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STRAITS CEMENT SDN. BHD.

Detailed Environmental Impact Assessment

Proposed Expansion of an Integrated Cement Plant of 5,000 TPD Clinker at Bukit Sagu, Kuantan, Pahang Darul Makmur

302020-00292-00-EN-REP-0002

29 December 2011

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EXECUTIVE SUMMARY

1. PROJECT TITLE AND BACKGROUND

The title of this report is Detailed Environmental Impact Assessment (DEIA) for the Proposed Expansion of an Integrated Cement Plant of 5,000 TPD Clinker at Bukit Sagu, Kuantan, Pahang Darul Makmur (the 'Project').

Pahang Cement Sdn. Bhd. currently owns and operates the existing cement plant in Bukit Sagu, Mukim Hulu Kuantan, Daerah Kuantan, Pahang. The existing cement plant was commissioned in 1997. It has an installed nominal clinker production capacity of 3,200 t/d and has been manufacturing clinker as an intermediate product to produce Ordinary Portland Cement.

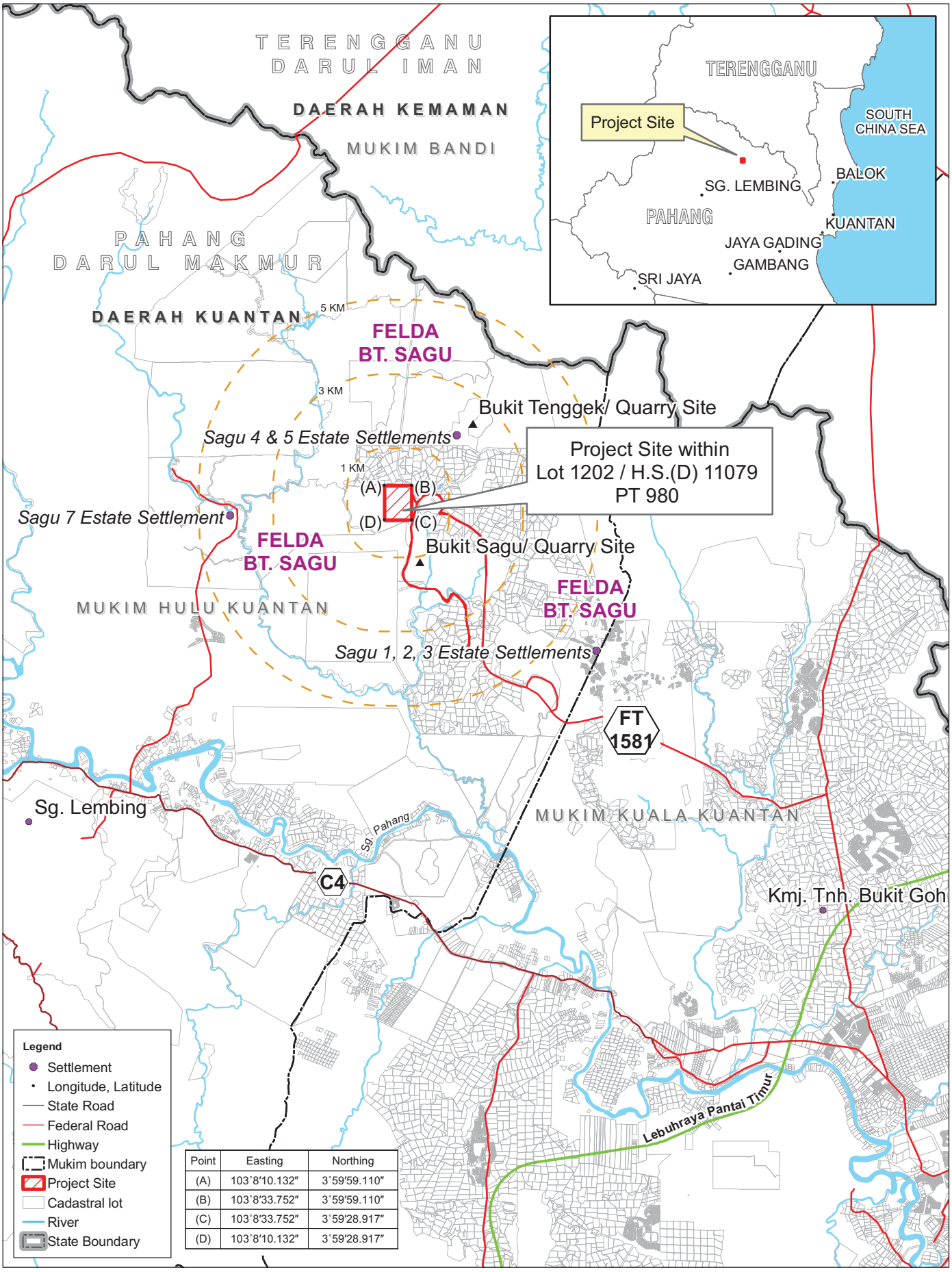
Two Environmental Impact Assessment (EIA) reports have been submitted and approved for the existing cement plant and the use of scheduled wastes for raw material substitution, respectively:

(a) The 1995 EIA: Proposed Pahang Cement Project, Bukit Sagu, Kuantan, Pahang Darul Makmur, Environmental Impact Assessment Study. Final Report, March 1995 (Approved by DOE Malaysia in 1995); and

(b) The 2008 Supplementary EIA: Reuse of Scheduled Wastes Spent Copper Slag and Red Gypsum for Pahang Cement Plant in Bukit Sagu 4, Kuantan, Pahang Darul Makmur. March 2008- Final (Approved in 2008).

2. PROJECT LOCATION

The Project is located at Mukim Hulu Kuantan, Daerah Kuantan in Pahang Darul Makmur, approximately 30 km north-west of Kuantan Town and 40 km south-west of Kemaman town in Terengganu. The Project site is adjacent to the west and parallel to the existing cement plant at coordinates 3° 59'59.110" N and 3° 59'59.110" E, as indicated is Figure ES.1.



Point	Easting	Northing
(A)	103°8'10.132"	3°59'59.110"
(B)	103°8'33.752"	3°59'59.110"
(C)	103°8'33.752"	3°59'28.917"
(D)	103°8'10.132"	3°59'28.917"

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PROJECT LOCATION

FIGURE: ES 1

0 1 2 4 KM

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3. PROJECT PROPONENT

The Project Proponent is Straits Cement Sdn. Bhd. (Straits Cement). Straits Cement is a subsidiary of Pahang Cement Sdn. Bhd. (a wholly owned subsidiary of YTL Cement Berhad). The contact information for the company is as follows:

Straits Cement Sdn. Bhd. 13th Floor, Oriental Place
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Contact person: Mr. Yau Kich Poi (Project Director)

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Fax: +6 03 2072 2826
Email: kpyau@ytl.com.my

4. EIA CONSULTANTS

The Project EIA Consultant is WorleyParsons Services Sdn. Bhd. The contact information for the company is as follows:

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5. STATEMENT OF NEED

The need for the Project is based on the following factors:

(a) Regional and local cement demand - It is estimated that the gap between the national supply and demand of cement is growing by some 2 million t/y. One of the needs for the Project is therefore to ensure sustainable supply of locally produced cement to meet the anticipated increase in demand for cement in the near future.

(b) Contribution to State economy - Pahang Cement has contributed to the Pahang State's economy since the operation of the existing cement plant in 1998. The Project will contribute to the State economy as seen with the existing cement plant at Bukit Sagu.

(c) Socio-economic benefits - The Project is expected to create new jobs in terms of skilled and semi-skilled employees upon Project operation in addition to spin-off benefits to the surrounding local economy during the Project construction and operational phases.

6. PROJECT DESCRIPTION

6.1 Background of the Existing Cement Plant

(a) The existing cement plant has a clinker production capacity of approximately 3,200 t/d (approximately 3,800 t Ordinary Portland Cement - OPC, per day).

(b) Attained quality management and environmental management certification:

- MS ISO 9001:2000 (Quality Management System – Requirements);
- MS ISO 14001:2004 (Environmental Management System – Requirements with Guidance for Use);
- OHSAS 18001:1999 (Occupational Health and Safety Management Systems – Specification); and
- MS ISO/IEC 17025 (Laboratory Accreditation).

(c) Raw Materials Substitution: Iron ore and natural gypsum at the existing plant are approved to be substituted with scheduled wastes, Spent Copper Slag (SW104) and Waste Gypsum/ Red Gypsum (SW205), as raw materials. The scheduled wastes are being utilised to replace up to 100% of iron ore, and up to 50% of natural gypsum.

6.2 Overview of the Project

6.2.1 Clinker Production Capacity

The Project is proposed to have clinker production capacity of approximately 5,000 t/d (approximately 3,333 t Ordinary Portland Cement per day and 3,077 t Portland Composite Cement, PCC).

6.2.2 Main Project Facilities

The main Project facilities are a premix crusher, premix store, raw material and additives stores, raw mill, preheater, kiln, clinker cooler, clinker silo, cement mills, limestone mill, limestone silo, cement silos, mixing plant, packing plant, palletizing plant, coal store and coal mill.

6.2.3 Cement Production Process

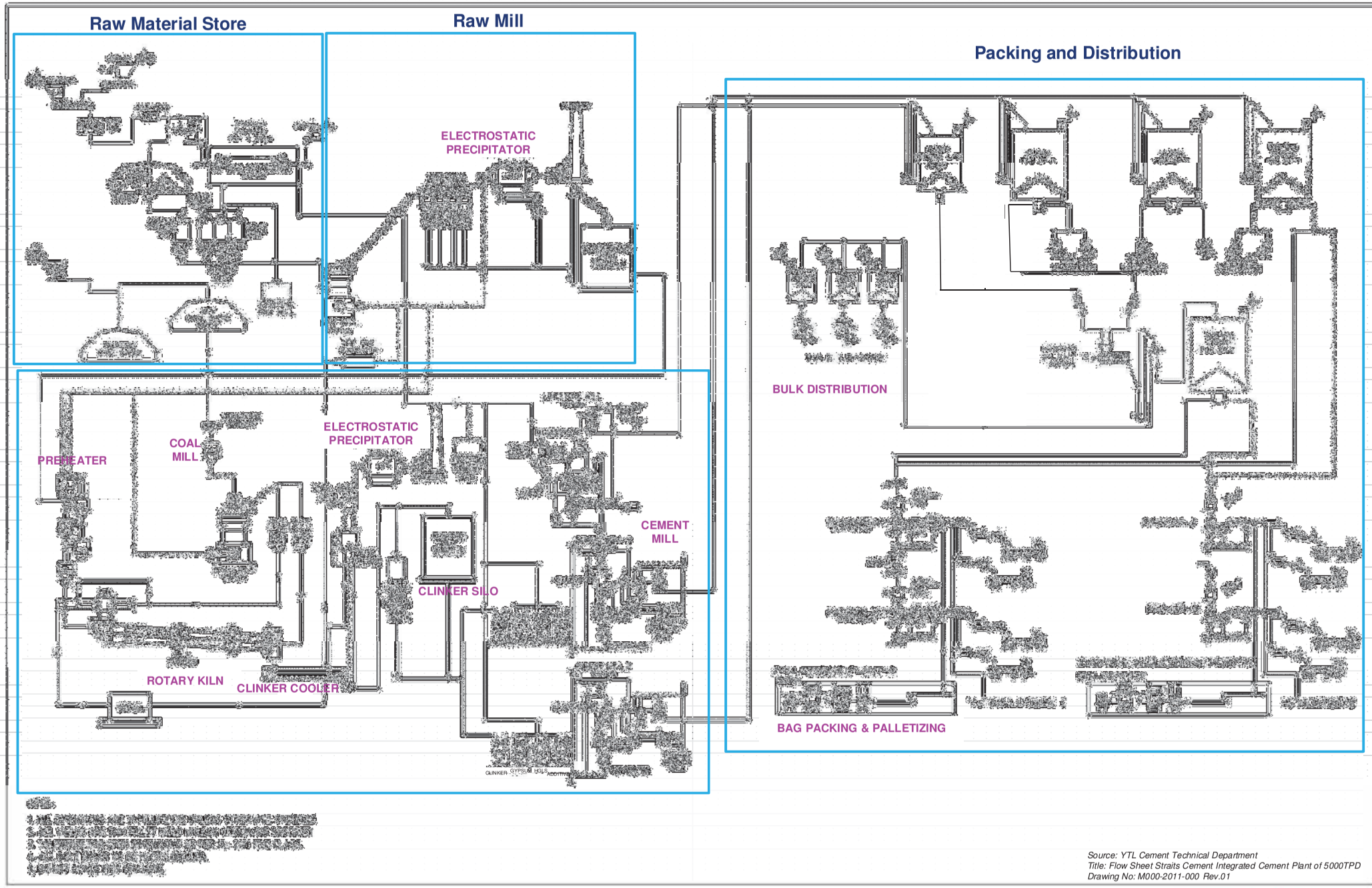
The Project will adopt a dry cement production process. The schematic process flow diagram is shown in Figure ES 2 and described in the following sections:

(a) Raw Materials

Raw materials and the sources for the Project are as shown in Table ES 1:

Table ES 1: Raw Materials and Its Sources

Raw Material	Source
Limestone	Limestone quarry, approximately 1 km south from the existing cement plant.
Clay	Clay deposit, approximately 500 m southwest from the existing cement plant.
High grade limestone	Limestone quarry, approximately 1 km south from the existing cement plant.
Sand	Sg. Lembing, 10 km from Project site
Iron Ore	Bukit Besi, Terengganu
Copper Slag	Imported from Japan.
Natural Gypsum	Imported from Thailand.
Raw Material Substitutes – Scheduled wastes	
(a) Spent Copper Slag (SW104)	Waste Generator, Malaysian Marine & Heavy Engineering Sdn. Bhd., Pasir Gudang, Johor.
(b) Red gypsum (SW205)	Waste generator, Tioxide (M) Sdn. Bhd. (Part of the Huntsman Cooperation, U.S.A.), Kemaman, Terengganu.



Source: YTL Cement Technical Department
Title: Flow Sheet Straits Cement Integrated Cement Plant of 5000TPD
Drawing No: M000-2011-000 Rev.01

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PROCESS FLOWCHART						FIGURE: ES 2	-
08 DEC 2011	date	L.T.M.	drawn by	L.T.M.	edited by	H.Y.P.	app by
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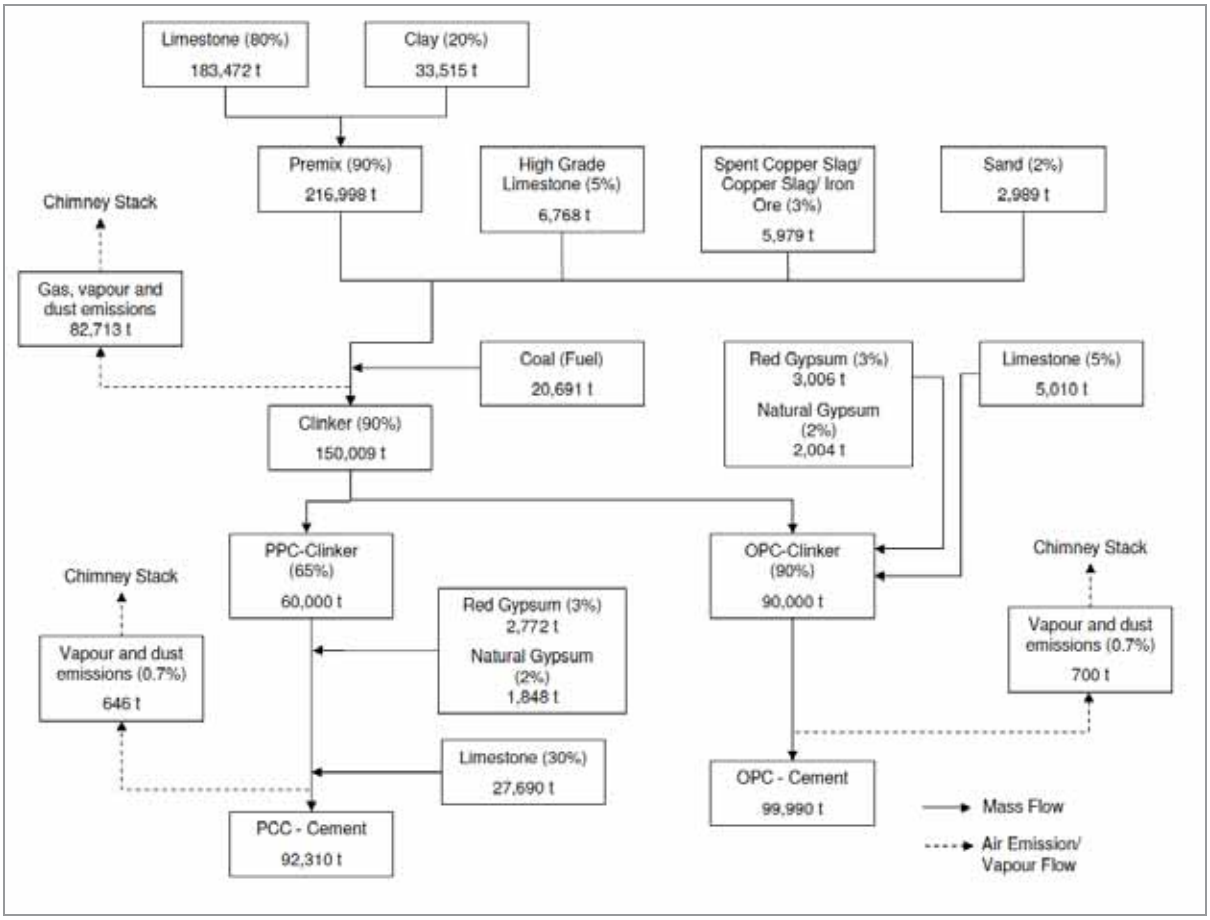
(b) Material Balance Diagram

A typical mass balance diagram for raw material consumption, emissions and discharges from the production processes of the Project, based on a 30-day average material consumption, is shown in Figure ES 3.

Based on a 30-day average, approximately 216,988 t of limestone premix is required to produce 150,009 t of clinker. Upon grinding with additives such as natural gypsum, red gypsum and limestone, the production process may yield up to 192,300 t of OPC and PCC cement.

Figure ES 3: Typical Project Mass Balance Diagram for OPC and PCC Production (30-day average)



(c) Raw Material Preparation in the Raw Mill

Raw materials will be mixed and fed into the raw mill to grind and dry: producing ‘raw meal’ which will then be delivered to the raw meal silo.

(d) Clinker Production in the Kiln

Clinker is an intermediate product in the manufacture of cement from calcinating and sintering of raw meal. It is formed as a result of chemical reactions between the raw materials in a process called pyro-processing, in which the raw meal is evolved into clinker.

(e) Clinker Grinding in the Cement Mill

Powdered OPC is produced by dry-grinding of cement clinker with additives, i.e. gypsum and high grade limestone which takes place in the cement mill. Powdered limestone is produced by dry-grinding of high grade limestone in the limestone mill located in the limestone storage hall.

Cement and limestone powder will be periodically extracted and transported to the mixing plant to produce blended PCC. The blended PCC cement will be transported to PCC silo for packing or bulk dispatch.

(f) Cement Packing and Palletizing

Cement will be packed into 50 kg bags and palletized into 40-pack-pallet for secure loading and handling. Alternatively, cement from storage silos may also be bulk loaded into cement tankers for direct delivery to consumers or to regional distribution centres.

6.2.4 Quality and Pollution Control System

(a) Air Pollution Control

For the Project, the air pollution control consists of two electrostatic precipitators (EP) and 47 bag filters located at various sources within the production facilities. The existing plant has one electrostatic precipitator (EP) and 36 bag filters. The achievable level of air emissions will be based on “Best Available Technology Not Entailing Excessive Cost” (BATNEEC) concept for nitrogen dioxides (NO_2), sulphur dioxides (SO_2) and dust particulates.

Cyclones will be installed within various stages of process to capture materials entrained in airflows that are routed through principal process units. The cyclones will assist in enhancing the efficiency of bags filters and EPs.

Coal is transported internally via covered a belt conveyor line system which will be effective for dust and spill minimization.

(b) Water Pollution Control

The Project is expected to produce cooling water blowdowns on a monthly basis but the volume is considered negligible. Domestic wastewater will be treated via individual septic tanks to meet the

minimum requirements stipulated by the Environmental Quality (Sewage) Regulations, 2009 (Standard B).

(c) Noise Control

In-plant shielding of noise emissions is adopted to ensure the cumulative noise levels at the site boundary are within the regulatory requirements. Measures will include:

i) Employing well assembled equipment generating low noise levels, wherever possible;

ii) Installation for vibration insulation and damping for noise caused by equipment vibration;

iii) Installation of silencers for equipment generating aerodynamic noise; and

iv) Proper design of building structures to curb acoustic wave transmission.

(d) Waste Management

Waste generated from this Project is divided into scheduled waste and domestic waste.

Recyclable schedule scheduled waste will be recycled and the non-recyclable will be handled as scheduled waste. Waste oil will be stored in a covered area with concrete flooring and bund to avoid ground and water contamination. Scheduled waste will be stored in a secured location prior to collection by licensed contractors for disposal at Kualiti Alam disposal centres.

Domestic waste will be collected and stored at the waste depot within the Project site; and cleared periodically to the nearest municipal landfill.

6.2.5 Utilities and Fuel

The utilities and fuel demand as well as the sources for the Project are shown in Table ES 2.

Table ES 2: Utilities and Fuel Demand and Sources

Utility/ Fuel	Demand	Source
(a) Power Supply	Existing: 18 MVA Project: 38 MVA. Combined demand: 56 MVA	• 132 kV switch yard within the existing cement plant
(b) Water Supply (for plant operations)	Existing: 22,000 m^3/month Project: 22,000 m^3/month Combined demand: 44,000 m^3/month	• Treated water from Jabatan Bekalan Air (JBA)
• Process water (feed water)	Existing: 500 m^3/d Project: 700 m^3/d Combined demand: 1,200 m^3/d	
• Domestic water	Combined demand: 260 m^3/d	
• Fire fighting water	Not applicable;	• Stored in water tank of

Utility/ Fuel	Demand	Source
	(Standby water tank)	1,630 m^3 capacity
(c) Coal	Existing: 120,000 to 140,000 t/y Project: 200,000 t/y Combined demand: 320,000 to 340,000 t/y	• Coal storage yard (coal is imported from Indonesia)
(d) Fuel Oil - Diesel	Not applicable, diesel is used as back-up fuel	• Existing main diesel storage tank: 500,000 liter capacity • Existing reserve diesel storage tank: 10,000 liter capacity • Existing emergency diesel storage tank: 1,500 liter capacity • Other existing diesel storage tank: 6 x 18,200 liter capacity • Proposed emergency diesel storage tank: 1,500 liter capacity

6.2.6 Abnormal Plant Operations and Fire Fighting/Detection System

Abnormal production operations could be associated with power outages, raw mill breakdown, inefficient combustion of coal, degradation of kiln refractory lining and breakdown of cyclone, EP or bag filters. Potential consequences from the abnormal incidences will be mitigated to reduce the impact relating to high discharges of dust to the atmosphere, initiation of explosion and fires causing structural damage, inducing nuisance impacts on surrounding communities, loss of production time, damage to equipment and danger to the welfare of workers.

Fire fighting/detection system will be provided for the Project and will be similar to the existing plant operation.

6.2.7 Manpower Requirement

Approximately 580 workers will be involved during construction phase.

The existing plant has 131 workers and the Project is expected to employ 85 workers during operational phase.

6.2.8 Development Schedule

The Project is expected to be operational 25 months after granting of approvals by relevant government agencies and contract award.

7. PROJECT OPTIONS

7.1 Site and Technology Options

Site suitability was assessed to determine to site selection, based on the following criteria: land status, size and proximity to main raw materials, compatibility with surroundings and availability of sufficient buffer, infrastructure and road network and concentration of process areas within the existing facilities. The Project site is deemed suitable for the intended second line expansion.

In terms of technology options for production methods, the dry process is the most energy efficient as less energy is required for drying of kiln feed. Hence, the dry process indirectly reduces the overall capital costs as well as operation and maintenance costs. As for grinding methods, the vertical roller mill is selected for raw material and limestone grinding, while roller press & tube mill is selected for cement grinding. Both systems are low in power consumption.

The option of employing a combination of bag filters, EPs and cyclones are selected for the air pollution control system.

7.2 'With Project' and 'No Project' Options

The 'With Project' option will create an additional supply source of cement for the central and southern region of Peninsular Malaysia. It is also viewed as a source of pollution with the potential to adversely affect air quality possibly causing nuisance impacts on neighbouring areas and other environmental issues. The environmental impacts of this option have been assessed and mitigating measures are described in *Section 9 Impact Assessment and Mitigation Measures* in the main DEIA report.

The 'No Project' Option refers to cancellation of the Project with the Project site remaining *status quo* and without development activities. The investment of not less than RM 700 million will not be realised in the region. It is also expected to indirectly affect downstream or upstream industries for example, through a loss of employment opportunities in related fields such as engineering and consultancy, transportation and material supply. It will also limit the potential for balanced distribution of cement production in Peninsular Malaysia.

It is envisaged that the 'With Project' option benefits outweighs the dis-benefits, if the Project is implemented.

8. EXISTING ENVIRONMENT

The study area for the EIA encompasses the surrounding area which extends up to 5 km from the boundary of the Project site and the existing plant, including a settlement which is just outside study boundary. Environmental sampling and monitoring was conducted September 2011 for baseline water quality, air quality and background noise levels. Other technical surveys were conducted between August and October 2011 for the study area.

Table ES 3: Existing Environment

Component	Description
Physical Characteristics	Terrain and Topography The site is relatively flat naturally; ground level at the existing cement plant site is 15.3 m above m.s.l and at the Project site is between 15.3 and 31 m above m.s.l. Geology Near surface geology of Kuantan area comprises quaternary deposits comprising recent alluvium and basalt. Large deposits of carboniferous material, including carboniferous sandstone or metasandstone can be found towards the east of the Project site, carboniferous limestone/ marble at the Bukit Sagu limestone ridge and associated acid to intermediate volcanic just south of the Bukit Sagu limestone ridge area. Soil Telemong-Akod Local Alluvium Series, Holyrood-Lunas Series, Durian-Munchong-Bungor Series, Kuala Berang-Kedah-Serdang Series and Steepland Series.
Water Quality	Hydrology The Project site is located within the Sg. Batu catchment. The main tributaries of Sg. Batu are Sg. Rong and Sg. Sagu. Sg. Batu is located on the eastern boundary of the Project site and flows in a southerly direction into Sg. Reman. Land use within the catchment is dominated by green areas, mainly by FELDA oil palm cultivation scheme, located on the upper and lower catchment. Other land uses include, forested areas, proposed Sg. Reman reservoir and dam, industrial, residential, vacant land, transportation and water bodies. Water Quality Baseline water quality at Sg. Batu, upstream (W1) and downstream (W2) of the Project site was in compliance with Class III of the NWQS. Results from the ongoing water quality monitoring at Sg. Batu, wastewater discharge from the existing plant site and groundwater were shown to be fairly good. The ongoing water monitoring results were compared against Class III limits, Standard B and the Dutch standards, respectively. Average results were found to be in compliance with their respective standards.
Meteorology	The climate at the Project is equatorial, warm and humid all year, and characterized by two distinct monsoonal seasons. Meteorological data from the Kuantan Meteorological Station (03° 47' N, 103° 13' E) 25 km south-southeast of the Project site is considered representative of the meteorological conditions at the Project site and is summarized as follows: • Mean daily temperature: 26.3℃ • Mean daily humidity: 85.2 % • Total annual rainfall: 2,966.7 mm • Dominant wind directions: Blowing from the north, northeast, east and southwest

Component	Description
	• Calm period: 20.6 % of the time
Air Quality	Ambient Air Quality Baseline ambient air quality sampling was carried out at five stations - within the existing cement plant boundary and sensitive receptors namely the Sagu 1, 2, 3 Estate Settlements, Sagu 4 & 5 Estate Settlements and Sagu 7 Estate Settlement. The parameters measured were total suspended particulates (TSP), particulate matter <10 micron (PM10), dust fall, sulphur dioxide (SO_2) and nitrogen dioxide (NO_2). Analysis results show that air quality parameters complied with the Recommended Malaysian Air Quality Guidelines (RMAQG) as follows: • TSP levels from 26 µg/m^3 to 138 µg/m^3, dust fall from 15 mg/m^2/d to 124 mg/m^2/d while PM10 ranged from 18 µg/m^3 to 22 µg/m^3; • SO_2 was not detected; and • NO_2 levels from 35.8 µg/m^3 to 52.7 µg/m^3. Routine TSP monitoring results for five monitoring stations within the plant boundary ranged from 37 µg/m^3 to 87 µg/m^3 and complied with the Recommended Malaysian Air Quality Guidelines (RMAQG). Dustfall levels ranged from 30 mg/m^2/d to 659 mg/m^2/day (complying with the RMAQG limit in 7 out of 16 measurements). Stack Monitoring • Emissions from seven stacks located within the existing plant were monitored for dust, sulphur dioxide (SO_2), sulphuric acid mist (H_2SO_4), sulphur oxides (SOx), nitrogen oxides (NOx), Lead (Pb), Cadmium (Cd), Copper (Cu), Zinc (Zn), Arsenic (As), Antimony (Sb), Mercury (Hg), Carbon Monoxide (CO), Carbon Dioxide (CO_2), Volatile Organic Carbon (VOC) and dioxin and furan. • The routine stack monitoring results indicate that all parameters at all stacks consistently well below the regulatory limits for all parameters and complied with the emission limits specified in the Environmental Quality (Clean Air) Regulations 1978.
Noise	Baseline noise levels at the site boundary: • Northeast boundary of existing cement plant (N1): Day time 57.7 dB(A); Night time 49.3 dB(A) • Western boundary of the Project site (N2): Day time 46.2 dB(A); Night time 42.7 dB(A) • Southern boundary of the existing cement plant: Day time 56.3 dB(A); Night time 46.9 dB(A) Routine background noise levels at the site boundary: • Northeast boundary of existing cement plant (N1): Day time 50.2 to 65.0 dB(A); Night time 52.9 t0 55.0 dB(A)
Land Use	• Project site: Located entirely within its existing cement plant site. • Type of land use for the proposed land lot: Industrial land.

Component	Description
	• Immediately adjoining the Project site: Agriculture land which mainly consists of FELDA oil palm plantations. • The 5-km study area covers an area of about 9,578.47 hectares, consisting of agriculture land, mainly oil palm plantation (77%) and forest land (16%) • Settlements within the study area are the Sagu 4 & 5 and Sagu 7 Estate Settlements. Sagu 1, 2, 3 Estate Settlements located just outside the 5 km distance, at 5.4 km from the site boundary.
Terrestrial Flora and Fauna	• No significant species of flora and fauna were found at the Project site as it is a cleared land prepared for development. • The Project site is dominated by secondary vegetation and no endangered species were noted at the site. • Since the area was first cleared during the development and construction activities of the existing plant, sightings of wildlife and animals were rare. • Vegetation within the study area is predominated by oil palm plantations. • The outcrops of Bukit Sagu and Bukit Tenggek in the study area are likely to have flora which is endemic to limestone hills. The common limestone flora found in these hills is expected to be similar to other limestone hills in Malaysia such as the *Canscora pentanthera, Croton cascarilloides, Streblus ilicifolius and Zizyphus oenophila*. • Animals observed in the study area are mostly domesticated animals such as chickens, cattle, cats and dogs. • Common species such as the long tailed macaques (Macaca fascicularis), Plantain squirrels (*Callosciurus notatus*) and birds such as Oriental Magpie and Robin (*Copsychus saularis*) were also observed in the study area. • Protected species observed during site survey include the Asian palm swifts (*Cypsiurus balasiensis*) and Asian Fairy-bluebirds (*Irena puella*).
Road Network and Infrastructure	• The Project site is accessible from Jalan Bukit Sagu (FT1581), a two-lane road with varying carriageway width (6.5 to 7.0 m), which primarily serves the FELDA settlers in the Bukit Sagu area. • Jalan Bukit Sagu is connected to Jalan Bukit Kuantan (FT1487) at the east. • Other main roads located near to the Project site (i.e. located more than 10 km from the Project site) are Jalan Bukit Kuantan (FT1487), Jalan Bukit Goh (FT1486) and Jalan Sungai Lembing (State Route C4) and Lebuhraya Pantai Timur. • Jalan Bukit Kuantan, Jalan Bukit Goh and Jalan Sungai Lembing are currently 2-lane roads. Jalan Bukit Kuantan has narrow carriageway width with no paved shoulder and some sections of the road are on rolling terrain. The narrow road section at Jalan Bukit Kuantan does not allow vehicles (especially trucks/lorries) to comfortably pass each other due to lack of tolerance between passing vehicles • Mid-block road capacity analysis:

Component	Description
	The existing Jalan Bukit Sagu is operating satisfactorily, with volume to capacity ratio of less than 0.15 during peak hours which is equivalent to a level of service 'A'. This traffic condition was reflected during the onsite observation where vehicles were moving smoothly with minimal interruption on Jalan Bukit Sagu.
Utilities and Services	Electricity • Pahang Cement is one of the five heavy industrial sites that will extract power directly from the national transmission grid via the 132 kV supply. Water • Water supply in Kuantan is operated and distributed by JBA through eight water treatment plants (WTP), which include Bukit Sagu WTP. • The Technical Report for RTD Kuantan identified that Bukit Sagu WTP would operate beyond capacity by 2004 and was scheduled to be upgraded in 2010. The current supply/capacity of Bukit Sagu WTP is not known. • The Project Proponent has communicated their water demand to JBA. Sewerage • A series of septic tanks are provided for sewage treatment within the cement plant. The septic tanks were designed for 6 Population Equivalent (PE) to 30 PE each. Solid Waste Disposal • The nearest municipal solid waste disposal sites is the KM1 Jalanraya Kerangau/Jabor Sanitary Land Site. Solid/hazardous waste collection in the study area is managed by licensed contractor. For hazardous waste, it will be disposed at Kualiti Alam hazardous waste centre.
Socio-economic Baseline and Population	District Population Profile • Projected District Population: 411,900 in 2010. • Ethnicity: Bumiputera (Malays and Orang Asli), 77.7%; Chinese, 17.1%; Indian, 2.1%. • Workforce in the District: 125,514; District Workforce Distribution: Primary Sector, 6.2%; Secondary Sector, 28.6%, Tertiary Sector 65.2%. Population within the Study Area • Population centers – FELDA Estate Settlements: Sagu 1, 2, 3 (5.4 km); Sagu 7 (4.0 km); Sagu 4 & 5 (1.5 km). • Other type of settlements: Not applicable • Estimated population and households: Population 2,859; 761 households • Socio-economic questionnaire survey: 112 respondents of the 761 households. Opinion and Perception Survey • Survey findings: Fully support the Project (49%); Support with conditions such as providing job opportunities to the locals, improving the traffic conditions and safe guarding the environment (46%).
Public Health Status	Cross sectional survey findings: • Almost all the local community has adequate basic amenities which include safe

Component	Description
	water supply, appropriate sewage and solid waste management system. • In general, the incidences of diseases which can be direct or indirect results from the exposure to the putative source of hazardous effluent, and poorer air quality are apparently low.

9. IMPACT ASSESSMENT AND MITIGATION MEASURES

9.1 Soil Erosion Risk

Soil loss rates at the Project earthwork areas are calculated to be:

(a) 8.0 t/ha/yr during the pre-construction phase, which is the existing scenario;

(b) 137 t/ha/yr during the construction phase, which is when soil erosion is at its maximum; and

(c) 0.07 t/ha/yr during the post-construction scenario.

During the pre-construction phase, soil loss is likely to occur as a result of erosion from the existing exposed areas within the vacant Project site. Low erosion rate during the post-development phase is expected due to stabilization of site conditions and the presence of impervious surfaces. During the construction phase, cut and fill earthwork activities will occur and will increase the likelihood of soil erosion during the construction period.

Erosion and sedimentation control measures which could be implemented during construction phase include:

(a) Revegetation of exposed surfaces through turfing or hydro-seeding;

(b) Construction of berms with runoff drains along slopes, earth drains and earth banks;

(c) Sediment basins/silt traps for containing sediment that is eroded; and

(d) Other measures as recommended in the relevant guidelines such as the Guidelines for the Prevention of Soil Erosion and Sedimentation issued by the DOE.

9.2 Water Quality

Construction Phase

Wastewater streams generated during the construction phase will include surface runoff and domestic wastewater. The potential sources of impacts from surface runoff will be localized and temporary; and can be controlled by appropriate onsite measures, which include measures imposed for the 'Soil Erosion' section of the DEIA. There will be no exceedances of Class III of the NWQS for Total Suspended Solids (TSS) concentrations during construction phase based on the mass balance

equation. It is anticipated that the provision of silt traps will reduce the TSS concentrations by almost 50%.

Domestic wastewater during construction phase is to be treated by chemical toilets. Provided that the chemical toilets are properly maintained by licensed contractor, no adverse impact to the water quality is anticipated.

Operational Phase

The production of cement during Project operation adopts a dry-process of manufacture whereby minimal industrial wastewater is generated. Wastewater generated will be mainly in the form of cooling water blowdowns, stormwater and sewage effluent. It is recommended that all existing mitigating measures to protect water quality are continued to ensure that all pollutants are minimised as far as is practicable prior to discharge to Sg. Batu. These measures include:

(a) Passing of all blowdowns, stormwater, surface runoff from bunded areas and wash water through silt traps; and

(b) Conveying sewage effluent through septic tank for biological treatment, together with annual inspection of tanks.

Silt traps and septic tanks shall be regularly cleaned and maintained in good working conditions and be incorporated into the operational procedures to ensure good efficiency. The increase in capacity is not deemed to cause adverse effects on the surrounding water quality, so long as the mitigating measures recommended are adequately maintained.

9.3 Air Quality

Sensitive receptors in the vicinity of the Project site were identified:

(a) Sagu 4 & 5 (1.5 km, northeast);

(b) Sagu 7 (4 km, west); and

(c) Sagu 1, 2 & 3 (5.4 km, southeast)

Construction Phase

The main potential air pollutant emissions during the construction phase will be fugitive dust originating from site preparation and earthworks, civil works and transportation of construction material and equipment to site. Site preparation and earthworks create exposed areas that are prone to dust generation during dry periods with strong winds, which usually occurs during the late afternoon and during the downdraft of a thunderstorm.

Due to calm conditions and low wind speed, as well as a separation distance of more than 1 km between the identified sensitive receptors and the Project site, air quality impacts due to fugitive dust emission during the construction period are expected to be minor and short-term in nature.

Operational Phase

Air pollution dispersion modelling was carried out using the Industrial Source Complex Short Term Version 3 (ISCST3) model. The parameters selected for modelling were the main pollutants expected to be emitted by the Project, namely total suspended particulate (as TSP), sulphur dioxide (SO_2) and nitrogen dioxide (NO_2).

The air pollution sources are point sources and area sources. The identified main point sources are the kiln preheater, raw mill and clinker cooler, limestone crusher, cement grinding plant, packing plant and coal mill stack, minor dedusting points with bag filter dust collectors. The area sources are the existing and proposed open storage areas for additives and coal as well as the limestone quarry.

In this study, a 6 km x 6 km Cartesian grid with a 200 m grid interval was applied for the air dispersion model. Related meteorological data was obtained from the Kuantan Meteorological Station.

Two scenarios were modelled to reflect the various possible operating scenarios at the Project involving normal operating conditions as well as abnormal events. The scenarios are as follows:

Scenario I: Dust as TSP, SO_2, NO_2, mercury and dioxin and furan were modelled for the normal operation of the existing and proposed plant.

Scenario II: Uncontrolled release of TSP was modelled for a 1-hour averaging time for the abnormal operation of the existing and proposed plant.

The air pollution dispersion model predicts Maximum Average Incremental Concentrations (MAIC) of the pollutants that were modeled.

Overall, the modelling results of stack emissions during normal operation indicate that the ground level concentrations for the pollutants modelled are within the recommended ambient air standards. The zone of impact is generally predicted towards the southwest from the plant site. During abnormal operation, high ground level concentrations are predicted. However, gas exit velocity from the stacks is very low, and emitted dust cannot travel far away. The dust will be dispersed to the ground level immediately around the stack and the maximum concentration will occur within the plant premises.

The ambient air monitoring results at the sensitive receptors carried out during blasting activities indicated that the air quality at the surrounding sensitive receptors is not adversely affected by dust from quarry blasting.

To ensure that air pollution control systems operate at their design performance level and to reduce the probability of failures, it is necessary that regular monitoring and maintenance of the systems be undertaken. An effective emergency response system is required to be in place to minimize uncontrolled emissions.

9.4 Noise

Sensitive receptors at risk of exposure to noise due to the Project include workers working at the existing cement plant and FELDA plantation workers working at the oil palm plantations within 1 km from the site boundary. Other receptors, such as the communities located more than 1 km from the site boundary, are found to be buffered by oil palm plantations.

Construction Phase

The impact of noise during the construction phase is negligible and short term in nature, confined to the construction period.

Operational Phase

During the operational phase, the increase to boundary noise levels is predicted to be acceptable and within the permissible limits. The estimated incremental noise levels are not anticipated to be noticeable at the north-eastern and the southern plant boundary or from the existing plant site. An increase in noise levels is expected along the western boundary which is currently vacant. However, the increase is within the maximum allowable day and night time noise limits of 65 dB(A). Therefore, no significant adverse impacts on sensitive receptors are predicted as a result of the Project.

Overall, the proposed Project noise control measures shall be maintained throughout the operational phase and other suitable long term noise control measures may be introduced to further minimize or abate the impact of noise.

9.5 Land Use

The Project is compatible and complies with the land use zoning plan advocated in the Draft Local Plan Kuantan 2010-2015.In terms of environmental implications, no significant adverse impacts are expected to be generated from the Project in relation to site land use and compatibility with surrounding land uses in the study area.

9.6 Traffic

Construction Phase

As the predicted volume of construction traffic is low (i.e. less than 250 PCU/hr), it is not likely to cause significant impact on the performance of the surrounding road network. Furthermore, the volume of construction traffic also varies throughout the construction period depending upon the construction activities. In terms of routes for the construction traffic, it will still use the existing Jalan Bukit Sagu as this road is the main road serving the Project site. However, effort should be made to ensure mud and dirt from construction vehicles is not deposited on the road. Vehicles leaving the

construction site should pass through an effective wheel-wash system. Wastes transported out of the construction site by trucks should also be properly covered.

Operational Phase

The results of traffic impact analysis during operating stage indicated that the volume of traffic entering and exiting the cement plant is expected to increase in line with the increase in the cement plant capacity from 3,200 t/d to 8,200 t/d. With the proposed expansion, the number of trucks is expected to increase to 400 trucks per day. The total 12-hour traffic (i.e. from 7.00 am to 7.00 pm) is expected increase from 640 PCU (2-way) to 1,601 PCU (2-way), whilst the peak hour traffic is expected to increase from 85 PCU/hr to 213 PCU/hr during morning peak and from 140 PCU/hr to 350 PCU/hr during evening peak.

Results of road capacity analysis based upon the additional increase in traffic revealed that from the viewpoint of road capacity, the existing Jalan Bukit Sagu is expected to operate satisfactorily. The road is expected to operate at maximum volume to capacity ratio of 0.22 which is equivalent to a level of service 'A'. This means that the carrying capacity of Jalan Bukit Sagu near the cement plant site is able to accommodate the traffic that is expected to be generated by the existing and the proposed plant.

Nonetheless, it is proposed that measures be undertaken to control vehicular speed on Jalan Bukit Sagu. It is proposed that transverse bars and speed limit signs as well as warning signs to be installed before junctions and along bends along the road leading into the cement plant site.

In order to address the road safety issues, a public participatory programme is proposed. This can be achieved by installing signboards with contact numbers for complaints at visible spots on vehicles from the cement plant. This programme is to allow the public to lodge complaints to the cement plant operator/management in the event of any traffic safety issues involving vehicles from the cement plant. In addition, it is recommended that a training and awareness programme on road safety be initiated for road users in the study area.

It is also recommended that further study is undertaken in respect of traffic safety for Jalan Bukit Kuantan-FT1487 (i.e. road located outside the study area) as some section of the road is narrow and with no paved shoulder. This is in view of the fact that this road functions as the main access for FELDA settlers in Bukit Sagu, Bukit Kuantan, Bukit Goh and Neram to get into the external main roads such as Jalan Sungai Lembing and Lebuhraya Pantai Timur (LPT).

9.7 Quantitative Risk

Hazardous materials handled onsite are diesel and coal. The Project involves utilisation of coal as its main fuel in the clinker production, while diesel is utilised for start up, back up or emergency fuel in the rotary kiln.

Coal fires occurrence probability in storage yard is predicted to be remote as the low rank coal utilised in this Project is not freshly mined and proper storage methods will be applied at the Project. Nevertheless, establishment and implementation of a detailed dust explosion risk management control system will help to minimise the risk of coal fires occurring at the Project.

The results of the quantitative risk assessment for diesel storage areas show that the plant meets the risk acceptability criterion for industrial areas ($1x10^{-5}$ fatalities/person/year) as well as for nearby residential areas ($1x10^{-6}$ fatalities/person/year). Hence, the Project site is suitably located and it satisfies the individual risk criteria proposed in the EIA Guidelines for Risk Assessment, 2004.

9.8 Waste Management

Solid wastes expected to be generated during the construction and operation of the Project include overburden earth excess, construction waste, general refuse, scheduled waste, equipment maintenance parts and sewage sludge. The following measures are proposed to minimise the impacts of solid waste generation:

(a) Excess earth (i.e. clay) will be reused as raw material in the cement production and thus will eliminate the need for disposal offsite;

(b) Contractor to recycle as much of the construction materials as possible onsite;

(c) Scheduled waste will be handled in accordance with the Handling and Storage and Labelling of Scheduled Wastes of the Environmental Quality (Scheduled Wastes) Regulations, 2005;

(d) General refuse will be stored in enclosed bins or compaction units separate from construction and chemical waste. A licensed contractor will be employed to remove general refuse from the site on a daily basis to minimise odour, pest and litter impacts; and

(e) Enclosed containers will be provided during the containment and delivery of sewage sludge to minimise odour impacts.

9.9 Socio-economic

From responses received in the survey and also from the focal group sessions held between the local community and the Project Proponent, the general consensus is that the respondents are amenable to the Project

Upon soliciting the feedback from the local community from the study areas and assessment based on the opinion and perception survey findings as well as response received during the focal group session, adverse socio-economic impact of the Project on the community residing within the study area is not anticipated.

9.10 Environmental Health

Public health assessment was conducted to determine the existing health status of the population residing within the vicinity of the proposed cement plant and to predict the potential health impact from the plant operations. The population health status was determined through perceptional health survey and analysis of the secondary health data from the nearest health facilities and from Hospital Tengku Ampuan Afzan, Kuantan for the period from 2008-2010 and 2010 respectively.

The potential health impact was determined through health risk assessment (HRA) methodology. The health survey showed the point prevalence rates for diseases among the sensitive receptor related to the proposed project were 32.4%, 5.0%, 2.9% and 2.9% among children and 12.5%, 5.4%, 2.4% and 1.1% among adults respectively for common cold (URTI), fever, skin diseases and asthma. However, these rates were lower than the NHMIS III, 2006.

The analysis of the secondary data from the nearest health clinic showed that the main reason for outpatient visits for ailments related to air pollution were common cold or URTI and asthma. Hospital data showed that the air pollution related diseases admissions were lower than the Health Facts 2010.

In HRA, two simulated scenarios were conducted, i.e. the normal emission scenario whereby the air pollution control equipment is working efficiently and the emergency emission scenario when there is failure of the control system. Under both these scenarios, the exposure to SO_2, NO_2, CO and PM2.5 at all receptors will not impose adverse acute or chronic health impact to the local population including the sensitive groups. Exposure to the toxic air pollutants was also unlikely to cause adverse acute and chronic health impacts as all the calculated hazard quotient were less than 1.

10. RESIDUAL IMPACTS

Residual impacts for this DEIA takes into consideration the cumulative effects from the operation of the existing cement plant and the Project. The impact assessment has shown that if all adverse environmental impacts associated with the Project are properly managed, the majority of the environmental risks will be controlled to acceptable levels during the construction and operational phases.

The assessment anticipated an acceptable increase in background noise levels (below 65 dB(A)) along the western boundary of the Project site.

An increase in traffic volume to and from the Project site during the operational phase is anticipated in view of the increased production capacity for the cement plant. Residual impact is envisaged in terms of road safety due to the increase of vehicular movements. Mitigation measures are proposed to minimize these impacts.

The assessment also confirmed that the health of the local community is not likely to be affected by the combined emissions from the expanded plant during normal operations if all the proposed mitigation measures are carried out accordingly.

12. ENVIRONMENTAL MANAGEMENT

It is crucial that the Project Proponent is committed to properly manage the environmental during the construction and operational phases of the Project. In this regards, Strait Cement, through Pahang Cement, has a corporate policy statement on Safety, Health and Environment. The policy stipulates that the work undertaken by Strait Cement shall not pose adverse effects on the environment and this is to be achieved by adopting environmentally sound practices and work ethics.

The Project will be implemented in accordance with the Corporate Safety, Health and Environment Policy and in compliance with all relevant environmental legislative regulations and standards. The company requires similar commitments from all parties involved in the Project, including their contractors and consultants. In addition, the company is committed to ensure a safe work environment for all staff and personnel involved in the Project.

A comprehensive Environmental Management Plan (EMP) will be prepared upon approval of the DEIA Report, prior to the implementation of the Project. The EMP will specify the various monitoring programmes required to determine the effectiveness of mitigating measure adopted and to monitor changes to the surrounding biological, chemical, physical and social environment, as required.

Based on the activities of the Project and the impacts that are likely to arise from them, an environmental monitoring framework is proposed for this DEIA.

13. CONCLUSION

The Project proposed the construction and operation of a cement production line with 5,000 t/d clinker production capacity which is located in adjacent to the existing cement plant which has a 3,200 t/d nominal clinker production capacity.

Routine environmental monitoring has shown a long term compliance with the environmental components such as air quality, noise, river water quality and in the groundwater. Existing baseline data for traffic, socio-economic and public health have indicated acceptable findings where no major issues were encountered.

The proposed Project will adopt a similar, and where applicable, improved level of environmental commitments as of the existing plant in terms of air quality control, water quality control, noise control and waste management to ensure compliance with the respective environmental legislations and standards.

Overall, the detailed EIA for the proposed expansion of the existing cement plant at Bukit Sagu and associated facilities has predicted that the Project entails minimal significant adverse environmental impacts. The Project is expected to comply with the respective environmental standards and legislations during the construction and operational phases when the proposed mitigation measures are implemented.

Thus, the detailed EIA supports the development and operation of the Project, in adjacent to the existing cement plant at Bukit Sagu, Kuantan, Pahang Darul Makmur. This is provided that all mitigation and control measures identified in this study are fully implemented, as summarized in the Table ES 4.

Table ES 4: Existing Environment

No	Issue	Proposed Mitigating Measures	Reference in Report	DOE Comments
1.	Soil Erosion • Clearing of land cover, foundation excavation and grading causing soil erosion. • Loss of sediment to receiving streams.	• Revegetate exposed surfaces through turfing or hydro-seeding. • Construct berms with runoff drains along slopes, earth drains and earth banks. • Provide sediment basins/silt traps at site for containing sediment that is eroded. • Limit clearing to areas within the planned earthworks area. • Carry out earthworks in the drier months (i.e. February to August). • Minimise time lag between site preparation and construction activities. • Provide adequate riparian reserves in accordance to DID requirements.	Section 9.1	
2.	Water Pollution Construction Phase • Surface runoff. • Wheel washing water. • Wastewater from building construction. • Wastewater from site facilities. • Storage and handling of oil, other petroleum products and chemicals.	• Provide sand/silt removal facilities and direct the surface runoff into storm drains. • Regularly maintain silt removal facilities. • Cover temporary exposed slope surfaces (e.g. by tarpaulin), where applicable, particularly during rainy seasons. • Protect temporary access road with crushed stone or gravel. • Compact final surfaces of earthworks. • Adequately cover or temporarily seal manholes. • Clean vehicles (and wheels) before leaving the construction site. • Remove sand and silt from the washing water (from the vehicle washing bay) before discharging into the stormdrains. • Install bar traps at the drain inlets to removed / trap large object in the wastewater stream. • Ensure chemical toilets are provided by licensed contractors.	Section 9.2	

No	Issue	Proposed Mitigating Measures	Reference in Report	DOE Comments
	Operational Phase • Discharge of stormwater from plant. • Cooling tower blowdowns. • Domestic wastewater from toilets and kitchen facilities.	• Locate vehicle and plant serving areas within roofed areas. Drainage in these covered areas should be connected to storm drains via an oil and grease interceptor. • Collect and store waste oil for recycling or disposal in accordance with the Environmental Quality (Scheduled Wastes) Regulations, 2005. • Locate site fuel tank and chemical storage areas on sealed areas and surround by bunds with capacity to contain 110% of the largest storage vessel in bunded area. • Passing of blowdown and stormwater through the existing detention pond before being discharged to the river water. • Regularly inspect and maintain the existing detention pond. • Passing of stormwater from the workshop and chemical store areas through an oil interceptor before being discharged to the main drain. • Regularly inspect and maintain the oil interceptors. • Convey all sewage effluent to the septic tanks network.		
3.	Air Pollution Construction Phase • Fugitive dust from site preparation, earthworks and civil works. • Dust due to land transport activities.	• Water dry road surfaces, install wind fences and vehicle washing bay (wash trough) at the exit from site. • Revegetate exposed surfaces where applicable. • Stop work activities temporarily during periods of high wind. • Grade each phase separately and schedule to coincide with construction phase. • Operate on-road and off-road haul vehicles appropriately. • Confine loading and unloading procedures on the downwind side of storage piles. • Use tarpaulins, plastics or other material as temporary cover on exposed slopes, where applicable.	Section 9.3	

No	Issue	Proposed Mitigating Measures	Reference in Report	DOE Comments
		• Restrict access or redirect traffic to reduce vehicle trips.		
	Operational Phase • Fugitive and stack emissions. • Fugitive emissions from quarry activities including blasting and transportation.	• Perform loading and unloading procedures on the downwind side of the piles. • Enforce speed limits in the work area • Control dust through frequent watering of the work area and the temporary access routes • Conduct environmental quality monitoring and annual audit. • Equip workers with PPE in the cement plant and other associated facilities. • Do not conduct blasting during high wind periods. • Future residential development in the surrounding areas shall maintain a buffer zone extending for at least 500 m from the boundaries of the plant.		
4.	Noise Construction Phase • Limited noise from construction vehicles and confined to the construction period.	• Confine noisy construction activities to daytime only. • Turn off vehicles, equipment and engines when idle. • Equip workers with PPE in the cement plant and other associated facilities. • Use of low noise equipment. • Regularly maintain construction equipment and vehicles.	Section 9.4	
	Operation Phase • Increase in background noise due to Project operation.	• Properly plan the layout and design to prevent noise in the cement plant. • Implement and use low-noise plant design and equipment. • Regularly maintain equipment and machinery. • Equip workers working in the high noise areas with PPE in the cement plant and other associated facilities. • Ensure working hours are in compliance with the Factories and Machinery Act, 1967.		
5.	Land Use • Project compatible with	• Future residential development in the surrounding areas shall maintain a buffer zone extending for at least 500 m from the plant i.e. existing agricultural land use within the	Section 9.5	

No	Issue	Proposed Mitigating Measures	Reference in Report	DOE Comments
	surrounding land use.	proposed buffer zone recommended to be retained.		
6.	Traffic Construction Phase • Traffic safety issues • Issues associated with dust caused by construction vehicles.	• Ensure mud and dirt from construction vehicles not to be deposited on the road. • Clean vehicles leaving the construction site through effective wheel-wash system. • Properly cover truck load for vehicle leaving the construction site	Section 9.6	
	Operation Phase • Minimal road capacity issue as access roads in the study area able to accommodate the Project traffic. • Traffic safety issues.	• Impose speed limit for vehicles on Jalan Bukit Sagu. • Install transverse bars, speed limit signs and warning sign on the road stretch leading into the settlement areas. • Install signboard with contact number on trucks to facilitate the public to lodge complaint to Straits Cement. • Initiate training and awareness programme on road safety for truck operators.		
7.	Quantitative Risk • Fire risks at diesel storage area and coal in raw material storage area. • Coal dust hazard.	• Strictly adhere to the 'No smoking' at all times. • Develop a comprehensive Emergency Response Plan (ERP) for the Project, similar to the existing ERP for the existing plant. • Clean and remove extraneous combustible materials from designated workplaces. • Site fuel storage tanks sited within bunds to contain spillage. • Properly maintain fuel storage tanks and associated fittings. • Cover coal storage yard and site the storage yard away from heat sources. • Spread-out or re-compact the different layers of coal frequently to allow radiation of trapped heat and limit pressure. • Implement and strictly adhere to the standard safety and operating procedures for the	Section 9.7	

No	Issue	Proposed Mitigating Measures	Reference in Report	DOE Comments
		coal grinding unit. • Implement preventive and responsive safety designs in the coal mill • Periodically inspect and service equipment to ensure good working conditions. • Strengthen of building or install fire/blast partition walls in areas where appropriate separation distances cannot be achieved. • Provide training to coal grinding unit operators to minimise industrial hazards.		
8.	Waste Management Construction Phase • Overburden, earth excess, construction wastes, schedule wastes from maintenance work and general refuse. Operational Phase • Scheduled wastes as raw materials. • Schedule wastes from maintenance work, sewage sludge, general refuse	• Store and reuse suitable excess earth material (clay) for future production process. • Segregate and store construction waste in different containers or skips to enhance reuse or recycling of materials and to ensure proper disposal. • Manage scheduled waste in accordance to Environmental Quality (Scheduled Waste) Regulations, 2005. • Store general refuse generated onsite in enclosed bins or compaction units separate from construction and scheduled waste.	Section 9.8	
9.	Socio-economic	• Plan and implement administrative measures to mitigate road safety issues raised by the local community living within the study area. • Provide job opportunities to the local community.	Section 9.9	

No	Issue	Proposed Mitigating Measures	Reference in Report	DOE Comments
10.	Environmental Health • Local community in the study area is unlikely to be affected by the assessed criteria air pollutants emitted from the normal operation of the existing cement plant and the proposed plant in future.	• In the short term, engagement in cement industry safety initiatives and forums in order for the operators to share knowledge and good practices so that these become the industry 'norm'. • Adopt best practice in emission control measures and promulgate their use in related all operation. • In the medium to long term, the cement industry should encourage the carry out the health impact assessment to determine the real impact of the plant operational activities to the health of the local community.	Section 9.10	