Gert Sibande District Municipality

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ATMOSPHERIC EMISSION LICENCE AS CONTEMPLATED IN SECTION 43 OF THE NATIONAL ENVIRONMENTAL MANAGEMENT: AIR QUALITY ACT, 2004, (ACT NO. 39 OF 2004) (NEMAQA)

I, **Tsunke Daniel Hlanyane**, in my capacity as **License officer** (hereinafter referred to as "the Licensing Authority"), in terms of section 43 of the National Environmental Management: Air Quality Act, 2004 (Act 39 of 2004, hereinafter referred to as the "Act"), and as provided for in section 36(1) of the Act, hereby grant an Atmospheric Emission Licence to **Sasl South Africa (Pty) Ltd *Sasol Synfuels*** ("the Applicant)."

This Atmospheric Emission Licence is issued to **Sasol South Africa Pty (Ltd) *Sasol Synfuels*** in terms of section 41(1) of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) ("the Act"), in respect of Listed Activity **Category 1: Sub-category 1.1 Solid fuel Combustion Installations (excluding any solid material that is regarded as waste in terms of Waste Act, 2008), Sub-category 1.4 Gas Combustion Installations (excluding any solid material that is regarded as waste in terms of Waste Act, 2008), Category 2:Sub-category 2.1 Combustion Installations (excluding any solid material that is regarded as waste in terms of Waste Act, 2008), Sub-category 2.2 Catalytic Cracking Units, Category 3: Sub-category 3.3. Tar Processes, Sub-category 3.6 Synthetic Gas Production and Cleanup; Category 4: Subcategory 4.2 Combustion Installations (excluding any solid material that is regarded as waste in terms of Waste Act, 2008), Sub-category 4.7 Electric Arc Furnaces; Category 5: Sub-category 5.1 Storage and Handling of Ore and Coal; Category 6: Organic Chemicals Industry; Category 7: Sub-category 7.1 Production and or Use in Manufacturing of Ammonia, Fluorine, Fluorine Compounds, Chlorine and Hydrogen Cyanide, Sub-category 7.2 Production of Acids and Category 8: Sub-category 8.1 Thermal Treatment of General and Hazardous Waste.**

The Atmospheric Emission Licence has been issued on the basis of information provided in the company's application dated **21 July 2011** and subsequent variation submission. The Atmospheric Emission Licence is valid upon signature for a period not exceeding five (05) years from the date of fist issue of the licence. The reason issuance of the licence is for variation. The Atmospheric Emission Licence is issued subject to the conditions and requirements set out below which form part of The Atmospheric Emission Licence and which are binding on the holder of the Atmospheric Emission Licence ("the holder").

1 ATMOSPHERIC EMISSION LICENCE ADMINISTRATION

Name of the Licensing Authority	Gert Sibande District Municipality
Atmospheric Emission Licence Number	Govan Mbeki Sasol South Africa(Pty) Ltd Sasol Synfuels 0016/2018/F03
Atmospheric Emission Licence Issue Date	Upon date of signature
Atmospheric Emission Licence Type	Variation
Expiry date	05 years from date of first isssue (Govan Mbeki Sasol Synfuels 0016/2014/F01)

2 ATMOSPHERIC EMISSION LICENCE HOLDER DETAILS

Enterprise Name	Sasol Synfuels (Pty) Ltd
Trading as	Sasol Synfuels
Enterprise Registration Number (Registration Numbers if Joint Venture)	1979/002735/07
Registered Address	Synfuels Road Sasol Synfuels Secunda 2302
Postal Address	Private Bag X1000 Secunda 2302
Telephone Number (General)	017 610 2627
Industry Sector	Petrochemical
Name of Responsible Officer	Willem Oosthuizen
Name of Emission Control Officer	Johan Steynberg
Telephone Number	017 610 2644
Cell Phone Number	079 509 90116
Fax Number	017 610 4090
Email Address	estelle.marais@sasol.com
After Hours Contact Details	082 902 1989
Land Use Zoning as per Town Planning Scheme	Industrial Special Stand number 8488 Secunda Extension 35

3. LOCATION AND EXTENT OF PLANT

3.1. Facility Address

Physical Address of the Premises	Synfuels Road Sasol Synfuels Secunda, 2302
Description of Site (Erf)	Highveld Ridge Mpumalanga
Coordinates of Approximate Centre of Operations	Latitude[redacted] Longitu[redacted]
Extent (km^2)	2 405 hectares
Elevation Above Mean Sea Level (m)	1 597m
Province	Mpumalanga
Metropolitan/District Municipality	Gert Sibande District Municipality
Local Municipality	Govan Mbeki Local Municipality
Designated Priority Area	Highveld Priority Area

3.2. Description of surrounding land use (within 5 km radius)

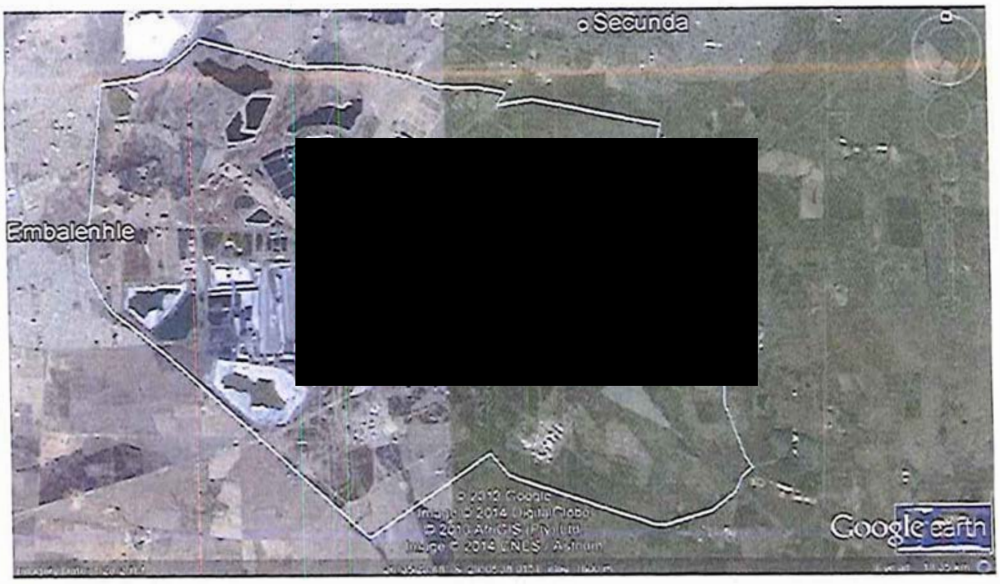

Figure 1: Goole Earth Image of area surrounding the site (5km)

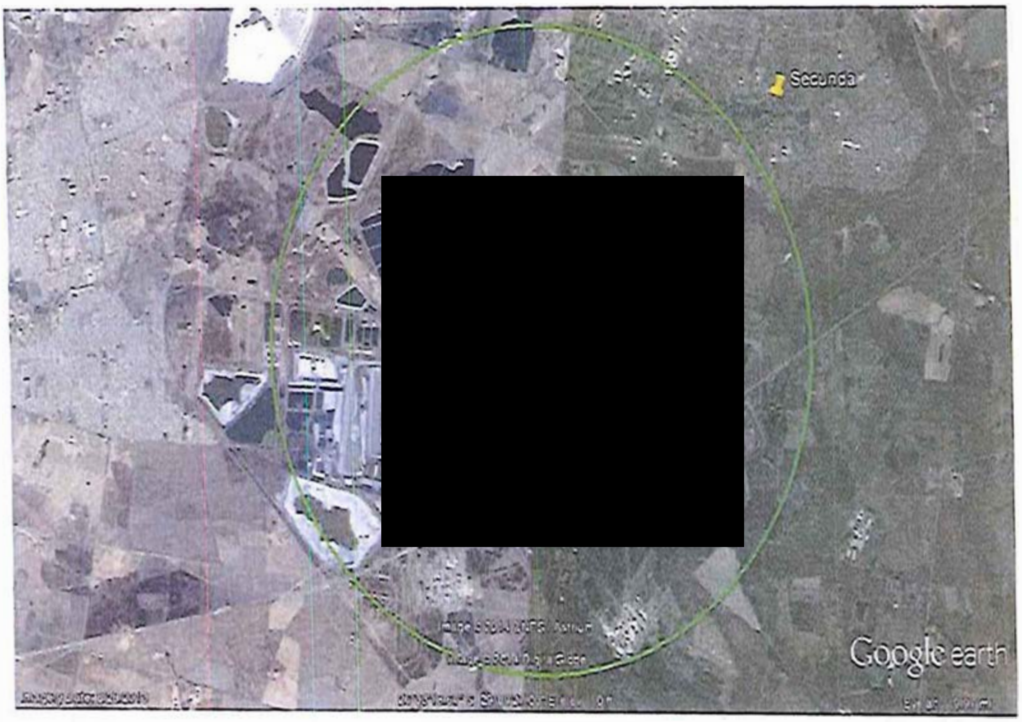

Figure 2: Locality map illustrating the area and activities within (5km) radius

4. GENERAL CONDITIONS

4.1. Process and ownership changes

(a) The holder of the atmospheric emission licence must ensure that all unit processes and apparatus used for the purpose of undertaking the listed activity in question, and all appliances and mitigation measures for preventing or reducing atmospheric emissions, are at all times properly maintained and operated to the minimum of manufactures specifications.

(b) No building, plant or site of works related to the listed activity or activities used by the licence holder shall be extended, altered or added to the listed activity without an environmental authorisation from the competent authority. The investigation, assessment and communication of potential impact of such an activity must follow the basic assessment procedure as prescribed in the Environmental Impact Assessment Regulations published in terms of section 24(5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), as amended.

(c) Any changes in processes or production increases, by the licence holder, will require prior approval by the licensing authority. Any changes to the type and quantities of input materials and products, or to production equipment and treatment facilities will require prior written approval by the licensing authority.

(d) The licence holder must, in writing, inform the licensing authority of any change of ownership of the enterprise. The licensing authority must be informed within 30 working (thirty) days after the change of ownership. The licence holder must immediately on cessation or decommissioning of the listed activity inform, in writing the licensing authority.

(e) The licence holder must immediately on cessation or decommissioning of a listed activity inform, in writing the licensing authority.

4.2. General duty of care

(a) The holder of the license must, when undertaking the listed activity, adhere to the duty of care obligations as set out in section 28 of the NEMA. The license holder must undertake the necessary measures to minimize or contain the atmospheric emissions. The measures are set out in section 28(3) of the NEMA.

(b) Failure to comply with the above condition is a breach of the duty of care, and the license holder will be subject to the sanctions set out in as set out in Chapter 7 Section 52 of NEMAQA (Act no. 39 of 2004), Chapter 10, Section 89 of the National Health Act 61 of 2003, Section 28 of the National Environmental Management Act 108 of 1998, Chapter 16 section151 of the National Water Act, and Chapter 7 section 68 of the National Waste Management Act, including any provisions contained in the By-laws.

4.3. Sampling and/or analysis requirements

(a) Measurement, calculation and /or sampling and analysis shall be carried out in accordance with any nationally or internationally acceptable standard in line with NEMAQA (Annexure A). A different method may be acceptable to the licensing authority as long as it has been consulted and agreed to in writing and to the satisfactory documentation necessary in confirming the equivalent test reliability, quality and equivalence of analyses has been submitted.

(b) The licence holder is responsible for quality assurance of methods and performance. Where the holder of the licence uses external laboratories for sampling or analysis, only accredited laboratories by the national accreditation body shall be used. The certified copy of the license and the accreditation of the external laboratory must be submitted to the license authority annually including its external audits certification.

(c) The licence holder must prior using any other methodology obtains written approval from the licence authority for use of such methodology for compilation of compliance sampling reports.

(d) The licence holder must provide the licensing authority on request with raw data obtained during sampling and or analysis including proof of agreed methodology used to reach the final results submitted for compliance.

4.4. General requirements for licence holder

(a) The licence does not relieve the licence holder to comply with any other statutory requirements that may be applicable to the carrying on of the listed activity.

(b) A copy of the licence must be kept at the premises where the listed activity is undertaken. The original licence must be made available to the environmental management inspector / air quality officer or an authorised officer representing the licensing authority who requests to see it.

(c) The licence holder must inform, in writing, the licensing authority of any change to its details but not limited to the name of the emission control officer, postal address and/or telephonic details within 5 working days after such change has been effected.

(d) The licence holder must hold an environmental / health consultation forum meetings with affected and interested parties bi –annually to give feedback on the impact of the facility on related matters, and must provide written prove of such consultation to the licensing authority bi-annually.

(e) The facility must implement offset program to reduce PM and SO^2 pollution in the ambient air / receiving environemt and the iimplementation plan to be presented to the national air quality officer and the licencing authority by 30 June 2015 after agreement followed by appropriate public participation process.the conditions associated with this will be included as Annexure to the AEL

4.5. Statutory obligations

The licence holder must comply with the obligations as set out in Chapter 5 of NEMAQA (Act no. 39 of 2004), Chapter 10 and 11 of the National Health Act 61 of 2003, National Environmental Management Act 108 of 1998, National Water Act no.36 of 1998, and National Waste Management Act no. 59 of 2008 including all related Municipal and District by-laws.

4.6. Annual payment of atmospheric emission licence processing fee

The licence holder must, for the period of validity of the licence, pay or make arrangement for the payment of the prescribed processing fee or district licence tariff to the licensing authority in line with the District tariff by-law or tariff policy in terms of MFMA (Act No. 56 of 2003) and NEMA:QA (Chapter 5 (37)

5 NATURE OF PROCESS

5.1 Process Description

5.1.1 Utilities

5.1.1.1 Steam Plant

Steam is used in various processes throughout the factory and for generating electricity. The Steam plant generates steam from 17 boilers using fine coal and boiler feed water. Electricity is generated by means of 10 steam driven turbine generators. Steam Plant (Unit 43 /243) supplies process steam for the Gasification process, as well as drive steam for the turbines at Synthol and Oxygen East. Make-up steam is let down to satisfy deficits on the MP and LP factory steam headers. The balance of the steam produced is used to generate electricity. U43 and 243 both have eight Babcock boilers, while U243 has a ninth boiler built by ICAL. Electricity is generated in turbo-generator sets rated at 60MWe. There are 6 and 4 turbo-generators at both U43 and U243 respectively, resulting in combined generation capacity of 600MWe. The operating philosophy of steam plant is such that the steam header pressure control is done by manipulating the boilers and turbo generator load.

5.1.1.2 Gas Turbines

Two gas turbines provide additional electricity generating capacity. Natural gas from Mozambique and Methane Rich Gas (MRG) from Cold Separation (Gas Circuit) are used as the feed streams.

The open cycle gas turbine (OCGT) power plant consists of 2 x GE PG9171 (E) gas turbine generators and associated plant. The nominal output from each gas turbine is approximately 104MW. The gas turbines utilise natural gas as fuel. The exhaust gas from the gas turbines is used to generate high pressure steam in Heat Recovery Steam Generator (HRSG). Each gas turbine have its own boiler (HRSG) with supporting boiler feed water pre-conditioning equipment as well as own blow down equipment. Each HRSG is at 163t/h MCR 40 bar (g) steam production.

There are two GT trains (GT 1 and GT 2) which are operated independently in parallel. Each GT train has a maximum operating generation capacity of 104 MW during summer months and 110 – 118 MW during winter months. The GTs has a design generation capacity of 118 MW. All generation capacities assumes a power factor (Cos φ) of 0, 8. The Gas Turbines supply electricity into the Eskom grid.

5.1.2 Gas Production

5.1.2.1 Coal processing

Coal is conveyed from Sasol Coal Supply (SCS) East (CV2000, CV2008, CV2009) and West (CV3000, 3008, 3009) to Coal Processing (Unit 01 / 201). The coal is conveyed into 14 bunkers on top of Coal Processing on each side. The material is then screened in a Primary and Secondary vibrating screen. The coarse fraction (oversize material) is conveyed to Coal Distribution (Unit 02 / 202) through CV15, CV16, CV17 (East) and CV15, 15a, 16, 17 (West). These conveyer belts transfer material on the incline conveyers (CV18, 19, 20, and 21) where the coal is then dumped into the North and South bins of the respective East and West Coal Distribution plants. From the North and South bin, the coal is conveyed via the wing conveyers (CV26 to 28, CV29 to 31, CV32 to 34 and CV35 to 37). Last mentioned conveyer belts service two tripper cars per conveyer where it is then used to fill the different bunkers of the gasifiers.

The undersized material from the Secondary vibrating screen is transferred by means of gravity to the sieve bend screen where primary dewatering takes place. The oversize material from the sieve bend screens are transferred to a centrifuge where further dewatering takes place. The undersize of the sieve bend screens are transferred in a slurry launder to the thickener system where flocculent is added to aid in the settling of the coal particles. The underflow of the thickeners is pumped to the filter section where the slurry is dewatered by means of vacuum filtration. The filter cake is removed from the filter cloth with the aid of a compressed air cycle. The filter cake and centrifuge product combine on CV9 and 10 to be used as feed to the Steam Plant (Unit 43 / 243). The water is recovered from the thickener to be used as spray water.

5.1.2.2 Gasification and Raw Gas Cooling

84 Sasol® FBDB™ gasifiers (42 gasifiers at each unit, 10 and 210), are used to gasify coarse coal at a temperature of approximately 1 300°C using high pressure superheated steam and oxygen. The Sasol® FBDB™ gasifiers is a commercially proven process for the conversion of coal feedstock into synthesis gas. In this process, the following streams are formed:

- Raw gas which is transferred to Raw Gas Cooling and then to Rectisol for further purification
- Ash as a waste stream that is processed by the Inside Ash
- Gas Liquor (a water stream) is transferred to Gas Liquor Separation to separate tars, oils and solids from the aqueous phase.

Wet gasification coal (the coarse fraction) is sent to the coal storage at the top of each gasifier. Coal is loaded to each gasifier using batch operated coal locks. Inside the gasifiers, carbonaceous fraction of coal reacts with steam and oxygen mixture producing crude (raw) gas containing hydrogen, carbon dioxide, carbon monoxide, methane, steam, as well as small concentrations of hydrocarbons, tars, oils, phenols, ammonia and many more.

Hot gas leaving the gasifiers at approximately 500 degree Celsius is first quenched to remove solids and heavy tars and then cooled in heat exchangers at Raw Gas Cooling (units 11& 211) down to approximately 38 degree Celsius before it is sent to Rectisol for further purification. During gasification process, mineral matter contained in coal is oxidised and ash is produced. The ash is intermittently removed from the bottom of the gasifier via an automatically operated ash lock hopper, quenched with water and sent to Inside Ash unit for processing and disposal.

The gas liquor containing dissolved oil, phenols, tar acids, organic acids and ammonia, is worked-up in the Gas Liquor Separation, Phenosolvan, Ammonia Recovery and biological Water Recovery effluent treatment plants, before it is used as make-up water to the process cooling towers.

5.1.2.3 Rectisol

The main function of Rectisol is to remove acid gases, such as CO2 and H_2S, together with other impurities from the raw gas produced by Gasification. The resulting cleaned gas, called pure gas, is the feedstock to the Synthol plant.

The Rectisol process is a physical absorption process that washes the raw gas [redacted] order to remove CO_2, H_2S, BTEX's and other organic and inorganic compounds. The raw gas and methanol flow counter-current through an absorption tower which comprises two sections. The resultant pure gas is routed directly to Synthol and the loaded[redacted]s routed to the regeneration systems. [redacted] the first tower section has water added to it and the BTEX-rich Naphtha phase is removed by gravity separation in an extractor drum and sent to Tank farm. [redacted] phase is distilled to separate t[redacted] (which is recycled back into the system) and the water (sent to waterworks for further processing). The methanol from the second tower section is flashed to remove CO_2, H_2S and other gases and some of it is then heated to strip off any remaining gases. The CO_2 and H_2S-containing off gas streams are routed to Sulphur plant and Wet Sulphuric Acid for further processing. The entire process is supported by a propylene refrigeration system.

5.1.3 Gas Circuit

5.1.3.1 Benfield

Tail Gas from Synthol (gas synthesis section) passes through a knock-out drum and a filter coalescer to remove any liquid droplets from the feed gas. The gas is then heated by heat exchange with hot potassium carbonate solution and enters the absorber column. CO_2 is absorbed from the gas stream into the potassium carbonate absorption medium. The cleaned gas then passes through a knock-out drum into the DEA system, which acts as a CO_2 removal polishing unit. The sweetened gas then passes through a cryogenic separation unit called Cold Separation.

The rich (loaded with CO_2) potassium carbonate solution is regenerated by flashing the solution and by reboil in the regeneration column. The CO_2 and steam mixture is released to atmosphere and the lean potassium carbonate is re-circulated to the absorber column. A similar recycle and regeneration process is used in the DEA system. The CO2 and steam stripped from the DEA solution, joins the carbonate regeneration column and is released to atmosphere. Condensate is added to both regeneration columns (carbonate and DEA) to make up for the water lost to atmosphere

5.1.3.2 Catalyst Manufacturing and Catalyst Reduction

The Synthol (SAS) reactors are based on high temperature Fischer – Tropsch technology and uses [redacted] catalyst. [redacted] availabili[redacted] breakthr[redacted]

[redacted]

Raw Mill Scale (RMS) is fed to the rotary kiln. The objective of the kiln is to burn off oily contaminants, evaporate moisture and primarily oxidize the RMS to magnetite (Oxidized Mill Scale or OMS). The OMS is then fed to the electric arc furnace where the OMS and promoters are fused together at the prescribed furnace conditions in order to obtain a catalyst with the desired chemical composition and mechanical strength. From the furnace the catalyst is cast to ingots, cooled down and then crushed. This crushed fused catalyst is then fed to the Ball Mill circuit. The purpose of the ball mill circuit is to mill the crushed catalyst and classify the powder into the specified particle size distribution suitable for fluidization in the SAS reactors.

The milled catalyst is stored in four milled catalyst hoppers, from where it is transferred with nitrogen to the Catalyst Reduction units. The Catalyst Reduction Unit consists of three identical trains on each factory. The objective of the reduction step is to reduce (and thus activate) the iron catalyst. This is done through reaction of the catalyst with 99% pure hydrogen at 420°C. The reduction process is a batch process and batches of approximately 120 tons of milled catalyst are processed. Once a batch is completed, the reduced catalyst is unloaded to the fresh catalyst hoppers at Synthol from where it is then loaded to the SAS reactors during the SOLCRA cycles.

5.1.4 Refining

5.1.4.1 Tar distillation units (UNIT 14/214)

The purpose of this unit is to fractionate crude tar, originating from Gasification, into different fractions, which is then used as feed for downstream units. These fractions (from low to high boiling point) include light naphtha, heavy naphtha, medium cresosote, heavy cresosote, residue oil and pitch.

Unit 27A

The purpose of Unit 27A is to remove the neutral oils contained in the HNO-DTA (high neutral oil depitched tar acids) feed, producing LNO-DTA (low neutral oil depitched tar acids). Unit 27A is the final processing step in the Tar Acid Value Chain (TAVC) on the Secunda site. The LNO-DTA consists mainly of phenols, cresols and xylenols (PCX's) that are extracted from the gas liquor stream at Phenosolvan into crude tar acids (CTA), from where the majority of pitch is removed in the Primary Depitchers where the distillate product HNO-DTA is sent to Unit 27A.

5.1.4.2 Unit 74

The CTA feed stream to the Primary Depitcher at Phenosolvan is split into the side draw, HNO-DTA stream going to Unit 27A and the phenolic pitch bottoms stream that is fed to Unit 74. [redacted]

5.1.4.3 Coal tar Naphtha hydrogenation (Unit 15/215)

The purpose of this unit is to hydro treat a combined feed of Rectisol naphtha, light naphtha and heavy naphtha from Unit 14/214 to remove phenolic and nitrogen compounds. Olefin saturation and sulphur removal also takes place to produce a product acceptable for utilisation in the petrol pool. The liquid product is fed to a H_2S stripper where the sour water is removed from the product stream. The final product goes to storage to be used as blending component in petrol.

5.1.4.4 Creosote hydrogenation unit (Unit 228)

The purpose of this unit is to hydrotreater heavy tar derived cuts to produce creosote naphtha and diesel. The plant receives medium creosote, heavy creosote and residue oil from units 14/214. The unit also receives MTP, FFC, coker gas oil and waxy oil transfer material from unit 39 and this if fed to the unit as a percentage of the U2/14's feed streams. After the hydro treating reactors a high concentration hydrogen gas stream, hydrogen sulphide (produced) rich gas stream and sour water (produces and added) is separated from the hydrocarbon stream at various points. The hydrocarbon stream is separated into a creosote naphtha and creosote diesel stream. Due to

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the high naphthene and aromatic content the creosote naphtha is routed to the platformer, while the creosote diesel is a final diesel blending component.

5.1.4.5 Naphtha hydrotreater, platformer and CCR (Unit 30/230 and Unit 31/231)

The naphtha hydrotreater is a catalytic refining process used to saturate olefins and remove oxygenates. The feed for the naphtha hydrotreater is naphtha cut originating from Synthol light oil, distillate naphtha from the distillate hydrotreater (Unit 35/235) and creosote naphtha from U228. After the hydro treating reactors a high concentration hydrogen gas stream, hydrogen sulphide (produced) rich gas stream and sour water (produces and added) is separated from the hydrocarbon stream at various points. [redacted]

[redacted]

During a normal operating [redacted] due to excessive carbon build-up. The catalyst is continuously removed from the platforming reactors and sent to the CCR unit, where the carbon is burnt off the catalyst restoring the activity of the catalyst. A certain amount of fines are produced in the unit and that is disposed of.

Catalytic distillation hydrotreater (Unit 78)

The U78 CD Hydro Unit is designed to individually hydro-isomerizes C5 and C6+ hydrocarbons [redacted] catalyst [redacted] and produce a diene-free C5 feedstock to the Skeletal Isomerisation unit (U90) and eventually the TAME unit. The reactions take place [redacted] catalyst in the [redacted] The C5 CDHydro product from the column's bottoms (essentially diene free) is routed to the Skeletal Isomerisation unit, and eventually to the CDTame unit for Tame (tertiary amyl methyl ether) production. The C5 product can also be routed either to storage, directly to U79 or in combination of the mentioned scenarios.

5.1.4.6 CDTame unit (Unit 79)

The CDTame Unit 79 converts a C5 product from the C5 CDHydro column via the Skeletal Isomerisation Unit 90, to produce TAME (tertiary amyl methyl ether). [redacted]

TAME product is recovered from the bottom of the reaction column. The distillate contains the C5 Raffinate and some met[redacted] The methanol is extracted from the distillate stream in the methanol extraction column. [redacted] Methanol is recovered from the methanol / water mixture in the methanol recovery column and recycled to the reaction section of the process. [redacted]

5.1.4.7 C5 Isomerisation (Unit 90)

The C5 Skeletal Isomerisation Unit (Unit 90) produces branched chained iso-amylenes from the C5 olefinic feed from the C5 CD-Hydro Unit (Unit 78). The branched chained iso-amylenes are required as feed to the CD-TAME Unit (Unit 79).

[redacted]

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The C5 olefinic feed from Unit 78 is treated at very low pressure and high temperature in an adiabatic reactor over a moving catalyst bed of Unit 90. The catalyst is withdrawn at a fixed/variable rate from the reaction section to be regenerated in a continuous regeneration unit and returned to the reaction section.

5.1.4.8 Vacuum distillation (Unit 34/234)

The vacuum distillation unit (U34/234) separates the decanted oil (DO) stream from Synthol as well as the heavy components produced in U2/29. The products from this unit are light vacuum gas oil and heavy gas oil for unit 235 Diesel Hydrotreaters and a minimum amount of heavy fuel oil for U39 Carbo Tar.

Distillate hydrotreater (U35/235)

The purpose of this unit is hydro treating. The plant receives heavy components from SLO and the lighter components from the vacuum distillation units (2/34). [redacted]am and hydrogen sulphide (produced) ri[redacted] The hydrocarbon stream is separated into a naphtha, light diesel and a heavy stream.

The naphtha stream is sent to the naphtha hydrotreaters (2/30), the distillate selective cracker (35DSC) and the light diesel is sent to the diesel component tanks. [redacted] units. The hydrogen compression system s[redacted] Refinery and Chemical units.

5.1.4.9 Distillate selective cracker (U35)

The DSC unit consist of two main sections- the cracking/dewaxing reactor reaction and the fractionation section. The main function of the reactor is to crack the heavy feed material into diesel range boiling material and to isomerise n-paraffin into iso-paraffin. The DSC fractionation section main purpose is to separate reactor effluent material into very light gasoline boiling range material, a heavy diesel cut and a fuel oil cut.

5.1.4.10 Light oil fractionation (Unit 29/229)

The purpose of this unit is to perform the primary fractionation for the Refinery facilities. The feed to the unit is stabilised light oil (SLO) from Synthol. The unit produces a light C5/C6 stream for CD Hydro unit (U78), a naphtha product that feeds Octene and the Naphtha Hydro-treatment units (U2/30), a distillate stream that feeds Safol and Diesel Hydrotreaters (U2/35), a heavy product that feeds the vacuum distillation unit (U2/34).

5.1.4.11 Polymer hydrotreater (Unit 33/233)

The purpose of this unit is to convert olefins, from either a heavy naphtha fraction or a distillate fraction, to the corresponding paraffin's to produce. [redacted]

5.1.4.12 Catalytic polymerisation and LPG recovery (Unit 32 / 232)

The purpose of this unit is to produce motor fuels namely petrol, diesel and jet fuel from a stream of C3/C4. This is [redacted]

5.1.4.13 Sasol Catalytic Converter (Unit 293)

The SCC [redacted] is a Fluidized Catalytic Cracking (FCC) process, similar in configuration to a refinery FCC unit. Low molecular weight olefins and paraffin's are converted to ethylene and propylene [redacted] Fresh C6/C7 feed from the [redacted]

Tar, Phenosolvan and Sulphur

5.1.4.14 Gas Liquor Separation

The purpose of the gas liquor separation unit is to separate various gaseous, liquid and solid components from the gas liquor streams. Dissolved gases are removed from the gas liquor by expansion to almost atmospheric pressure. The different liquids and solids are separated in separators by means of physical methods based on settling time and different densities.

To achieve a good separation of gases, liquids and solids the following requirements have to be considered:

- The differences between the specific gravity of the water and the lighter (oil) and heavier (tar) fractions must be sufficiently great;
- Emulsions have to be avoided.

There are four types of separators, namely: Primary, Secondary, Tertiary and Oily Separators. Separation takes place by gravity at controlled temperatures and atmospheric pressure. The feed to the gas liquor separation unit originates from the cooling and washing of the raw gas from coal gasification. The raw gas contains large amounts of water vapours (steam, carbonization water and coal moistures (surface water, hygroscopic moisture, decomposition water, mineral moisture)) and by-products from carbonization such as tar, oil, naphtha, phenols, chlorine, fluorine and fatty acids. It also contains dissolved gases (mostly NH_3, CO_2, and H_2) and small amounts of combustible gases and coal dust as well as inorganic salts. Feed steams originate in:

- Gasification (unit 10/210);
- Gas cooling (unit 11/211);
- Rectisol (unit 12/212);
- Phenosolvan (unit 16/216);
- Coal Tar Filtration (CTF) (on the Western site only);
- Refinery Unit 14 & 74;
- Carbo Tar.

5.1.4.15 Phenosolvan

The Phenosolvan (Unit 16 / 216) and Ammonia Recovery (Unit 17 / 217) plants are part of the Gas Liquor Value Chain. These are mainly water purification plants, whose purpose is to remove impurities such as suspended solids and oil as well as to recover pitch, phenols, organic waste, carbon dioxide (CO2), hydrogen sulphide (H2S) and ammonia (NH3) from the gas liquor before pumping the stripped gas liquor to Water Recovery (Unit 52 / 252) for re-use in the Synfuels Factory as cooling water. Only phenols and ammonia are marketable products.

Unit 16 / 216 serves the purpose for gas liquor filtration, phenol and pitch extraction, solvent recovery and depitching of crude tar acids to produce depitched tar acids (DTA). Unit 17 / 217 serves the purpose for solvent recovery, acid gas removal, organic contaminants removal, ammonia recovery as well as purification and liquefaction of ammonia.

5.1.4.16 Sulphur Recovery

The plants receive the feed-gas from Rectisol for the absorption and conversion of H_2S prior to routing the H_2S lean gas to the stack. The off-gas from Sulphur plant is combined with the off-gas from Rectisol before being routed to the stack. The H_2S in the feed-gas from Rectisol is absorbed into the sulpholin liquor by means of venturi absorbers.

From the absorbers the liquor with absorbed H_2S goes into the reaction tanks where elemental sulphur is produced. In the reaction tanks vanadium (V) is an active oxidizing agent that oxidizes HS to elemental Sulphur. During this process vanadium is reduced to inactive vanadium (IV), which needs to be re-activated. The slurry from the reaction tanks is sent to two oxidizers arranged in series.

The sulphur slurry in the oxidizers is separated from the liquor by means of weirs in the last oxidizer. The Sulphur slurry from the last oxidizer falls directly into three (3) slurry tanks. From the slurry tanks, the slurry is pumped to decanters for the removal of the entrained liquor. The liquor is routed back to the process via the balance tank. The Sulphur rich cake from the decanters is re-pulped using wash condensate before it is pumped to the sulphur separator

In the separator, the liquid sulphur is separated from water and sent down to the sulphur pit. From the pit, the liquid sulphur is transported by road trucks to the granulation plant for filtering and formation of sulphur granules.

During the conversion of HS to elemental sulphur and the re-oxidation of vanadium, salts such as NaSCN, NaHCO3 and Na_2SO_4 are formed. A bleed stream from the discharge side of the circulation pump is routed to the sulphate plant to produce Sodium Sulphate as a by-product, thereby reducing the salt concentration of the circulation liquid.

5.1.4.17 Wet Sulphuric Acid Plant

The feed gas to Wet Sulphuric Acid (WSA) is sourced from Rectisol Phase 3 and 4, which are routed to a knock out drum (per phase). The outlets of the knockout drums combined before Phenosolvan off gas joins the feed header into the WSA combustor where the feed gas is burned with fuel gas and hot air to form SO_2 containing process gas.

After the combustion the process gas is cooled in a waste heat boiler. The formed process gas, after being cooled down, leaves the waste heat boiler and dilution air is introduced to ensure sufficient oxygen content before entering the [redacted] NOX converter. In the NOX converter the nitrogen oxides are removed from the process gas. The reduction of the nitrogen oxides is carried out by the injection of ammonia into the process gas and subsequently passing the gas mixture over a catalyst where the nitrogen oxides react with the ammonia and are converted to nitrogen and water vapour.

From the NOX converter the process gas is further processed in the SO_2 converter. The SO_2 in the process gas is oxidized catalytically. The SO_2 gas reacts with O_2 to form SO_3 gas. The formed SO_3 gas reacts with the water vapour present in the process gas through exothermic hydration reaction, resulting in the formation of the sulphuric acid gas (H_2SO_4).

The process gas then enters the Wet Sulphuric Acid (WSA) condenser where it is further cooled by means of air in a glass tube heat exchanger, and the remaining part of the hydration reaction and the condensation of sulphuric acid take place. The produced sulphuric acid has a concentration of 96.5 wt%, with a maximum acid mist content of 20 ppm (by volume) when leaving the top of the WSA condenser.

The hot sulphuric acid product will leave the bottom of the WSA condenser. Normally, if no special precautions are taken, condensations of sulphuric acid vapour will result in a mist of very small acid droplets. These very small droplets cannot be separated from the process gas in the WSA condenser. Thus to overcome this problem four mist control units are installed. The mist control units generate a gas stream containing very small silicon particles. These silicon particles act as nuclei for the formation of larger acid droplets. By adding the particles to the process gas upstream of the condenser, the droplets formed will be large enough to be separated from the process gas in the demisters installed at the top of the WSA condenser. A mixing arrangement is installed in the duct upstream of the condenser to ensure that the silicon particles are homogeneously mixed into the process gas.

The cleaned gas leaves the top of the WSA condenser. Even though all four mist control units are well in operation, the clean gas will contain a small amount of remaining acid mist which is reduced by the Wet Electrostatic Precipitator (WESP). The WESP consists of an empty column scrubber part, where the cleaned gas sprayed with weak acid and the precipitator part where the mist particles form a liquid film on the vertical collecting electrodes due to the strong electric field. The liquid film then runs down the electrodes to the scrubber sump and the cleaned gas proceeds to the stack where it's lead to the atmosphere.

5.1.4.18 Carbo Tar and Coal Tar Filtration

5.1.4.18.1 Coker (Unit 39)

The Delayed Coker Plant receives the so called bottom of the barrel products from upstream units to produce coke. The plant mainly operates in three different modes to produce three different types of coke. These modes are the normal MTP (medium temperature pitch) mode, WO (Waxy Oil) mode and the hybrid mode, which is a 70:30% blend between MTP and FCC (fluidised catalytic cracker) slurry.

Reactions and Catalyst
The Coker Plant produces green coke using a delayed coking process, which involves thermal cracking of the feedstock (pitch, waxy oil or FCC slurry) at elevated temperatures and long residence time at specific conditions. The basic reaction that takes place is:
HC + Impurities = C + Impurities + Vapour (H2O & Volatile material)

5.1.4.18.2 Calciner (Unit 75)

The coke calcining unit, (U75) receives green Coke from the Delayed Coker plant (U39) and thermally upgrades the green coke to produce calcined Coke. U39 processes three basic types of feed: Waxy Oil, Medium Temperature Pitch (MTP) and Hybrid [redacted]

5.1.4.18.3 Coal Tar Filtration (Unit 96)

At Unit 096 tar is received from the Gas Liquor Separation units (Unit 13 and 213). Solids and water is removed from the tar. The solids get removed by means of decanters and filters while water gets removed by means of a force feed Evaporator. The solids get trucked to the Mixing plant where it is mixed with fine coal and fed to the boilers. The final tar product with an ash spec of less than 0.020 and the water spec less than 1.50% is pumped to tank farm as feed for the Tar distillation units (Unit 14 and Unit 214).

5.1.4.18.4 Feed Preparation (Unit 86)

The purpose of the Feed Preparation Plant (U86) is to clean-up heavy residue streams from tanks and dams containing solids and water; the feed streams can vary depending on availability. The plant consists of two Trains; Train 1 processes Waxy Oil (WO) related product, which is obtained from the American Petroleum Institute (API) dams; and Train 2 processes the crude tar from various sources and also serves as a Coal Tar Filtration (CTF) contingency.

Train 1 can also be utilised to process tar when there is very high tank levels from Tank Farm (256TK 1401/2). Through the series of processes, water and solids are removed from the contaminated feed streams and made available to customers such as heating fuels and Tar Distillation Units (U(2)14).

5.1.4.18.5 Calciner (Unit 76)

This unit is a storage facility for final products from the Calciner Unit 075 and distribution via rail and road trucks of different sizes, quantities and products.

5.1.5 Water and Ash

5.1.5.1 Multi hearth sludge incinerator

Waste activated sludge is burned in 4 twelve bed multi hearth type incinerators (2/unit). Each incinerator has two burner chambers designed such that each chamber can be supplied with fuel gas. Combustion and cooling air is also introduced to the incinerator. Thickened waste activated sludge is fed into incinerator (4 units).
Off-gas, slurry and ash exit the incinerator.

5.1.5.2 HOW Incinerator

The purpose of the HOW incinerator is to burn concentrated high organic waste (HOW) and gas fumes from Phenosolvan and Ammonia recovery (U17/217). The interior of the incinerator consists of a horizontal combustion chamber that has been lined with fireproof bricks out of a kind of ceramic that is extremely heatproof.

The burner is a combination burner for optional or simultaneous combustion of fuel gas and HOW. It is mounted to the front of the combustion chamber. The product is atomized with steam in the burner. Fuel gas serves as the pilot flame to ignite the HOW. For this reason the fuel gas flame must be kept burning permanently. For combustion oxygen is required. In this case, a controlled quantity of air is provided to the burner. This is called the primary air (combustion air). Warm air containing combustion gases is let out to the atmosphere through the chimney.

5.1.5.3 Sewage Incinerator

The purpose of the domestic sewage plant is to treat all sewage from Secunda town and ablution facilities from Sasol Secunda site, upgrading it to render it suitable to discharge to the river. The process can be divided into sections

- Inlet works (Primary Treatment section)
- Biological Section (secondary treatment section)
- Polishing section (Tertiary Treatment section)

Untreated sewage enters the inlet works where screening and removal of grit takes place. The flow then moves to the Biological section where the removal of soluble and particulate organic material is removed from raw sewage. The last section (polishing section) is where the further removal of suspended solids takes place and the sanitation of effluent before the effluent is released to the river. The function of the sewage incinerator is to burn waste screenings from the primary treatment section. The products are ash and combustion gases

5.1.5.4 Thermal Oxidizer

In order to prevent atmospheric pollution from the storage tanks and vessels that contain VOC's they are vented to a thermal oxidizer. This consists of a piping/ducting system to draw vapours from the following tanks.

- Oily Waste Tanks (TK2005/11/12)
- Phenolic Waste Tanks (TK2002/4)
- Organic Waste Tanks (TK2006)
- Flare K/O water (TK2003)
- Quarantine Waste Tank (TK2016)
- Recovered oil Tank (TK2009)
- APS storage tank (TK2512)
- Hydrocarbon Equalization Tank (TK2501)
- API Separator (TK2505)
- Recovered Oil Tank (TK2510)
- DAF Separator (DAF 2501)
- Area 10 Loading Arms (ME 1010/1011/1013)

5.1.6 Market and Process Integration

5.1.6.1 Central corridor flares

A system consisting of 2 flare stacks, 2 relief headers and other associated equipment to collect and completely incinerate off gases, off-specification gases and emergency venting.

5.2 Listed activities

Listed Activity Number	Category of Listed Activity	Sub-category of the listed activity	Description of the Listed Activity	Sasol Synfuels Processes
1.1	Combustion Installations	Solid Fuel Combustion installations	Solid fuels combustion installations used primarily for steam raising or electricity generation	Steam boilers
1.4	Combustion installations	Gas Combustion Installations	Gas combustion (including gas turbines burning natural gas) used primarily for steam raising or electricity generation	Gas Turbines
2.1	Petroleum Industry, the production of gaseous and liquid fuels as well as petrochemicals from crude oil, coal, gas or biomass	Combustion installation	Combustion installation not used primarily for steam raising or electricity generation (furnaces and heaters)	Refinery
2.2	Petroleum Industry, the production of gaseous and liquid fuels as well as petrochemicals from crude oil, coal, gas or biomass	Catalytic cracking units	Refinery catalytic cracking units	Sasol Catalytic Cracker
3.3	Carbonization and Coal gasification	Tar processes	Processes in which tar, creosote or any other product of distillation of tar is distilled or	Carbo Tar (Coker, Calciner, Feed Preparation)

			is heated in any manufacturing process	Refinery Tar distillation units
3.6	Carbonization and Coal gasification	Synthetic gas production and clean up	The production and clean-up of a gaseous stream derived from coal gasification and includes gasification, separation and clean-up of a raw gas stream through a process that involves sulphur removal and Rectisol as well as the stripping of a liquid tar stream derived from the gasification process	Gasification Gas Liquor Separation CTF Rectisol Phenosolvan Sulphur Recovery
4.2	Metallurgical industry	Combustion installation	Combustion installation not used primarily for steam raising and electricity generation (except drying)	Catalyst preparation – rotary kilns
4.7	Metallurgical industry	Electric Arc Furnaces	Electric arc furnaces in the steel making industry	Catalyst preparation – electric arc furnaces
5.1	Mineral Processing, Storage and Handling	Storage and handling of ore and coal	Storage and handling of ore and coal not situated on the premises of a mine or works as defined in the Mines Health and Safety Act 29/1996	Coal Processing
6	Chemical Industry	Organic Chemical Industry	The production or use in production of organic chemicals not specified elsewhere including acetylene, acetic, maleic or phthalic anhydride or their acids, carbon disulphide, pyridine, formaldehyde, acetaldehyde, acrylonitrile, amines and synthetic rubber.	Benfield
7.1	Inorganic Chemical Industry	Production and or use in manufacturing of ammonia, fluorine, fluorine compounds, chlorine and hydrogen cyanide	Production and or use in manufacturing of ammonia, fluorine, fluorine compounds, chlorine and hydrogen cyanide and chlorine gas (excluding metallurgical processes related activities regulated under category 4)	Phenosolvan
7.2	Inorganic Chemical Industry	Production of acids	Production, bulk handling and or use of Sulphuric acid in concentration exceeding 10 %	Wet Sulphuric Acid
8.1	Thermal treatment of General and Hazardous Waste	Thermal treatment of General and Hazardous Waste	Facilities where general and hazardous waste are treated by the application of heat	Sludge incinerators, HOW incinerators, Sewage incinerator,WRF RTO

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5.3 **Unit process or processes**

Unit Processes with Listed Activities undertaken on site in terms of Section 21 of the AQA

Unit Process	Function of Unit Process	Batch or Continuous Process
Utilities		
Coal milling process	There are 4 mills per boiler. The mill grinds the course coal to fine coal, which is known as pulverized fuel (PF). Primary air dries the coal and then transports the PF into the boiler furnace for combustion.	Continuous
De-aeration process	The feed water de-aerators make use of low pressure steam to heat up the feed water as well as to remove the oxygen from the feed water. Oxygen causes corrosion inside the boiler tubes if it is present. Chemical dosing into the de-aerator discharge line also helps to remove the oxygen.	Continuous
Combustion process	The PF is combusted in the 17 boilers and the hot flue gases are used to heat up the water in the water wall tubes. The hot flue gases containing ash and other gases are used to heat up the primary air while being extracted from the boiler furnace via the Induced draught fans. The heated water is separated in the steam-water drum and reintroduced into the boiler to be superheated before supplied to the factory as Superheated steam.	Continuous
Flashing process	Blow down from the steam/water and mud drum as well as drains are flashed in the blow down vessel to 4bar steam.	Continuous
Ash capture and handling process	The flue gas contains fly ash and coarse ash. The fly ash is separated from the flue gas using Electrostatic precipitators. The ash which is not captured by the precipitators is sent up the stack. The coarse ash falls from the furnace section into drag chains. Both the course and fly ash is mixed with water and pumped to the ash system.	Continuous
Electricity generation process	Excess Superheated steam not used in the process is used to generate electricity in turbo-generators. There are 10 turbo generators with a capacity of 60MW.	Continuous
Burner oil for start-up process	Burner oil used during start up and shutdown of boilers. Burner oil also used when coal milling is stopped for maintenance.	Intermittent
Gas turbine	Power generation by burning natural gas	Continuous
Heat Recovery Steam Generator (HRSG)	Steam is generated using the hot off gas from the gas turbines. The steam generation includes a boiler, economisers, evaporators, and super heaters. Superheated steam is generated from this process at 425°C and 4300kPag with a maximum flow of 163t/h per boiler.	Continuous

Gas Production		
Coal Processing		
Separation	Separation of fine and course coal	Continuous
Gasification		
Gasification and Raw Gas Cooling	Sasol® FBDB™ Gasification Process	Continuous
Rectisol		
Absorption	[redacted]	Continuous
Regeneration	Purification [redacted]	Continuous
Gas Circuit		
Benfield		
Benfield	The purpose of the Benfield Process is to remove Carbon Dioxide from the tail gas entering the Cold Separation thereby preventing freeze blockages.	Continuous
Catalyst preparation		
Catalyst Manufacturing	[redacted]	Continuous (Arc furnace is semi-batch process)
Catalyst Reduction		Batch
Refinery		
Generic Refinery Unit Processes		
Tank	The feed tank serves as feed reserve tank. This is for a holdup for the polymerisation of the mixed feed components and for the separation of entering water.	Continuous
Vaporiser	The vaporizer separates the light ends from the heavy ends. Saturated HP steam is used to vaporise the feed.	Continuous
Distillation column	The purpose of the columns is to purify hydrocarbon streams as well as separation of the hydrocarbon streams into various components.	Continuous
CD Hydro Hydrogenation Columns	To hydrotreater and separate hydrocarbons.	Continuous
Separation and collection drums	It's used to separate streams into lighter and heavier components and.	Continuous
Hydrotreating reactors	The reactors are used to saturate olefins and oxygenates. To remove nitrogen and sulphide components as well as removing other impurities in the presence of hydrogen.	Continuous
Platforming reactors	[redacted]	Continuous
U90-Skeltal isomerisation reactor	The purpose of the skeletal isomerisation unit is to convert the C5 feed from the CD-Hydro unit to iso-amylenes as feed to the CD-	Continuous

	TAME unit	
Catalytic polymerisation	[redacted]	Continuous
Heat exchangers	There are a large number of heat exchangers that is used heat up, cool down, vaporise and condense the hydrocarbon streams. There is a combination of product, product exchangers (two process exchangers exchanging energy) as well as product utility exchangers.	Continuous
Air coolers	The air coolers are used to cool down and condense hydrocarbon streams	Continuous
Ejectors	The equipment is used to generate a negative gauge pressure (vacuum). There are a number of plants in the refinery that utilises vacuum conditions help with the separation of hydrocarbon streams	Continuous
Compressors	The compressors are used to increase and or maintain the high operating pressures of the refiner y processes. There are reciprocal, centrifugal and turbine compressors used in the refinery environment	Continuous
Pumps	The pumps used in the refinery are centrifugal, multi stage and positive displacement pumps	Continuous
Electrical heaters	The electrically heater is normally not in operation. The heater is primarily provided for catalyst regeneration and is also used to heat up the main reactor for start-up.	Start-up and as required
Heaters	The heaters are used to heat up hydrocarbon and gas streams	Continuous
Super flex Catalytic Cracker	[redacted]	Continuous
Catalyst Fines system and Waste Heat Boiler	The purpose of the unit is to recover catalyst fines from the flue gas. The waste heat boiler cools the flue gas against boiler feed water to produce high pressure steam.	Continuous
Gas Cleanup equipment - [redacted] reactors - DEA and Caustic sections - Gas Dryers	The purpose of the unit is to remove oxygen, acid gasses and moisture from the process gas.	Continuous
Liquid Dryers	The purpose of the unit is to remove water from the C3 stream.	Continuous
Propylene Refrigerant system	The propylene refrigeration system is a closed-loop system providing three levels of refrigeration, -39°C, -22°C and 4°C.	Continuous
Tar distillation units		
Water Stripper (14VL101/201; 214VL101/201)	The crude tar that is fed to the stripper is heated in a number of heat exchangers. This feed is then stripped of water in VL101. The overhead vapours of the stripper are then condensed and the water free crude tar is sent to VL102	Continuous
Distillation Column (14VL102/202; 214VL102/202)	This column is operated at atmospheric pressure and superheated stripping steam is fed to the bottom section to control the temperature. The distillation tower is heated up by the tar furnace 14HT-101. The overhead vapours being mainly water and light naphtha are condensed. In the distillation tower 14VL-102 heavy naphtha, medium creosote and heavy creosote are recovered as	Continuous

	side streams of the tower.	
Reflux Drum (14DM102/202; 214DM102/202)	The condensed vapours of both of both VL101 and Vl102 are fed to this drum where the water is separated from the light naphtha. The water overflows into the sewer, the hydrocarbons are partly sent as reflux to 14 VL101 and 14 VL102, and partly routed as light naphtha product to the tank.	Continuous
Flash Drum (14DM104/204; 214DM104/204)	The net bottom product of the distillation tower is withdrawn from the tar furnace (14HT-101) circulation stream and sent to the flash drum 14DM-104. In this drum, operating under vacuum, separation between pitch and residue oil is achieved by one stage flash evaporation.	Continuous
Heavy Creosote Process Vessel (14DM106/206; 214DM106/206)	This vessel stores heavy creosote which is a side draw from VL102 before it is pumped to tank farm.	Continuous
Medium Creosote Process Vessel (14DM107/207; 214DM107/207)	This vessel stores medium creosote which is a side draw from VL102 before it is pumped to tank farm.	Continuous
Heavy Naphtha Process Vessel (14DM108/208; 214DM108/208)	This vessel stores heavy naphtha which is a side draw from VL102 before it is pumped to tank farm.	Continuous
Pitch Drum (14DM109/209; 214DM109/209)	The bottoms product of 14 DM104 is pitch, which passes via a barometric pipe to pitch cooler 14 ES114 and to the pitch drum 14 DM109, from where it is pumped to Carbo Tar, unit 39 or Tank Farm.	Continuous
Residue oil Drum (14DM110/210; 214DM110/210)	The top product of the flash drum 14 DM104 is residue oil, which is condensed in 14 ES115, a steam producing heat exchanger, and then travels via 14 DM111 along a barometric pipe to the residue oil drum 14 DM110 from where it is pumped by 14 PC108 to battery limit.	Continuous
Heaters (14HT101/201; 214HT101/201)	This furnace is used to heat a high circulating bottoms product from 14VL102 and thus control the temperature of the column.	Continuous
Unit 27A		
Neutral oil stripper (27VL101)	The purpose of this stripper is to remove the neutral oils contained in the HNO-DTA (high neutral oil depitched tar acids) feed, producing LNO-DTA (low neutral oil depitched tar acids). The [redacted]	Continuous
Flash Drum (27DM103)	[redacted]	Continuous
Separator Drum (27DM1)	[redacted]	Continuous
Unit 74		
Vacuum Distillation	This is the secondary depitcher column that flashes phenolic pitch	Continuous

(74VL101)	at 2 – 7kPa at a temperature of 150 – 205°C and fractionate the stream to recover as much phenolic material possible in the side draw, without entraining catechol or any heavy ends. The column [redacted]	
Coal tar naphtha hydrogenation		
Feed Tank (15TK-101)	The feed tank serves as feed reserve tank. This is for a holdup for the polymerisation of the mixed feed components and for the separation of entering water.	Continuous
Vaporizer (15EX-101)	The vaporizer separates the light ends (Naphtha) from the heavy ends (residue oil). Saturated HP steam is used to vaporise the feed.	Continuous
Residue Stripper (15VL-101)	The purpose of the residue stripper is to strip the remaining low boiling components by means of super-heated recycle gas.	Continuous
Residue Oil Collection Drum (15DM-102)	Residue oil from the residue stripper is collected in the residue oil collect drum and is continuously pumped to tank farm.	Continuous
Pre-reactor (15RE-101)	The bottom of the pre-reactor accommodates a separator, which retains any entrained liquid droplets, before the hydrocarbon vapour mixture enters the pre-reactor. The pre-reactor is filled with catalyst which is used to hydrogenate components, which easily tend to polymerise.	Continuous
Main Reactor (15RE-102)	Recycle gas and a hydrocarbon vapour mixture passes through the main reactor. A quench stream of cold recycle gas is used between the two main reactor beds to prevent H_2S from reacting back to mercaptans or thiophenes and to prevent severe hydrogenation.	Continuous
HP separator (15DM-106)	Separates the raffinate from the gas.	Continuous
Medium Pressure Naphtha Water Separator (15DM-107)	The medium pressure Naphtha water separator is a three phase separator, firstly to separate the gas liquid mixture and secondly to separate the organic aqueous liquid mixture. The gas/raffinate and condensate are separated under gravity, due to their density difference. The water and product is separated by a gooseneck. The entrained injection and reaction water separated in is discharged from the bottom of the separator's water compartment directly to unit 16/216 as waste water, or to the oily water sewer during upset conditions	Continuous
H_2S Stripper (15VL-102)	[redacted]	Continuous
Naphtha hydrotreater, platformer and CCR		
Naphtha reactors System	Saturation of olefins	Continuous
NHT Charge Heater	Heating of NHT reactor feed	Continuous
Separation drums	Hydrogen, uncondensed hydrocarbons gases and water is separated from the condensed reactor products	Continuous

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Stripper System	Removing of light ends (H_2S and water)	Continuous
Stripper Reboiler (Fired Heater)	Heating Stripper bottoms	Continuous
Splitter System	Splits between C_5+ and C_5-	Continuous
Splitter Reboiler (Fired Heater)	Heating Splitter bottoms	Continuous
Platformer Charge Heater	Heating Platformer reactor feed	Continuous
Platforming Reactors	Produces aromatics from paraffin's and naphthenes	Continuous
Continuous Catalyst regeneration system	Regenerates Platformer catalyst on continuous basis	Continuous
Product Separator	H_2 is separated from the condensed Platformer product	Continuous
Debutanizer	Removes C_4- from final product	Continuous
Debutanizer Reboiler (Fired Heater)	Heating Debutanizer bottoms	Continuous
Catalytic distillation hydrotreater		
78VL-101 (Depentaniser)	Splits a liquid feed stream into C5 and C6+ streams. The C6+ stream is sent to the Alpha Olefin plants for Hexene extraction. The C5 stream is sent to 78VL-102 (CD Hydro Column)	Continuous
78VL-102 (CD Hydro Column)	[redacted]	Continuous
CD Tame		
79RE-101 (Primary reactor)	[redacted]	Continuous
79RE-103 (Secondary reactor)	[redacted]	Continuous
79VL-101 (CD TAME Column)	[redacted]	Continuous
79VL-102 (Methanol Extraction Column)	Uses a water stream to extract methanol from the C5 Hydrocarbons. The C5 Hydrocarbon is sent to storage, and the methanol-water stream is sent to 79VL-103.	Continuous
79VL-103 (Methanol recovery column)	The water-methanol stream from 79VL-101 is split into methanol and water streams. The methanol is recycled to the front end of the process, and the water is recycled to 79VL-102 where it is used to extract the methanol.	Continuous
C5 Isomerisation		
U90-Skeltal isomerisation unit	The purpose of the skeletal isomerisation unit is to convert the C5 feed from the CD-Hydro unit to iso-amylenes as feed to the CD-TAME unit	Continuous
Vacuum distillation		
Vacuum Distillation	The aim is to fractionate high boiling point hydrocarbons at low temperatures by lowering the pressure to ±2.5kPag using Decanted Oil from U20 and the heaviest fraction from U29 is	Continuous

	fractionated to a Heavy and Light Gas Oil and Waxy Oil.	
Distillate hydrotreater		
Distillation	The Fractionation of the feed oil material into components of similar boiling range.	Continuous
Light diesel stripping	Separation of diesel (medium cut material) range boiling material from the feed stream using distillation.	Continuous
Naphtha stripping	Separation of Naphtha (light material) range boiling material from the feed stream using distillation.	Continuous
Hydrogenation	[redacted]	Continuous
Catalyst Sulphiding	This is to regulate catalyst activity	Continuous
Water removal	Removal of water from the feed oil stream in a drum operated such that water settles in the drum's water boot.	Continuous
High temperature Separation	Separate a feed stream into a liquid and vapour streams in a drum at a high temperature.	Continuous
Low Temperature separation	Separate a feed stream into a liquid and gas streams in a drum at a low temperature.	Continuous
Hydrogen recycle	To reuse the hydrogen rich off gases leaving the cold separation drum.	Continuous
Heating	This is to preheat feed streams and cool down product streams.	Continuous
Distillate selective cracker		
Cracking reaction system	[redacted]	Continuous
Distillation	Fractionation of the heavy oil material	Continuous
Vacuum distillation	Separate the heavy distillate material mainly heavy diesel.	Continuous
Heating and Cooling	Preheat feed material and cool down product streams	Continuous
Water removal	Separate entrained water from feed stream	Continuous
Hot Temperature separation	Separate reactor product stream into a liquid and vapour stream.	Continuous
Hydrogen recycle	Recycle the off gas rich stream separate from the reactor liquid stream	Continuous
Catalyst sulphiding	To regulate the catalyst activity	Continuous
Light Oil Fractionation		
Atmospheric Distillation	The purpose of the unit is to fractionate the Stabilised Light Oil into different fractions of molecules used in downstream processes. The different fractions are C5/C6 to the CD Tame unit, Naphtha to Octene (and U30NHT); Light Diesel to Safol (and U35DHT) and a Heavy fraction to U34.	Continuous
Polymer Hydrotreater		
Polymer Hydrotreater	The purpose of the unit is to hydro treat the polymer produced in the Catalytic polymerisation unit to a paraffinic petrol and diesel/jet fuel fractions.	Continuous

Catalytic polymerisation and LPG recovery		
Catalytic polymerisation	The purpose of this unit is to produce motor fuels namely petrol, diesel and jet fuel from a stream of C3/C4 through polymerisation over a phosphoric acid catalyst.	Continuous
LPG recovery	The purpose of this section is to recover unreacted paraffinic C3 and C4 material for LPG production.	Continuous
Sasol Catalytic Converter		
Pre-heat furnace	The purpose of this section is to vaporise the low molecule olefin and paraffin feed	Continuous
Super flex Catalytic Cracker	[redacted]	Continuous
Quench Column and Strippers Towers	The purpose of this unit is to remove heavy oil and separate the process gas from the gasoline phase.	Continuous
C4 and C5 CD Hydro Hydrogenation Columns	The purpose of this unit is to saturate olefins.	Continuous
Catalyst Fines system and Waste Heat Boiler	The purpose of the unit is to recover catalyst fines from the flue gas. The waste heat boiler cools the flue gas against boiler feed water to produced high pressure steam.	Continuous
Process Gas Compression (KC2501 – PGC)	The purpose of the unit is to compress the process gas.	Continuous
Gas Cleanup equipment ▸ [redacted]eactors ▸ DEA and Caustic sections ▸ Gas Dryers	The purpose of the unit is to remove oxygen, acid gasses and moisture from the process gas.	Continuous
SCC De-Propanizer (VL4001)	The purpose of the unit is to separate C4 molecules from the process gas.	Continuous
Chill Train, De-Methanizer and Cold Box	The purpose of the unit is to cool down the process gas and remove methane.	Continuous
C2 System which can be divided into the De-Ethanizer and C2 Splitter	The purpose of the unit is to separate C3 molecules from C2 molecules and to separate the C2 molecules into ethane and ethylene.	Continuous
PPU 5 which comprises of the FT De-Propanizer and C3 Splitter	The purpose of the unit is to separate C3 from C4 molecules and to separate the C3 molecules into propane and propylene.	Continuous
Liquid Dryers	The purpose of the unit is to remove water from the C3 stream.	Continuous
[redacted] Refrigerant system	[redacted]	Continuous
Tar, Phenosolvan and Sulphur (TPS)		
Gas Liquor Separation		
Gas Liquor Separation	The purpose of the gas liquor separation unit is to separate various gaseous, liquid and solid components from the gas liquor streams. Dissolved gases are removed from the gas liquor by expansion to almost atmospheric pressure. The different liquids and solids are separated in separators by means of physical methods based on settling time and different densities.	Continuous

Phenosolvan		
Water Purification	The purpose of this system is to filter out any oil, tar and suspected solids. Solids-free gas liquor flows to the Saturation Column where its pH is reduced to about 8.9 by scrubbing CO_2 rich acid gases to prepare it for the extraction process.	Continuous
The extraction process	The purpose of the extraction system is to remove phenols from gas liquor by mixing gas liquor with di-isopropyl – ether (DIPE) to extract the phenols.	Continuous
DIPE recovery and Phenol production	The DIPE and phenols are then separated through several distillation processes.	Continuous
Ammonia Recovery (Unit17)	Recovering of ammonia from the gas liquor. The Raffinate from Unit 16 / 216, with about 1% DIPE, is first sent to the de-acidifier to remove acid gases	Continuous
Acid Gas Scrubber	The purpose of this system is to remove final traces of CO_2 from the ammonia. This system is divided into three sections namely: Bottom, Middle and Top pump-around. In the bottom pump-around CO_2 is removed from the ammonia. This is achieved by further cooling the product to below 65 ·C. This results in NH_3 reacting with CO_2 to form ammonium carbonate. Traces of CO_2 from ammonia are then pumped back to the de-acidifier (2)17VL-X01 for NH_3 recovery.	Continuous
Fractionation system	The ammonia leaving the Acid Gas Scrubber overhead is firstly compressed prior to the fraction process to improve ammonia recovery. The distillate product of the Fractionators (2)17VL-105 is NH3 and the bottoms product is Organics. The ammonia is cooled down to form a liquid and expanded and the final ammonia product is sent to Tank Farm.	Continuous
Sulphur recovery		
Sulphur recovery	The purpose of the Sulphur Recovery unit is to reduce the amount of sulphur released into the atmosphere as hydrogen sulphide (H_2S) gas by producing elemental sulphur as a saleable product.	Continuous
Wet Sulphuric Acid		
Wet Sulphuric Acid	The purpose of the Wet Sulphuric Acid (WSA) unit is to reduce the amount of sulphur released into the atmosphere as hydrogen sulphide (H_2S) gas by producing Sulphuric acid as a saleable product.	Continuous
Carbo Tar		
Coker	The Delayed Coker Plant receives bottom of the barrel products from upstream units to produce coke.	Continuous
Calciner	The coke calcining process is used to thermally upgrade green coke in order to remove associated moisture and combustible volatile matter (VCM) and to otherwise improve critical physical properties like the electrical conductivity, real density, etc	Continuous
Coal Tar filtration	CTF utilises three solids removal processes and one water removal process. Solids are removed by means of gravity separation in the feed receiving dump bins, followed by solids removal by means of centrifugal separation in the decanter and lastly the final solids are removed by the pressure leaf filters. The water is removed by means of a forced feed evaporator system.	Dump bins, decanters, force feed evaporator – continuous Filters - batch
Unit 86	The main unit processes for U86 Train 1 is heat exchange,	All processes are

	centrifugation and distillation while the main processed for U86 Train 2 is heat exchange, distillation and then filtration. Tankage of product happens before and after processing.	continuous except for the batch filtration processes
Unit 76	The unit consists mainly of conveyors systems combined with storage silos. Loading and weighting facilities are also on site.	Continuous
Water and Ash		
Multi hearth sludge incinerators	The purpose of this system is to incinerate waste activated sludge from the biological treatment systems which treat industrial and domestic effluent respectively. The systems has 4 centrifuges per side to dry the sludge, which is then incinerated in 1 of 2 multiple stage hearth incinerators per side, with a temperature of around 780°C in the burning zone. The off-gas is sent to an emission treatment system, where they pass into the atmosphere, while the coarse ash is sent to Outside ash for disposal.	Continuous
HOW incinerators	The purpose of this system is to incinerate high organic waste (HOW). The HOW, which is pumped from U17/217 to the HOW storage tank, is ignited by means of a fuel gas pilot flame inside a single chamber, refractory brick-lined incinerator. The combustion temperature is controlled at 950°C, and there are two burners. Steam is used to atomize the HOW. The only combustion product is off-gas.	Continuous
Sewage incinerator	The purpose of this incinerator is to burn screenings from primary treatment. It is a single chamber, furnace-type incinerator. The incinerator is manually filled with screenings .Diesel is used as a fuel, and the incinerator has two burners and one fan per burner. The combustion is automated, and operators have very little control over any of the parameters. The products are off-gas and ash.	Batch
WRF TO	Some of the enclosed storage and treatment tanks at WRF do not vent to the atmosphere but rather to the thermal oxidiser. It is introduced to the burners (which are kept burning with fuel gas) with air for combustion.	Continuous
Market and Process Integration (MPI)		
Flares		
Central corridor flares	A system consisting of 2 flare stacks, 2 relief headers and other associated equipment to collect and completely incinerate off-gases, off-specification gases and emergency venting.	As required

5.4 Hours of operations

Unit Process / Plant	Operating Hours	No. Days Operation per Year
Utilities		
Boilers	Continuous	365
Gas Turbines	Continuous	365
Heat Recovery Steam Generator (HRSG)	Continuous	365
Gas Production		
Coal Processing	Continuous	365

Gasification and Raw Gas Cooling	Continuous	365
Rectisol	Continuous	365
Gas Circuit		
Benfield	Continuous	365
Catalyst Manufacturing	Continuous	365
Refining		
Tar Distillation	Continuous	365
Unit 27A	Continuous	365
Unit 74	Continuous	365
Coal Tar Naphtha Hydrogenation	Continuous	365
Creosote Hydrogenation	Continuous	365
Naphtha Hydrotreater, Platformer and CCR	Continuous	365
Catalytic Distillation Hydrotreater	Continuous	365
CD Tame	Continuous	365
C5 Isomerisation	Continuous	365
Vacuum distillation	Continuous	365
Distillate Hydrotreater	Continuous	365
Distillate Selective Cracker	Continuous	365
Light Oil Fractionation	Continuous	365
Polymer Hydrotreating	Continuous	365
Catalytic Polymerisation and LPG recovery	Continuous	365
Sasol Catalytic Converter	Continuous	365
Tar, Phenosolvan and Sulphur		
Gas Liquor Separation	Continuous	365
Phenosolvan	Continuous	365
Sulphur Recovery	Continuous	365
Wet Sulphuric Acid	Continuous	365
Carbo Tar and Coal Tar filtration, Coker	Continuous	365
Calciner	Continuous	365
Coal Tar Filtration	Continuous	365
Feed Preparation	Batch processing	365
Unit 76	Continuous	365
Water and Ash		
Multi Hearth Sludge Incineration	Continuous	365
HOW Incineration	Continuous	365
Sewage Incineration	Batch Processing	365
WRF TO	Continuous	365

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Market and Process Integration		
Central Corridor Flares	As required	365

5.5 Graphical Process Information

5.5.1 Utilities

5.5.1.1 Boilers

[redacted]

5.5.1.2 Gas Turbines

[redacted]

5.5.2 Gas Production

5.5.2.1 Coal Processing

[redacted]

5.5.2.2 Gasification and Raw Gas Cooling

[redacted]

[redacted]

5.5.2.3 Rectisol

[redacted]

5.5.3 Gas Circuit

5.5.3.1 Benfield

[redacted]

5.5.3.2 Catalyst Manufacturing

[redacted]

5.5.4 Refining

5.5.4.1 Tar Distillation (Unit 14 / 214)

[redacted]

5.5.4.2 Unit 27A

[redacted]

5.5.4.3 Unit 74

[redacted]

5.5.4.4 Coal Tar Naphtha Hydrogenation (Unit 15 / 215)

[redacted]

5.5.4.5 Creosote Hydrogenation (Unit 228)

[redacted]

5.5.4.6 Naphtha Hydrotreater, Platformer and CCR (Unit 30 / 230 & 31 / 231)

[redacted]

[redacted]

Catalytic Distillation Hydrotreater (Unit 78)

[redacted]

5.5.4.7 CD Tame

[redacted]

5.5.4.8 C5 Isomerisation

[redacted]

5.5.4.9 Vacuum Distillation

[redacted]

5.5.4.10 Distillate Hydrotreater

[redacted]

*Hydrogenation of oxygenates and olefins.

5.5.4.11 Distillate Selective Cracker

[redacted]

5.5.4.12 Light Oil Fractionation

[redacted]

5.5.4.13 Polymer Hydrotreating

[redacted]

5.5.4.14 Catalytic Polymerisation and LPG Recovery

[redacted]

5.5.4.15 Sasol Catalytic Converter

[redacted]

5.5.5 Tar, Phenosolvan and Sulphur (TPS)

5.5.5.1 Gas Liquor Separation (Unit 13 / 213)

[redacted]

5.5.5.2 Phenosolvan

[redacted]

5.5.5.3 Sulphur Recovery

[redacted]

5.5.5.4 Wet Sulphuric Acid

[redacted]

5.5.5.5 Coker (Unit 39)

[redacted]

5.5.5.6 Calciner (Unit 75 and Unit 76)

[redacted]

5.5.5.7 Coal Tar Filtration (Unit 96)

[redacted]

5.5.5.8 Feed Preparation Plant (Unit 86) Train 1

[redacted]

5.5.5.9 Feed Preparation Plant (Unit 86) Train 2

[redacted]

5.5.6 Water and Ash

5.5.6.1 Bio sludge incinerators

[redacted]

[redacted]

5.5.6.2 HOW Incinerators

[redacted]

5.5.6.3 Sewage Incinerator

[redacted]

5.5.6.4 WRF Thermal Oxidiser

[redacted]