4 PROJECT DESCRIPTION

4.1 PROJECT MOTIVATION

Air Products has produced acetylene gas for the past 40 years at two of their facilities, located in Kempton Park, Johannesburg and in Pinetown, just outside Durban. Over the years, lack of a managed town planning system at both locations has resulted in encroachment on the facilities’ boundaries. The Kempton Park facility has been encroached on by manufacturing facilities (Structures 2000, Marble Classic CC and Carbotech) to the west, a steel manufacturing company (Steelmate) and the Vaal University of Technology to the east and the Gautrain rail line borders the site to south. To the north, the site is bordered by Plane Road however just beyond this road; a new residential development is being planned, which will result in further encroachment on the Air Products facility.

The Pinetown facility has been encroached on by municipal maintenance facilities to the west, the M5 Road to the east with Toyota across the M5, Tetrapak to south and a mechanical workshop to the north. Figure 4.1 and Figure 4.2 indicate the boundaries (in red) of both facilities and its bordering land-users.

Acetylene plants are associated with potential hazards from materials stored and manufactured on site. These hazards include potential fire or explosion hazards which may pose an on- site and off-site safety risk to employees and adjacent land-users respectively. As such, Air Products has put in place various operational layers of protection including procedures to manage and control these hazards on site. However, these risks still exist and the off-site risks have grown significantly as the facilities have been encroached upon by surrounding developments. These facilities therefore represent a higher risk now than they did when they were initially established.

To reduce the risks associated with these two sites, Air Products intends to decommission the acetylene plants at their Pinetown facility and at their Kempton Park facility. It is therefore planned to establish a new acetylene facility with a location and site layout that aims to pose risk levels that comply with the United Kingdom’s Health and Safety Executives “Broadly Acceptable” principle.
In terms of the commercial viability of acetylene gas, it has various applications in multiple industries. Approximately 80 percent of annual global acetylene production is used for chemical syntheses with the remaining 20 percent consumed for oxyacetylene cutting, heat treating, and welding. The predicted demand for acetylene gas based on Air Products experience in the industry as well as market analysis is depicted in Figure 4.3. In the past ten years, the demand for acetylene gas has doubled with the current annual demand being approximately 800 000 kg and is set to grow steadily for the next ten years.

Figure 4.3  Predicted Global Demand for Acetylene Gas (in Kg)

Source: Air Products South Africa (Pty) Ltd, May 2014

4.1.1  Project Benefits

The Project will provide at least ten job opportunities during the construction phase and at least twenty job opportunities during the operational phase. Through project employment, skills development and training opportunities are offered to all Air Products employees. Air Products thus enables historically-disadvantaged individuals (HDI’s) to participate in the South African economy through skills development, employment equity, preferential procurement, and socio-economic development by contributing to Broad Based Economic Empowerment (BEE). Air Products is a level 4 contributor.

Air Products has a Code 400 Skills Development Plan in place in which over 90 percent of the overall funds are allocated to historically disadvantaged people who require academic and skills advancement. Air Products promotes a “Culture of Life-Long Learning” within its structures, which has seen many HDI’s obtain recognized qualifications. Air Products embraces the opportunity it has to create a diverse talent pool, internally for its own
Air Products has in place a Corporate Social Initiative (CSI) strategy which identifies and supports socio-economic development projects that benefit the communities that surround their facilities. In relation to the Project, Air Products are currently in discussion with the Japie Greyling Primary School, located in Daleside to provide funding (R11 000 per month) for a school feeding programme. Air Products also intend to donate equipment and other infrastructure such as air-conditioning systems and computers that will no longer be required at the Kempton Park facility due to the partial decommissioning that will take place at this facility.

In addition, a Project CSI fund will be set up at project commencement. An annual amount of R70 000 per annum will be set aside for community development projects or initiatives (ie education related projects).

4.1.2 Envisaged Sustainability Aspects

Air Products have considered various sustainability mechanisms in the design of the Project.

- **High Standards of Safety:** Safety and quality are key strategic and operational elements for Air Products as such the company is ISO 18001 and ISO 9001 certified. The Project would therefore be constructed and operated in compliance with high standards of safety.

- **Energy Efficiency:** Air Products are currently investigating the possibility of installing solar photovoltaic (PV) panels to supplement their power requirement of the planned Project administrative office only. The Heating Ventilation and Air Conditioning (HVAC) system that is planned to be installed in the buildings on site will have inverters that would result in energy saving of up to 40 percent. Furthermore, low voltage (3 Watt) Light-Emitting Diode (LED) light bulbs will be used in all buildings. Power correction factors have also been considered in the design of the facility; this will enhance energy efficiencies by evenly spreading the power.

- **Water Efficiency:** It is planned to capture all stormwater run-off into two catchment pits, which are to be positioned down gradient or at the lowest point of the site. This natural gradient will be further enhanced by the construction of surface bed channels and drains to direct run-off water into the catchment pits. As and when required, the water stored in these pits will be pumped to the facility to supplement the water requirement. Up to 90 percent of the water used in the plant process will be recycled and re-

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1 Air Products intend to decommission the acetylene plant at the Kempton Park plant located at Spencer Road, Kempton Park. The schedule for this decommissioning is dependent on the operation of the Acetylene plant under consideration and is therefore scheduled for end 2015, beginning of 2016.
used with minimal amounts being lost through the lime by-product generated.

- **Waste Recycling**: In accordance with Air Products Environmental Best Management Practices Procedure (October 2008), the Project will, to the extent feasible, segregate and recycle waste paper, aluminum cans, cardboard, wood pallets and packing materials. Furthermore, scrap metal, including cylinder valves, cylinders (except acetylene cylinders), and equipment will be recycled through a scrap metal dealer. Used oils, saturated absorbents and drums will also be recycled through an Air Products-approved oil recycler.

- **Technology Efficiency**: The design of the facility has considered the most efficient technology such as the Pressure Swing Adsorption (PSA) system described further in Section 5. PSA systems do not result in waste emissions (ie drying agents) and therefore would not require regular maintenance.

4.2 **PLANT PROCESS AND PROJECT COMPONENTS**

The Project will produce acetylene gas from mixing calcium carbide (CaC₂) with water. This mixture results in an exothermic (ie heat generating) reaction, whereby acetylene gas is released and Calcium Hydroxide (Ca(OH)₂) or lime is produced (Figure 4.4). Acetylene gas (C₂H₂) is a chemical compound, which has no odour or colour in its purest form. It is used amongst various industrial sectors as a fuel or chemical building block or for cutting and welding.

**Figure 4.4 Chemical Process of the Project**

The process plant will comprise of the following key components:

- turnbins;
- generator vessel;
- heat exchanger;
- ammonia scrubber;
- low pressure dryer;
- compressors;
- high pressure dryers; and
- high pressure fillers.
These components are illustrated in Figure 4.5 and described further in the sections that follow.

**Figure 4.5 Acetylene Production Process**

![Acetylene Production Process Diagram]

Source: Air Products South Africa (Pty) Ltd (February 2013)

### 4.2.1 Turnbins

Turnbins are storage containers that are used to transport, store and feed calcium carbide into the filler hoppers on the acetylene generators. The turnbins are weatherproofed to ensure that the calcium carbide is kept dry. Turnbins will be placed onto the filler hoppers of the generator vessel with a hoist.

Each turnbin will have a capacity of 1.5m$^3$ (*Figure 4.6*). Approximately 64 turnbins are required for Phase 1 of the Project with an additional 64 turnbins required for Phase 2. Turnbins filled with calcium carbide will be transported to site by a licensed service provider. These turnbins will be stored in a covered storage area (9m x 12m) to avoid moisture. Once a turnbin has been emptied into the hopper, it will be stored in an open area until it is transported off-site to be re-filled by the supplier. The calcium carbide will be supplied from a supplier based in Newcastle, KwaZulu Natal who has supplied Air Products for the past 40 years.

The proposed raw material consumption rate of calcium carbide for two shifts (24 hours) is 24 tons.
4.2.2 Generator Vessel

The reaction between the calcium carbide and water will take place in a generator vessel to produce the acetylene gas. The generator vessel will be a closed system with a capacity of approximately 8m$^3$ (Figure 4.7). The vessel is filled with water and the calcium carbide is added, resulting in an exothermic reaction. The working pressure of the generator vessel is 90kPa with a temperature range of 58-62ºC.

Initially, only one generator is proposed, which will be located at the centre of the site. An additional generator will be installed during Phase 2 of the Project, adjacent to the first generator. The maximum production rate of the Project, incorporating both generators is 14400m$^3$/day

Filler hoppers are attached above the generator vessel and serve as a feeder into the vessel. Turnbins are placed onto the filler hoppers to feed the calcium carbide into the vessel.
4.2.3 **Heat Exchanger**

The generated gas is fed through a cooler/condenser that provides heat exchange between the warm gas (54 - 63 °C) and cool water supplied from the cooling tower system.

4.2.4 **Low Pressure Dryer**

The acetylene gas passes through a low pressure dryer, which is a pressure vessel charged with rasid rings that absorbs the moisture from the gas. When passing through the low pressure dryer, the acetylene gas has a pressure of 90 kpag. The primary reason for the low pressure dryer is to ensure that the water content of the gas entering the ammonia scrubber is reduced.

4.2.5 **Ammonia Scrubber**

The acetylene gas may contain certain impurities, such as ammonia. Ammonia can be generated as a by-product from the chemical process and depends on the quality of the calcium carbide used. The calcium carbide material supplied within South Africa is considered to be of a high quality when compared to material that is imported. The facility therefore requires an ammonia scrubber in the event that imported calcium carbide would be used in the facility. This process takes place in a sealed water bath vessel, where water strips ammonia from the acetylene gas. The concentration of ammonia would be less than <100 parts per million (ppm), generated from the scrubber.
4.2.6 Acetylene Compressor

The acetylene gas will be compressed in six multi stage compressors (Figure 4.8) which serve to compress the acetylene gas from 90kPa to 2400kPa. Phase 2 of the Project will include a further six compressors. The compressors will be submerged in a water bath. During compression a small quantity of acetylene emission is possible, which can be reduced by regular inspection and maintenance of the compressor equipment.

The operation of the compressor will be in accordance with the Air Products Acetylene Compressor Procedure (April 2008) and includes specifications for pressure and temperature protection, these include shutdown, trips, alarms and safety valves.

Figure 4.8 Multi-stage Compressors

Source: Air Products South Africa (Pty) Ltd (February 2014)

4.2.7 High Pressure Dryer (PSA)

This dryer uses a molecular sieve to remove residual moisture in the gas, before it is filled into cylinders. The Pressure Swing Adsorption System (PSA) comprises two tubular cylinders with activated alumina beds, complete with various switching valves. This system separates the acetylene gas from moisture (H₂O).
4.2.8 Pre Inspection / High Pressure Filler

Prior to the cylinders being filled, it will be determined if they are suitable for service and can be safely filled. Cylinders that indicate evidence of damage, dents or faulty valves will be rejected. After cylinders are filled with acetone, which is used to dissolve the acetylene gas, the cylinders will be weighed and then connected to a manifold for filling to take place, the maximum fill pressure is 2400Kpag (24 barg). A water spraying system is used to cool the cylinders during the filling process (Figure 4.9).

Figure 4.9 Cylinder Filling

Source: Air Products South Africa (Pty) (February 2014)

4.2.9 Process Systems and Piping

The proposed facility will also comprise system piping between all the components described above. The piping system will be a closed loop system, so that, where a cylinder has been overfilled, this gas is allowed to return to the compressors for re-filling via drain back pipes. The piping and process systems associated with the plant process are listed below.

- Back pressure valve, to reduce the velocity of gas entering the high pressure dryers.
- Cylinder charging, to accommodate multiple gas cylinders to be filled.
- Scale, to ensure each cylinder is the correct weight.
- Area monitor alarms, to check for acetylene in the atmosphere ie leaks.
• Acetone pump, to charge cylinders with acetone prior to filling.
• Drainback manifold, to recover acetylene gas back to the generator.
• Air compressor, used for plant instrumentation and the hoist.
• Master control, control system and annunciator (indicator lights).
• Mercoid switch, generator pressure controls.
• Flame arrestor, to prevent flash back of gas for plant, equipment and pipe reticulation system.

4.3 ASSOCIATED INFRASTRUCTURE

A suite of associated infrastructure is required to support the production process. The facility and its associated infrastructure will be located within the footprint of the site, illustrated in Figure 4.10 and described in the sections that follow.
Figure 4.10  Project Infrastructure Layout
### 4.3.1 Water Supply System and Storage

Rand Water is the primary authority for bulk water supply in the Midvaal area, with a main water pipeline (2300mm in diameter). Water is supplied to the rural area of Midvaal by the Daleside and Langerand reservoirs. The site’s water supply is provided by the Daleside reservoir. The Midvaal Local Municipality is the water service provider for the Project and it has been confirmed that a water supply pipeline (75mm in diameter) is in place to provide water to the site.

The Phase 1 water requirement is approximately 216 m$^3$ per twenty-four hour shift with the total for both phases being 432 m$^3$ per twenty-four hour shift. The facility is designed to recycle eighty to ninety percent of the water used. Approximately 172 m$^3$ of water will be recovered per shift; the top up water required per shift would be approximately 44 m$^3$ for Phase 1 and will be 88 m$^3$ for Phase 2, which will be supplied from the on-site water storage tanks (stormwater) as the first option or the main water supply.

Air Products intend channelling and storing the site’s stormwater run-off into two catchment pits. A land survey undertaken on the site indicates that the natural fall or gradient of the site slopes to the east. The two catchment pits (2 x 4500 m$^3$) will therefore be located along the eastern boundary of the site. The channelled run-off will be further enhanced by concrete surface beds, channels and drains. Water collected in these pits will be used as fire water and to supplement the Project’s water requirements. Two pump houses will also be installed to pump water from the pits, as and when required and will not be used continuously.

Water that is used in the acetylene generator is re-circulated from the lime filter press. This water is stored in a process water tank (9mx12m) and is tested prior to being used in the process. Process cooling water is stored in a separate tank for the heat exchange process, which also requires a cooling tower, these facilities would be located adjacent to the generator vessel. It is also planned for the cooling water to be re-used in certain processes as it is unlikely to contain any impurities.

### 4.3.2 Stormwater Management System

Stormwater management is critical for the day to day management of the Project. The potential for contaminated stormwater run-off is minimal, and therefore stormwater infrastructure will be constructed to optimise re-use of stormwater. Separate stormwater channels will be constructed around the dirty areas (ie lime separation and storage area). Stormwater run-off from potentially dirty areas will be diverted to a recycled process water system for purification and reuse. Stormwater run-off from clean areas will flow into the catchment pits to the east of the site.

A stormwater management plan and drainage design will be developed prior to construction and will be in accordance with the Air Products Design of...
Drainage Procedure (February 1999). The design will consider some of the following key considerations:

- The layout of drains will follow the shortest and easiest route to the point of discharge. The number of discharge points should be minimised;
- Consider future expansion of the facility when locating and sizing drains;
- Drainage pipes will not pass beneath or through equipment foundations;
- Manholes and gullies will not be located within liquid loading areas; and
- Oil interceptor pits will be located so as to be accessible to mobile cleaning vehicles and as close as possible to the source of flow.

4.3.3 Energy Supply and Substation

Electricity will be supplied by Eskom, via an existing 11 kilovolt (kV) distribution line along Tilliet Road. It is planned to construct a substation (4mx4m) on the site, which will transform the electrical output to a 380vac distribution board. The Project will have a power requirement of < 0.75 Megawatt (MW) for both phases of the Project.

There will also be two standby generators on site for in case of loss of electrical power from the grid. Electricity will be supplied to production facility as well as to provide power to the associated buildings including the workshops and administrative offices. The Project requires a services agreement with Eskom for the required electricity supply.

4.3.4 Chemical Storage Facilities

All storage facilities planned for the Project will be undertaken in accordance with the Air Products Storage and Containment of Environmentally Hazardous Substances Procedure (October 2008). As part of the Project, storage facilities are required for several hazardous substances and other chemical materials. All chemical storage facilities will be located aboveground and designed with secondary containment systems as well with shut off valves. Each storage area or container is described below.

Calcium Carbide

Turnbins containing calcium carbide (raw process material) will be stored in a covered storage facility to prevent moisture from entering the turnbins. This storage facility will be approximately 96m$^3$ in capacity with an area of 9m x 12m. This storage area has been designed to accommodate both phases of the Project.
**Nitrogen Storage**

Nitrogen is used primarily for maintenance and fire protection purposes. However, small amounts are also used for blanketing the acetone storage tank. The liquid nitrogen storage tank will be installed adjacent to the calcium carbide storage facility. The capacity of the nitrogen tank will be 10m³.

**Acetone Storage**

When the cylinders are being filled with the acetylene gas, acetone is added prior to filling to ensure that the cylinders are rid of any moisture. The acetone storage tank will be installed adjacent to the nitrogen tank and will have a capacity of 20m³.

**Fuel and Lubricants**

Other fuels, lubricants and solvents used for the process equipment or other equipment will be stored on site. Materials also include diesel, oils and cleaning agents for maintenance activities. These chemicals will be stored in a bunded and secured stores area, located adjacent to the maintenance and workshop facilities.

**Acetylene Gas Cylinder Storage**

The acetylene gas cylinders will be stored on site for distribution. It is expected that 16800 gas cylinders will be filled per month. At any one time, approximately 1800 gas cylinders will be on site, 900 full and 900 empty. These will be segregated and stored in designated areas and considered as rolling stock. The cylinder storage area will be approximately 7740m³ for both Phase 1 and 2.

In line with the Air Products Acetylene Cylinder Storage Area Procedure (January 2008), all areas in which the acetylene cylinders (full or empty) are stored shall be outdoors in a well-ventilated area. This area will be marked by signs indicating whether the cylinders are full or empty. Further procedural requirements for the acetylene gas cylinder storage include:

- storage area to be level and have a compacted surface;
- adequate drainage in the storage area;
- cylinders are to be stored upright; and
- a security fence (boundary fencing and/or 1.8m high chain-link fence) around the storage area.

**4.3.5 Maintenance and Workshop Areas**

A cylinder maintenance and workshop facility will be established for on-going maintenance of all facility equipment. The total area of this facility will be
18mx5m, including the stores area. A specific storage area for cylinders needing maintenance will be established which will meet the requirements of the Air Products Acetylene Cylinder Storage Area Procedure (January 2008).

4.3.6 Waste Management

Construction Activities

During construction, large quantities of building materials, including bricks and concrete will be generated due to the destruction and removal of the two existing buildings, mentioned above. Furthermore, the proposed site is strewn with litter. Site clearance and construction wastes will be managed in accordance with Air Products Waste Management Procedure (October 2008), which states that construction and demolition debris be managed as follows:

- All regulated wastes be removed by qualified workers and properly disposed of;

- Where practical, separate recyclable material from the waste (ie glass, wood, metal etc) and appoint a suitable waste contractor/s to collect for recycling or feed into the local municipal recycling system (if any);

- Re-use clean fill on site, where possible; and

- Transport remaining wastes to an approved landfill site.

Construction wastes will be the responsibility of the appointed contractor to collect and dispose of in an appropriate manner at a licenced landfill site with the capacity to receive such wastes.

Operational Activities

Waste management comprises all operational and maintenance activities that are involved in the handling, storage and disposal of wastes. The objective of waste management is to deal with hazardous and non-hazardous waste in a manner that protects human health and the environment. All wastes will be managed in accordance with the Air Products Waste Management Procedure (October 2008), which covers all waste streams.

The facility will identify and classify all wastes generated on site and a waste inventory developed. The waste inventory will record the type, quantity, origin, classification, and transport and disposal actions for each waste item.

In addition, waste segregation will be implemented for various reasons, including safety, opportunities for recycling through suppliers or different disposal options are required.

Only approved and licensed waste transport contractors will be used to collect and transport wastes off site to their respective disposal or recycling facilities. Oil from compressors change out and operation will be captured in catch pots.
and then transferred to appropriately stored containers for third party pick up and disposal. Containers will be stored within adequately bunded areas with spill control and oil/water separators in place.

In terms of the available disposal facilities, there is a regional landfill site located to the north of the Suikerbosrand Nature Reserve, outside the jurisdictional area of Midvaal. There is a smaller landfill site in Vaal Marina, which is currently in the process of being licensed along with other landfill sites in Walkerville and Henley-on-Klip. These sites will be investigated further prior to construction to determine capacities and categories of waste that can be accepted from the operation of the Project.

The processes during maintenance and operations will involve the generation of wastes. A summary of the wastes that are likely to be generated is provided in Table 4.1.

**Table 4.1 Operational Waste**

<table>
<thead>
<tr>
<th>Waste Stream</th>
<th>Main Sources</th>
<th>Possible Environmental Constituent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scrap metals</td>
<td>Used process equipment, tanks, empty drums and cylinders</td>
<td>Heavy metals</td>
</tr>
<tr>
<td>Waste lubricants</td>
<td>Equipment lube oil changes, Oil from compressors</td>
<td>Organic, heavy metals</td>
</tr>
<tr>
<td>Process waste</td>
<td>Generator and Compressor</td>
<td>Acetone, acetylene gas purifier, scrubber waste</td>
</tr>
<tr>
<td>Fluorescent tubes</td>
<td>Infrastructure illumination, Sandblast, greases, fuel oil filters, acids</td>
<td>Mercury, Argon, tubes</td>
</tr>
<tr>
<td>Maintenance wastes</td>
<td>Sandblast, greases, fuel oil filters, acids</td>
<td>Heavy metals, hydrocarbons, solids, solvents</td>
</tr>
<tr>
<td>Refrigerants</td>
<td>Air conditioning/refrigerant units</td>
<td>Non-CFC refrigerants</td>
</tr>
<tr>
<td>Paint materials</td>
<td>Paints, thinners, coatings Instrumentation and operations</td>
<td>Heavy metals, solvent, hydrocarbon Mercury</td>
</tr>
<tr>
<td>Mercury</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contaminated soil</td>
<td>Spill/leaks</td>
<td>Hydrocarbons, heavy metals, salts, treating chemicals</td>
</tr>
<tr>
<td>Cement</td>
<td>Cement mix water, cement returns</td>
<td>Heavy metals, viscosifiers, pH, salts</td>
</tr>
</tbody>
</table>

4.3.7 **Administrative Office**

The existing farmhouse is planned to be used as the administrative office (Figure 4.11). The structure of the house will be maintained with internal upgrades, including the replacement of windows, removal of carpets and cupboards and installation of electrical and water facilities, that have been previously removed. These upgrades have commenced with the approval of the GDARD (14 May 2014) as these upgrades do not constitute the production of acetylene gas and therefore are not considered to constitute the commencement of the Project.

The administrative office will include three offices, a meeting room, a training room, kitchen and dining area, filing and stationery room, store room, security room and toilet (male and female) facilities.
4.3.8 Change and Sanitation Facilities

The outbuilding adjacent to the farmhouse will be used by employees as a change/mess facility (Figure 4.12). It will include male and female toilets, with change rooms and lockers to store personal items. There will also be a canteen in which employees can have lunch.

Within the plant area a separate wash/mess facility (5mx8m) will be constructed for employees needing to be on the plant site.
4.3.9 Control Room

A control room will be constructed to monitor the production process and ensure standard operating conditions are met. The proposed control room will cover a total area of approximately 9mx7m.

4.3.10 Security Facilities

Due to current safety concerns (ie vandalism and theft), Air Products will commence with the construction of a site perimeter wall. GDARD has indicated that this would not constitute construction and has therefore approved this activity in a letter dated 14 May 2014 (Annex B). Building plans for the wall have been submitted to the Midvaal Local Municipality for approval. Once approved, Air Products will build the wall (ie by mid-July; completed by mid-October.) Site notices will be erected on and around the site to inform neighbouring landowners of the activity and to provide contact details of the relevant Air Products project manager should there be a queries and concerns resulting from the activity.

The perimeter wall will also have electrical fencing. There will be one entrance gate and one exit gate. A security post will be established at the main entrance gate, just off Tilliet Road.
\textbf{4.3.11 Roads and Parking}

The site will be accessed via Tilliet Road which is just off Kalksteen Road, a tributary road leading to Springbok Road (M61). Tilliet Road is a gravel road, which will be paved as part of the Project to access the site (Figure 4.13).

Within the site, a ring road will be constructed from the main entrance, around the facility and to the exit gate. Along the ring road, there will be cylinder off-loading and loading bays as well as an area for lime collection. Furthermore, there will also be an acetone road tanker off-loading facility along the ring road. There will also be an internal road, which passes by all the chemical storage facilities, the purpose of this road is to ensure the safe transport and handling of dangerous goods to these tanks or storage areas. The ring road will be a concrete paved road of approximately 650m in length and 7m wide. The speed limit on all Air Products facilities is 20km/h. The facility itself and areas around the facility will be underlain by concrete paving.

There will be approximately ten parking bays available for employees and visitors to the facility. The parking bays will be located at the entrance of the facility, adjacent to the administrative office.

\textit{Figure 4.13 Tilliet Road}

Source: ERM Site Visit, 28 November 2013 (Photographer: Kasantha Moodley)
4.4 CONSTRUCTION AND COMMISSIONING ACTIVITIES

4.4.1 Site Clearing

The initial stage of construction will involve site clearing and grubbing, which will be restricted to the area required for the construction of the proposed acetylene gas production facility. Site clearing will begin with the destruction and removal of two building structures, located on the northern portion of the site (Figure 4.14).

Figure 4.14 Buildings to be Removed

![Buildings to be Removed](source: ERM Site Visit, 28 November 2013 (Photographer: Kasantha Moodley)

Clearing and grading will also involve removal of trees and debris from the construction area and the preparation of a level surface for construction equipment/laydown area. Existing trees around the farmhouse will be assets and evaluated to be maintained. Topsoil and excavated material will be removed and stockpiled for reuse, with surplus material being placed and contoured around the proposed facility.

4.4.2 Construction Camp

The existing farmhouse, located on the southern portion of the site will be used as a contractor camp site. The out building adjacent to the farmhouse will be used as change facilities by employees.

4.4.3 Site Services

It is understood that services are available to the site and serviced part of the farmhouse developed on the southern portion of the site. These existing services will be utilised during the construction phase. A site services agreement will be signed with the Midvaal Local Municipality, prior to the Project commencing. During construction, Air Products employees will utilise
the existing sanitation facilities provided in the farmhouse and outbuilding. Additional portable toilets will be made available during the construction phase for contractors etc.

4.5 **OPERATION ACTIVITIES**

4.5.1 **Cylinder Filling**

Prior to filling, all acetylene cylinders will be inspected in accordance with the Air Products Acetylene Cylinder Pre-Fill Inspection Procedure (April 2008). This procedure requires the following checks:

- there are no significant dents and shell defects;
- the cylinder is not fire damaged;
- all parts that make up the cylinder are intact, ie, foot, neck rings and guards;
- the serial number, weight and all relevant details are legible;
- the cylinder is clearly marked as acetylene;
- the cylinder valve and guard are in good condition; and
- the cylinder has not been tampered with or modified in any way.

Once inspected, all cylinders will be filled in accordance with the Air Products Acetylene Cylinder Filling Procedure (April 2008). This procedure requires that all cylinders:

- be checked for leaks including the valve outlet;
- have a tamper evident plug fitted;
- have the correct labels attached before shipping; and
- shall be allowed to stand for 24 hours before being delivered to users.

4.5.2 **Cylinder Distribution**

Acetylene gas cylinders will be transported off-site by trucks. These trucks are owned and operated by Air Products, therefore it is the responsibility of Air Products to regularly inspect and maintain vehicles for road-worthiness. These fleet vehicles are not parked on site.

Cylinders are loaded and off-loaded by means of fork lifts. The delivery and collection of the cylinders will be undertaken by 33 ton vehicles with a payload of 25 tons. One truck can transport 200 cylinders. It is expected that two trucks will be travelling to and from site per day and will have a
turnaround time of approximately 2-3 hours. Deliveries and collection will be undertaken during normal working hours, five days per week.

The trucks will exit the site via Tilliet Road and then travel onto the M61 (Springbok Road) and onto the R59 highway to various companies in the region, including Acelor Mittal, Rand Water and Eskom. It is expected that three additional trucks will be on site per day for deliveries of raw materials and collecting lime.

4.5.3 **Process By-Product**

Calcium Hydroxide (CaOH)$_2$ is a by-product of the manufacturing process. According to the European Industrial Gasses Association (EIGA, 2011), lime slurry is considered a by-product and not a waste, as it is possible to market lime for different uses including use as a neutraliser in chemical processes, sewage water treatment, agriculture, building trade etc.

Air Products thus intend installing two sludge separation pits during Phase 1 of the Project and a further two during Phase 2. These slurry holding areas will be watertight basins, each with a capacity of 245m$^3$. The slurry will either be transferred to the filter press (10m$^3$/hr) for dry processing, bagging and storage or alternatively be transferred to the sludge separation pits, where excess water is removed and slurry is transferred to the Green Chem (contractor) storage pit with a capacity of 90m$^3$. The lime production rate for the facility for two shifts (24 hours) is 24 tons.

The Air Products Emptying and Cleaning the Lime Pit Procedure (April 2008) requires that a site specific procedure be developed for cleaning the lime pits. This procedure will cover the requirements for confined space entry and take into account the risk assessment for the activity including checking the oxygen level and the presence of acetylene.

4.5.4 **Maintenance Activities**

From time to time, a component of the facility will require maintenance or repairs. To undertake such works, Air Products will need to shut down the facility. Depending on the need, the facility can be shutdown for up to seven days or for more than a week (considered a long-term shutdown). A facility shutdown will be undertaken in accordance with Air Products Acetylene Plant Shutdown Procedure (April 2008). Once maintenance or repair works are complete, the facility can be started up again by undertaking various checks and inspections in accordance with Air Products Acetylene Plant Start Up Procedure (April 2008).

The generator vessel is one facility component which requires regular cleaning and inspection, especially due to any lime build up. This maintenance or repair work will be undertaken in accordance with the Air Products Generator Cleaning and Inspection Procedure (April 2008).
Furthermore, the cylinders require maintenance and/or repairs, which will be undertaken at the cylinder maintenance workshop. The number of de-valved cylinders in maintenance would be no more than one per maintenance operator to reduce the risk of gas release and potential fire.

4.5.5 On-Site Emergency Planning

The Air Products Acetylene Plant Emergency Systems Procedure (April 2008) requires that all Air Products facilities shall have suitable and sufficient systems to protect a plant in case of emergency during a major incident. Furthermore, it requires that all emergency systems are maintained so that they are available on demand during an emergency and designed such that they do not endanger the personnel on site. The minimum emergency systems required at an acetylene plant are detailed in Table 4.2 below.

<table>
<thead>
<tr>
<th>System</th>
<th>Objective</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen Purge</td>
<td>Intended to remove all acetylene from the plant and to leave it in a safe condition when an emergency situation is observed by an operator.</td>
<td>• Shutdown the plant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Introduce a nitrogen purge</td>
</tr>
<tr>
<td>Deluge System</td>
<td>Intended to remove all acetylene from the plant and to leave it in a safe condition when a fire is observed by an operator.</td>
<td>• Provide water coverage</td>
</tr>
<tr>
<td>Evacuation Alarm</td>
<td>Designed to be heard throughout the site to activate all personnel to evacuate to the assembly point.</td>
<td>• Evacuation to assembly points.</td>
</tr>
</tbody>
</table>

In addition the facility will have specific emergency procedures relating to potential problems on the hot generator, hopper and cylinder on the filling manifold. These procedures are detailed in Air Products Acetylene Plant Emergency Procedures (April 2008).

Air Products will therefore plan for and manage all possible site emergencies according to these minimum requirements and the Air Products Site Emergency Planning Procedure (August 2009). Possible types of emergencies that will be planned for include, but are not limited to, fire, loss of containment, process emergencies, security incidents, gas and chemical releases, health related emergencies, failure of utilities and product integrity issues.

With specific reference to fire, design of fire protection systems will be in accordance with the Air Products Acetylene Plants Requirements for Fire Protection Procedure (March 2008) which requires a fire detection system and firefighting equipment, such as hydrants and portable fire extinguishers. A fire safety design philosophy has been developed for the Project which
identified the potential hazards, their associated consequences and the safeguards which are included into the design. These safeguards have been included into the Project EMPr (Annex F).

A site specific Emergency Plan will be developed for the facility and will specify responsible parties, types of emergencies, site evacuation requirements, an emergency alarm, emergency response and control procedures. All site employees will be trained on the site Emergency Plan with training including emergency drill exercises. The Emergency Plan will be reviewed and updated on an annual basis by the facility manager.

The Emergency Plan will be based on the risks identified in the MHI Risk Assessment (Annex E5) undertaken for the Project. Furthermore, the Emergency Plan shall adhere to Section 6 of The Major Hazard Installation regulations; which outlines the requirements for on-site emergency planning. The requirements are detailed below.

- Establish an on-site emergency plan to be followed inside the premises of the installation or part of the installation classified as a major hazard installation in consultation with the relevant health and safety representative or the relevant health and safety committee;

- Discuss the emergency plan with the relevant local government, taking into consideration any comment on the risk related to the health and safety of the public;

- Review the on-site emergency plan and where necessary, update the plan, in consultation with the relevant local government service at least once every three years;

- Sign a copy of the on-site emergency plan in the presence of two witnesses, who shall attest the signature;

- Ensure that the on-site emergency plan is readily available at all times for implementation and use;

- Ensure that all employees are conversant with the on-site emergency plan; and

- Cause the on-site emergency plan to be tested in practice at least once a year and keep a record of such a test.”

4.6 DECOMMISSIONING ACTIVITIES

The decommissioning of the facility will be undertaken in accordance with the Air Products Decommissioning and Dismantling Acetylene Plant Procedure (April 2008) which requires the preparation of an environmental plan and method to clean the site and reinstate the site.
The facility will be shut down and the following activities will be undertaken during decommissioning.

- The facility will be purged with nitrogen until all acetylene has been removed.

- All excess raw materials including calcium carbide, lubricating oils, refrigeration gases will be removed from the site and disposed of in accordance with the local waste management by laws. The preferred option in all cases is to use as much of the products as possible rather than to dispose of it.

- The calcium carbide hoppers will be removed and transported to a dry location.

- The facility will be electrically isolated and all incoming power sources locked and tagged out.

- The generator will be filled completely with water and left for at least five days. This is to ensure any unreacted calcium carbide is converted into acetylene. The water will be emptied out of the generator and the generator opened and cleaned of all residual lime and debris.

- The hoppers will be dismantled using spark proof tools and any unreacted calcium carbide allowed to react with the air.

All infrastructures will be dismantled and removed off site. Machinery, steel and dismantled materials will be recycled where possible and disposed of at licensed disposal sites. There is currently no agreement in place which defines what will happen to the facility at the end of its lifecycle, but it is anticipated that the Project site will be returned to its original state. A dismantling and environmental plan will be developed prior to initiation of decommissioning activities.

4.7 PROJECT WORKFORCE

The establishment of the proposed acetylene gas production facility is expected to result in approximately ten temporary jobs during construction and 20 permanent jobs during operation.

Air Products intends retaining approximately ten employees from their existing Kempton Park and Pinetown facilities for the operation of the facility, whilst the other ten jobs will be sourced locally. To operate the facility, approximately ten skilled, five semi-skilled and five unskilled employees would be required. During operation, jobs will be available in the form of plant operators, security, cleaners (two) and gardeners (two). A proposed facility organisational structure is provided as Figure 4.15.
Air Products will offer training by offering multi skilling through the operational aspects of the facility. All employees are encouraged to complete their secondary education with tertiary level education being offered to plant operators and/or supervisors.

No employees will be housed on the proposed site during construction or operation.
Figure 4.15  Proposed Facility Operations Organisational Structure

Source: Air Products South Africa (Pty) (May 2014)
4.8  **PROJECT SCHEDULE**

A provisional schedule for Project activities is outlined in Table 4.3. The commissioning/construction date of Phase 1 is expected to commence in Quarter 1 of 2015. The proposed facility is planned to be operational in Quarter 4 of 2015. Phase 2 of the Project is expected to commence in 2024 and be fully operational in 2026; however this would be subject to customer future demand for acetylene gas.

The facility will have a lifespan of between 40 to 50 years.

**Table 4.3  Provisional Project Schedule**

<table>
<thead>
<tr>
<th>Project Activity</th>
<th>Duration</th>
<th>Start</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction (Plant and Associated Infrastructure)</td>
<td>12 months</td>
<td>January 2015</td>
<td>December 2015</td>
</tr>
<tr>
<td>Plant Commissioning</td>
<td>40 days</td>
<td>October 2015</td>
<td>December 2015</td>
</tr>
<tr>
<td>Plant Optimisation</td>
<td>2 months</td>
<td>January 2015</td>
<td>March 2015</td>
</tr>
<tr>
<td>Plant Personnel Training</td>
<td>1 month</td>
<td>October 2015</td>
<td>November 2015</td>
</tr>
<tr>
<td>Phase 1 Completion</td>
<td>0 days</td>
<td>December 2015</td>
<td>December 2015</td>
</tr>
<tr>
<td>Phase 2 Commissioning</td>
<td>2 years</td>
<td>2024</td>
<td>2026</td>
</tr>
</tbody>
</table>

Source: Air Products South Africa (Pty) (May 2014)