatment Centres (GTC’s) are associated with each potline. These are positioned between the potrooms and receive emissions from the pots. The GTC’s are dry scrubbing units that have the primary role of recycling nearly all fluoride and dust captured from the pots. The emissions are treated in the GTC to extract the fluoride using alumina as a dry scrubbing agent. The fluorinated alumina is then redirected into the pots.

THE CARBON PLANT AND RODDING SHOP

The anodes used to conduct electricity into the smelting pots are gradually consumed during the smelting process and are replaced on a rotating schedule. Anodes are manufactured on site in a carbon plant by means of a three-stage process:

- **Paste Plant** – Green (unbaked) anodes are produced by crushing petroleum coke and recycled anode butts (the remainder of the mostly consumed anodes), mixing it with liquid pitch to form an anode paste and compacting the paste into anode blocks.
- **Anode Baking Furnace** – The anodes are baked at approximately 1100°C in an oil-fired furnace for several weeks in order to give them mechanical and conductivity properties.
- **Roddng House** – After baking, the anodes are attached to rods by means of cast iron in the rodding house and then transferred to the storage facility from where it will be transported to the potline when needed.

Associated with the paste plant is a Pitch Fume Treatment Centre (PFTC). This is a dry scrubbing unit that treats poly-aromatic hydrocarbon (PAH) containing tar and dust emissions from the paste plant. Particulate coke is used as the scrubbing agent and this enriched coke is recycled into the paste plant.

Associated with the baking furnace is a Fume Treatment Centre (FTC) that extracts and recycles fluoride, PAH containing tar and dust emissions created by the anode baking process. The FTC is a dry scrubbing unit that utilizes
raw alumina as the scrubbing agent with the resultant fluoride rich alumina being recycled into the pots. This process results in destruction of PAH.

THE CASTHOUSE

The molten aluminium is extracted from the pots by a vacuum and siphoned into large ladles. The ladles are transported to the casthouse by means of specialized vehicles. At the casthouse the aluminium metal is siphoned from the ladles into holding furnaces in preparation for casting. The aluminium is then cast into ingots and bundled for shipping.

MATERIALS HANDLING AND STORAGE

In the harbour fresh alumina and petroleum coke will be unloaded by vacuum onto an enclosed conveyor system. The material will be transported to the smelter via the closed conveyor system where the alumina will be stored in sealed dome silos and the petroleum coke in an A-frame shed. Aluminium fluoride and liquid pitch will be transported from the harbour to the smelter by road.

Dedicated port facilities will be established for vacuum unloading of alumina and petroleum coke. Liquid pitch will be unloaded at a dedicated unloading station and stored at the port prior to transfer to the smelter. A metal storage site will be established adjacent to the port for the interim storage of aluminium ingots prior to export loading.

ELECTRICITY SUPPLY

Electricity will be provided by means of 3 x 275 kV transmission lines (operated as 132 kV distribution lines) from the Grassridge substation to the smelter site. The option however exists to use 400kV transmission lines. A dedicated electrical substation will be built at the smelter where the current will be converted from AC to DC prior to it being used in the smelting process.

LISTED ACTIVITIES

Construction and operation of the smelter will involve a number of activities listed in terms of Section 21 of the Environment Conservation Act, Act 73 of 1989. Of these the primary activity associated with the operation of the smelter is activity number 9 as listed in Schedule One published in Government Notice R1182 of 5 September 1997, being the conducting of processes that are scheduled processes under the Second Schedule of the Atmospheric Pollution Prevention Act (APPA), Act 45 of 1965.

The following processes that are scheduled under the Second Schedule of APPA will be conducted as part of the normal operation of the smelter.
The primary scheduled process that will be conducted is:

- **Aluminium processes** (process 32 in the Second Schedule to APPA): Being processes in which (a) aluminium is produced from its oxide by means of an electrolytic furnace.

Associated scheduled processes listed in the Second Schedule to APPA that will be conducted are:

- **Tar processes** (process 16): Coal-tar pitch is heated to create binder for the carbon anode blocks in a process that attains temperatures of above 114°C. Pitch is also heated during transportation, handling, storage and transfer in order to keep it in a liquid state.

- **Hydrofluoric acid process** (process 21) and **Fluorine processes** (process 24): The smelting process results in the production and release of gaseous and particulate fluoride compounds, including both salt and acid components.

- **Iron and steel processes** (process 30): Being processes:
  - (a) In which iron, iron ores, steel or ferro-alloys are produced or processed so as to give rise to noxious or offensive gases; or
  - (b) Involving the cleaning of castings and handling of casting mould materials.

- **Gas, coke and charcoal processes** (process 34): Being processes in which:
  - (c) Coke is produced – the smelter requires the coking of coal tar pitch when green anodes are baked at above 1100°C.
  - (d) Gases produced are subjected to purification processes.

Other activities listed in Government Notice R1182 of 5 September 1997 in terms of Section 21 of the Environment Conservation Act, Act 73 of 1989 that are associated with the construction and operation of the smelter are:

- The construction and operation of an electrical substation (listed as number 1(a));
- The transportation and storage of hazardous substances (listed as number 1(c));
- Construction of dams (listed as number 1(j)); and
- The storage of waste on site at a waste transfer site (listed as number 8).

Hazardous substances that will be transported, stored and used on site include but are not limited to the following:

- Liquid pitch
- Heavy fuel oil (HFO)
- Diesel
- Petrol
8. Conditions of Authorisation

8.1 General conditions

Condition 8.1.16:
The Major Hazardous Installation study conducted for the AP50 smelting technology to be updated to take into account the technology change to AP35 smelting technology and the findings of such study to be submitted to DEAE&T prior to the commencement of construction. The findings of this study must, where applicable, be incorporated into the final design and construction of the smelter. In addition the Alcan Health and Safety Directive and comprehensive risk management programme must be implemented at the Coega Aluminium Smelter.

8.3 Conditions pertaining to materials handling

Condition 8.3.4
Condition 8.3.3 does not apply to the transport of heavy loads (such as anodes, metal ladles and bath ladles) on site, nor to the transport of finished aluminium ingots from the casthouse to the harbour.

8.4 Conditions pertaining to waste management

Condition 8.4.11 (additional)
All waste from the smelter will be regarded as hazardous. Should Alcan regard a specific waste as non-hazardous and wish to dispose of such waste at a general waste site, then such specific waste will have to be delisted according to the delisting procedure contained in the minimum requirements documentation of the Department of Water Affairs and Forestry. Should Alcan wish to have a specific waste recycled by an external operator, special permission/exemption may be required to ensure the safe handling and ultimate fate of such waste.

8.5 Conditions pertaining to emissions to the atmosphere

Condition 8.5.6
The petroleum coke used at the smelter must have the lowest possible sulphur content commercially available.

Condition 8.5.14
A comprehensive ambient air quality monitoring programme to be compiled to the satisfaction of DEAE&T and DEAT and implemented for the smelter by Alcan at least one year prior to commissioning (for baseline completion). Such a monitoring plan must:
8.5.14.1. Expand on the existing ambient air quality monitoring programme for the IDZ currently limited to $\text{SO}_2$, $\text{PM}_{10}$ and TSP;
8.5.14.2. Include the monitoring of gaseous and particulate fluoride;
8.5.14.3. Include the continuous monitoring of indoor fluoride as prescribed by the Department of Labour;

8.5.14.4. Include the monitoring of stack emissions of fluoride and gaseous fluorine;

8.5.14.5. Include the monitoring of fugitive emissions of fluoride;

8.5.14.6. Include the monitoring of total fluorine (gaseous and otherwise) on a continuous basis;

8.5.14.7. Include the monitoring of SO$_2$ on a continuous basis;

8.5.14.8. Include the monitoring of PAH and PM$_{10}$;

8.5.14.9. Provide for the calculation of CO$_2$ emissions;

8.5.14.10. Provide for the reporting on greenhouse gases including C$_2$F$_4$ and C$_2$F$_6$ as equivalent CO$_2$ emissions;

8.5.14.11. Verify the emissions data used in the Air Quality specialist study;

8.5.14.12. Provide for the categorisation of any other plant emissions;

8.5.14.13. Indicate the frequency of monitoring intervals;

8.5.14.14. Involve key stakeholders; and

8.5.14.15. Provide for corrective measures where necessary.

**Condition 8.5.21**

Emissions from the smelter to adhere to any requirements/limits that may be set by the Air Quality Management division of the Department of Environment Affairs & Tourism. As a minimum however, the World Bank emission standards for aluminium smelters as set out below to be maintained in terms of the various constituent emissions by the smelter:

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Emission standard (kg/t Al)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Fluoride</td>
<td>0.6</td>
</tr>
<tr>
<td>Dust</td>
<td>1.0</td>
</tr>
<tr>
<td>PAH</td>
<td>0.02</td>
</tr>
<tr>
<td>Tar</td>
<td>0.04</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>1.8</td>
</tr>
<tr>
<td>Carbon tetrafluoride</td>
<td>0.1</td>
</tr>
<tr>
<td>Sulphur dioxide</td>
<td>1.0</td>
</tr>
</tbody>
</table>
8.6 Conditions pertaining to water use and liquid waste

Condition 8.6.6.6
The option of contaminated storm water containment, or even total storm water containment, treatment and re-use, either on or off site.

Condition 8.6.15
As a minimum, storm water from the Coega IDZ can only be released into the marine environment (Port of Ngqura) if it conforms (95 percentile) to the standard as set out in the table below. In this regard storm water leaving the aluminium smelter site must conform to the standards to be set by the Coega Development Corporation in order to meet the water quality requirements at the point of release into the marine environment.

<table>
<thead>
<tr>
<th>Constituent name</th>
<th>Unit</th>
<th>Storm water conc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspended solids (TSS)</td>
<td>Mg/l</td>
<td>9.8</td>
</tr>
<tr>
<td>F</td>
<td>Mg/l</td>
<td>21.3</td>
</tr>
<tr>
<td>Al</td>
<td>µg/l</td>
<td>9000.0</td>
</tr>
<tr>
<td>CN free</td>
<td>µg/l</td>
<td>10.0</td>
</tr>
<tr>
<td>Ag</td>
<td>µg/l</td>
<td>1.0</td>
</tr>
<tr>
<td>As</td>
<td>µg/l</td>
<td>50.0</td>
</tr>
<tr>
<td>Be</td>
<td>µg/l</td>
<td>3.0</td>
</tr>
<tr>
<td>Cd</td>
<td>µg/l</td>
<td>2.5</td>
</tr>
<tr>
<td>Cr</td>
<td>µg/l</td>
<td>20.0</td>
</tr>
<tr>
<td>Cu</td>
<td>µg/l</td>
<td>35.0</td>
</tr>
<tr>
<td>Fe</td>
<td>µg/l</td>
<td>350.0</td>
</tr>
<tr>
<td>Hg</td>
<td>µg/l</td>
<td>1.0</td>
</tr>
<tr>
<td>Ni</td>
<td>µg/l</td>
<td>60.0</td>
</tr>
<tr>
<td>Pb</td>
<td>µg/l</td>
<td>5.0</td>
</tr>
<tr>
<td>Sb</td>
<td>µg/l</td>
<td>10.0</td>
</tr>
<tr>
<td>Se</td>
<td>µg/l</td>
<td>3.0</td>
</tr>
<tr>
<td>Sn</td>
<td>µg/l</td>
<td>4.0</td>
</tr>
<tr>
<td>Ti</td>
<td>µg/l</td>
<td>5.0</td>
</tr>
<tr>
<td>V</td>
<td>µg/l</td>
<td>3.0</td>
</tr>
<tr>
<td>Zn</td>
<td>µg/l</td>
<td>180.0</td>
</tr>
<tr>
<td>Total hydrocarbons</td>
<td>Mg/l</td>
<td>0.4</td>
</tr>
<tr>
<td>Phenol</td>
<td>Mg/l</td>
<td>0.02</td>
</tr>
<tr>
<td>PAH’s:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Naphthalene</td>
<td>µg/l</td>
<td>1</td>
</tr>
<tr>
<td>Benzo(a) Pyrene</td>
<td>µg/l</td>
<td>1</td>
</tr>
</tbody>
</table>
Condition 8.6.22 (additional)
In the event that monitoring results indicate an unacceptable environmental impact, the implementation of a suitable waste water treatment facility, guided by results from the detailed water study as contemplated in condition 8.6.6, must be fast tracked.

Condition 8.6.23 (additional)
Storm water containing waste from the aluminium smelter may only be released into the storm water reticulation system of the Coega Development Corporation if the components of such system are designed to contain all storm water until its discharge to the natural environment in accordance with and under an authorisation issued by the relevant government departments.

Condition 8.6.24 (additional)
Storm water reticulation systems and storm water attenuation dams must be designed such as to retain the first flush runoff in case it might be necessary to treat the first flush runoff in order to remove contaminants from it. Initial operation however, may allow the attenuation dams to drain into the storm water system.

Condition 8.6.25 (additional)
Alcan shall ensure that a further specialist study is undertaken by an appropriate body on the accumulative load effects and long-term impacts of contaminants in the port and port sediments. Such study to be based on the anticipated activities and developments in the port and the IDZ and to be submitted to the Coega Environmental Liaison Committee for endorsement.

Condition 8.6.26 (additional)
The table contained in condition 8.6.15 is anticipated, but not guaranteed to form the basis of a discharge license to be motivated for by the CDC/NPA for the discharge of storm water containing waste into the port. The discharge quality limits set for the CDC/NPA will be informed by the outcome of the further specialist study required in condition 8.6.25.

Condition 8.6.27 (additional)
The discharge license will require extensive monitoring and review every five years to evaluate changes. Should discharge quality limits set for the CDC/NPA become stricter, load limits imposed on Alcan may be revised and further treatment of first flush storm water may be required.

8.11 Conditions pertaining to visual aspects

Condition 8.11.2
The CDC guidelines with regard to attenuation of visual impact (choice of colours, type of paint etc) to be applied and appropriate architectural modelling and surface colour treatment of buildings to reduce visual impact of the smelter to be used. In this regard a pale grey color must be used for all building cladding and the use of reflective cladding must be avoided.
Condition 8.11.10 (additional)
The design of the aluminium smelter to incorporate sealed dome silos as intended for the AP50 smelter and not cylindrical silos as originally proposed for the AP35 smelter.

A. STRUWIG
SCIENTIST: EIM
DATE:____________________

LEON ELS
DEPUTY DIRECTOR: WESTERN REGION
DATE:____________________

NGUBESIZWE SOKUPA
CHIEF DIRECTOR: ENVIRONMENTAL AFFAIRS (ACTING)
DATE:____________________