

GARADAGH CEMENT PROJECT NEW DRY KILN 6



GARADAGH CEMENT OJSC

Sahil Settlement
Salyan Highway
Baku AZ -1083

Environmental and Social Impact Assessment (ESIA) Non-Technical Summary



DRAFT FINAL

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This document is the *Non-technical Summary (NTS)* of the Environmental and Social Impact Assessment Report (*ESIA*) for the planned new Dry Kiln 6 (*“the Project”*) of Garadagh Cement O.J.S.C., Azerbaijan.

1 Introduction

Project Background

The company Garadagh Cement O.J.S.C, Azerbaijan (*“Garadagh Cement”*) intends to modernise its Garadagh cement production plant which is located near Sahil Settlement about 34 km southwest of Baku and about 1 km inland from the Caspian Sea.

Operation of the Garadagh cement plant was started in the 1950s. In 1999, the formerly state-owned cement plant at Sahil was privatised and the Swiss cement manufacturing company Holcim Ltd. acquired the majority of shares of Garadagh Cement. Holcim is one of the world’s leading suppliers of cement, aggregates and other construction related services.

Since the privatisation, the annual cement production capacity of the plant has been increased more than six fold accompanied by substantial investments in environmental technology. As a next step of this ongoing commitment, Holcim intends to introduce new technology at the plant to reduce energy and other production costs and further increase production capacity.

Within the frame of plant modernisation, a *state-of-the-art* dry-process rotary kiln including raw material handling and raw material preparation will be constructed at the Garadagh Cement plant site. This new Dry Kiln 6 will replace the present four wet-process kilns which will be decommissioned after commencement of regular production with the new Kiln 6. It is envisaged that at a later stage the wet kilns and associated stacks will be dismantled.

The replacement of the old kilns by a modern dry kiln process will significantly improve the environmental performance (in especially particulate matter emission reduction) and increase plant efficiency, reliability and product output. Kiln 6 will allow a significant increase of the cement clinker production capacity from currently approximately 2,600 tonnes per day (tpd) to a nominal capacity of 4,000 tpd to serve the rapidly

growing domestic cement market demand (*cf.* next subsection below).

Present Garadagh Cement operations use the waste limestone from the dimensional stonecutting activities that take place in the backcountry of the cement plant as main raw material source. For the Project, in addition, Garadagh Cement will reopen its currently unused Shakhgaya-West limestone quarry which is located at about 15 km distance inland from the plant to secure the long-term availability of limestone raw material.

A new crusher facility and train loading station will be installed at the former loading station of the quarry site and the presently abandoned railway line section which connects the Shakhgaya-West quarry with the Garadagh Cement railway line will be rehabilitated as part of the Project.

The capital investment for the Project is roughly 300 million Euro.

Need for the Project

The cement market in Azerbaijan is growing since 2003 and is expected to continue with a strong growth rate in correlation with the forecasted economic growth of Azerbaijan. In 2006, consumption was 2.6 million tonnes and in 2007 the demand for cement was already 3.2 million tonnes. It is estimated that by 2015 the domestic cement demand in Azerbaijan would increase further by some 40 %.

Garadagh Cement at present is the only cement clinker producer in Azerbaijan and also the largest cement manufacturing plant operating in the country. In 2007, the Garadagh Cement plant manufactured about 1.3 million tonnes of cement. For manufacturing this quantity of cement, Garadagh Cement had to import additional clinker due to the limited clinker production capacity of the existing kilns at the site. After Kiln 6 is working, increased clinker production will allow full utilization of the existing grinding capacity by own clinker production. The future annual quantity of cement manufactured by Garadagh Cement will be about 1.7 million tonnes based on an on-site clinker production of about 1.2 million tonnes per year. With this 30 % capacity increase in cement production, the Project helps to catch up with the domestic demand development and to avoid a further increase of the Azeri import portion for clinker and cement.

Environmental Impact Assessment for the Project

The Project requires approval from the *Ministry of Ecology and Natural Resources* (MENR) which is the competent authority in Azerbaijan for the environmental appraisal of projects. Garadagh Cement contracted the local consulting company SRM from Baku to carry out the Environmental Impact Assessment (EIA) for the project to be submitted to the MENR as application document for the environmental approval.

In addition, to fulfil the policy expectations of the Holcim Group (which is a member of the World Business Council for Sustainable Development (WBCSD) Cement Sustainability Initiative), its shareholder the European Bank for Reconstruction and Development (EBRD) and potential international project lenders, Garadagh Cement contracted a consultant team led by ERM (Frankfurt office/ Germany) locally supported by Azerbaijan Environmental Technology Centre, Baku (AETC) to prepare additional studies and compile supplementary information in a wider scoped Environmental and Social Impact Assessment (ESIA) report with reference to international standards.

The ESIA Report contains in detail the findings of the assessment of the likely environmental and social impacts associated with the construction and operation of the Project. It describes measures to avoid or mitigate identified impacts and to monitor compliance in an *Environmental and Social Management Plan* (ESMP).

While the local EIA is aimed to fulfil the Azeri requirements, the ESIA Report is to serve as a main input for the environmental appraisal of the Project by the EBRD and other potential lenders. Furthermore, the study forms the basis for specifying the environmental and social provisions in the contract for engineering, procurement of materials, equipment and construction with the EPC contractor, as well as operation and maintenance. This will ensure that the design, construction and operation of the Project will be in an environmentally acceptable manner and compliant with both national and international standards.

Key findings of the ESIA and ESMP measures are presented in this summary report further below (*cf.* Section 5).

As part of the ESIA activities, consultations with stakeholders and the public were undertaken and

project information was disclosed within the framework of a public consultation and disclosure plan (PCDP) set up for the Project. The *Draft Final ESIA Report* is subject to public disclosure and Garadagh Cement will organise an *Open Room* event for the interested public in the communities in the vicinity of the plant.

2 Description of the Project

Project Site Locations

The Project comprises activities at the Garadagh Cement plant premises located to the north-west of the highway and railway from Sahil Settlement, the Shakhgaya-West quarry area in the backcountry, including new crusher located at an old rail loading site, and the railway track and adjacent road connecting the quarry with the Garadagh Cement plant. An overview of the location of Project sites is provided in Figure ES-1.

Cement Plant

The Garadagh Cement plant site occupies an area of approximately 52 ha (approx. 1,630 m x 430 m). The existing production, handling and storage installations and facilities and administrative buildings are located mainly in the central and eastern part of the site. The new Kiln 6 and other new plant components will basically be erected within the existing premises boundary mainly on presently unoccupied space at the western part of the site. The new Dry Kiln 6 will be located approximately where the former Kiln 5 was situated, which was dismantled after privatisation in 2004.

Quarries

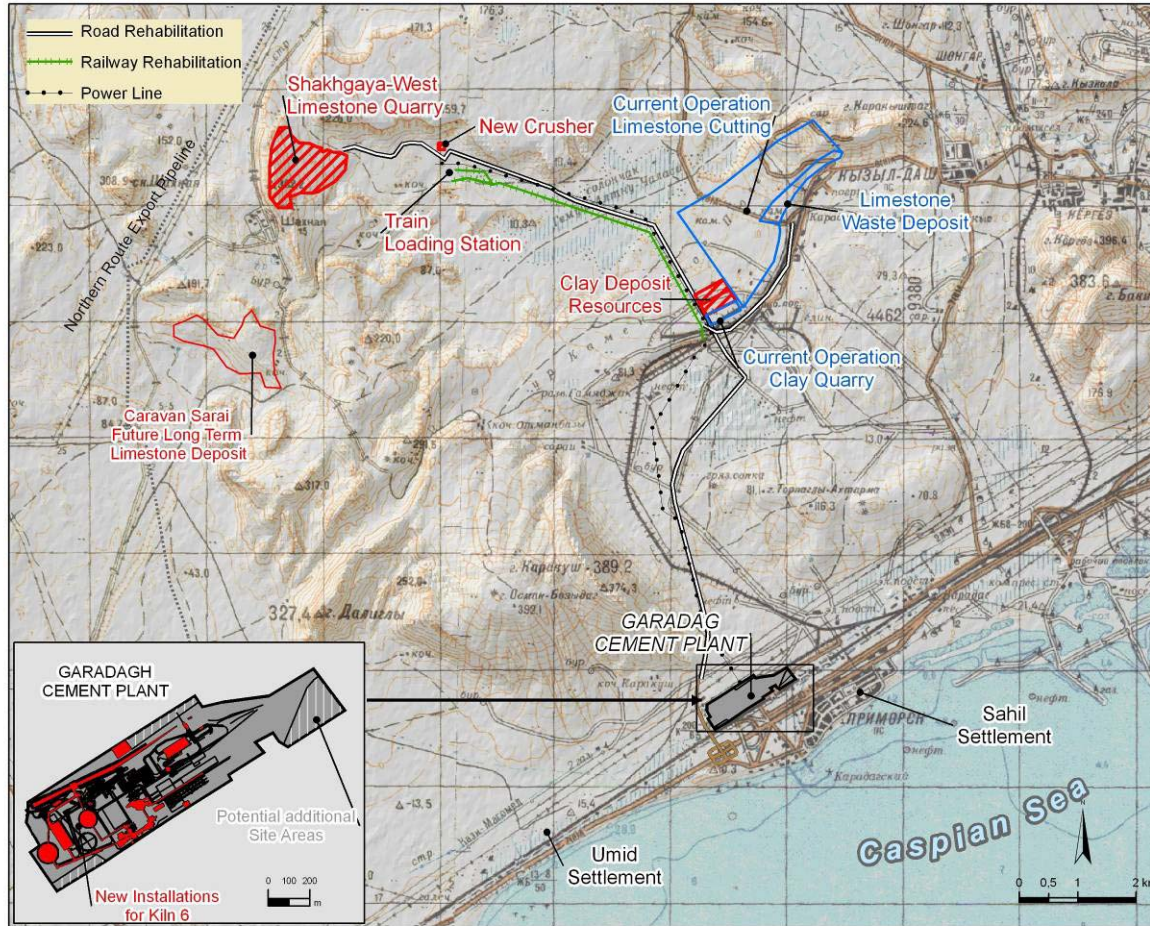
Garadagh Cement operates a clay quarry which will continue to be exploited for the Project. For the Project, the *Shakhgaya West* limestone deposit will be reopened. It is located about 12 km aerial distance and 15 km by road to the north-west of the plant. The quarry area of 152 ha was part of the privatisation package. Limestone extraction at this quarry area had started in Soviet times, but was abandoned soon after some initial operation as limestone quality was considered insufficient at that time.

As part of the privatisation, Garadagh Cement also received rights to explore the area of the *Caravansaraj* limestone deposit (~120 ha) which is located about 2 km to south of the *Shakhgaya-West*

quarry. This deposit is a further long term option for limestone supply which is not subject of the

present Project, but may be developed by Garadagh Cement at a later stage.

Figure ES-1: Project Sites Overview



Salient Features

New installations and modification of the existing plant

The modernisation of the Garadagh Cement plant under the new dry Kiln 6 Project comprises the modifications of the existing plant and the construction of following key installations:

- a dry process rotary kiln 72 m long (replaces the existing four 160 m long wet kilns);
- a 5-stage single string cyclone pre-heater with in-line pre-calciner (ca. 132 m high);
- a new ca. 140 m high stack (which replaces the three existing 65 m high stacks);
- a new grate cooler for 4,000 t/d clinker, equipped with shock blowers to avoid material clogging;
- a closed 10,000 t storage hall for solid fuels (coal/petcoke storage) and a 24 t/h vertical

roller mill for the solid fuels (coal/petcoke mill);

- a circular 24,000 t storage hall including pre-blending of different limestone qualities;
- a longitudinal 2 x 3,500 t pre-blending storage hall for clay and iron corrective (e.g. bauxite);
- a vertical 355 t/h roller mill for raw meal grinding;
- a 8,000 tonnes homogenization silo for raw meal;
- a 75,000 t clinker silo to accommodate the demand seasonality;
- a 16,000 t cement silo (with 2 bulk truck loaders) which increases the cement storage capacity to a total of 34,000 t;
- a new high voltage substation at the north-western part of the production site and connection to the 110 kV transmission line

which passes the plant (already under construction);

- extension of the existing internal infrastructure to accommodate the new kiln system (*e.g.* water network and drainage, power distribution, process control);
- extension of existing internal railway tracks by about 600 m and a new train unloading station on the north-western boundary of the site with 2 tracks of 1,500 t/h capacity each for incoming raw materials unloading and 1 track for solid fuels (hard coal/pet-coke) unloading;
- a second gate at the southern border of the site, and separation of site access and on site traffic routes for inbound and outbound traffic.

The existing slurry mills and slurry basins will become obsolete with the new dry Kiln 6, since no slurry is used in the dry process. Consequently, the existing feed-wastewater pipeline for process water from the Sahil waste water treatment plant (WWTP) will be closed and the storage tanks for slurry water will be removed. The modernised plant will only use freshwater from the existing public water supply pipeline, which passes the plant.

Other existing facilities at the production site will remain unchanged since they meet the future capacity requirements.

The reopening of Shakhgaya West limestone quarry goes along with the construction of a quarry base facility with a new crusher (750 t/h processing capacity), conveyor, storage and loading station (2x1,000 tph capacity), and the refurbishment of roads and railway tracks between the Garadagh Cement plant and Shakhgaya West quarry. Transport of fresh limestone from the quarry to the crusher (distance about 2 km) will be by mining dump trucks (*ca.* 40 trips per day).

For the new Kiln 6 operation, on average, 8 - 9 trains per day will transport 5,600 t of limestone and 800 t of clay from the quarries to the plant. Trains will usually run 5 days per week, between 6 a.m. – 22 p.m. In order to facilitate transportation of the increased raw material demand, Garadagh Cement will purchase 2 locomotives with diesel traction, in addition to the present six locomotives, and the length of the trains will be increased from presently 6 to 8 to future 15 wagons (*i.e.* 1,000 tonnes capacity per train).

Plant Technology

The new dry Kiln 6 is the key component of the plant modernisation and capacity extension. It will be designed based on commercially proven technologies to latest cement industry standards. The dry process with a five-stage pre-heater and pre-calciner rotary kiln introduces international *state-of-the-art* technology at the Garadagh Cement plant. The dry-process has several advantages over the wet process, such as increased thermal energy efficiency and lower product specific emissions, especially particulate matter and lower water requirement.

Measures to protect the environment (as described below) are integral part of the facility design. The plant will be equipped with all accessories and protection and safety equipment, auxiliary and ancillary equipment required for safe and continuous operation.

Natural disaster risks relevant to the site, like storm and earthquake, along with adequate provisions for hazards will be considered in the design and applicable construction norms will be applied.

Fuel

The present wet kilns are operated with domestic natural gas (13 Mio m³/month). In order to be flexible in response to the future fuel market developments (availability, price) and future natural gas export strategy of Azerbaijan, the new Kiln 6 is designed that it can be operated with different fuels. It is planned that operation of the new dry Kiln 6 will be based on imported hard coal, or pet-coke if available (preferably from Azeri refineries), but also firing with natural gas will be further possible.

Therefore, a housed raw coal/petcoke storage, a coal/petcoke mill and fine coal silos are part of the new components for the Project. For handling of solid fuels, additional unloading and transport facilities are required. The exhaust of the coal mill will be equipped with bag filters for control of coal dust emissions. Burning of the solid fuel will generate no waste or ashes since the residuals are incorporated in the clinker and thus substitute raw-material. Hard coal consumption will be *ca.* 15,000 t/month.

Energy Demand

Switching from the wet to dry process technology, results in a significant drop in the specific thermal

energy consumption for clinker production by about 50 % from 6.37 GJ/t to 3.2 GJ/t. clinker. On the other hand, the specific electrical energy consumption will slightly increase by 16 % (from 81 kWh/t cement to 94 kWh/t cement) due to switch from wet to dry process (slurry preparation is replaced by raw materials grinding which requires more electrical energy), and due to fuel switch from gas to coal and the resulting additional electrical energy demand for grinding the coal. The site's overall average electricity capacity will be up 32 MW, the peak demand with the New Dry Kiln 6 will be up to 22 MW.

Air Emission Control

After privatisation, the electrostatic precipitators (ESPs) at the present kilns were repaired and upgraded to reduce dust emissions to permissible limits. Still, present plant operations constitute the major source of air pollutants including particulate matter in the area. In addition, the present plant has many open storage areas, which leads to fugitive dust generation.

For the plant modernization, waste air from dust generating sources will be captured and controlled by highly efficient bag filters, in particular from the new Kiln 6 preheater and the grate cooler. Nitrogen oxide emissions from the new kiln will be reduced by operation of low-NO_x burners and selective non-catalytic reduction (SNCR) technique. With the plant modernization, housed storages will reduce the potential for re-suspension of dust through wind. All air emissions will be kept within national and international standards and best practice benchmarks (IFC/EU-BREFs). A comparison of key emission characteristics is provided in Table NTS- 1. The high efficiency of proposed abatement systems not only yields significantly lower flue gas concentrations but, despite of the overall production increase by more than 50%, also provides for a reduced absolute emission mass flow (see Table NTS- 2). Overall, the air pollutant emission situation at the plant will significantly improve with the new kiln.

Table NTS-1: Plant emissions present and future

Parameter	Emissions Concentrations (mg/Nm ³) *		Benchmarks	
	Present wet kilns 1-4	New dry Kiln 6	EU BREF /BAT	IFC
Pollutant:				
Particulate Matter	170 - 400	< 30	20 - 30	30
Nitrogen oxides (NO _x)	400 - 900	< 500	200 - 500	600
Sulphur Dioxide (SO ₂)	30 - 180	~ 200 *	200 - 400	400

(Nm³ = Standard cubic metre; BAT: Best available technique)

* based on sulphur content as determined by raw material analysis

Table NTS-2: Emissions Mass Flow existing plant vs. Kiln 6 project

Parameter	Emissions Mass flow (kg/h)	
	Present wet kilns 1-4	New dry Kiln 6
Pollutant:		
Particulate Matter	160	30
Nitrogen oxides (NO _x)	316	157
Sulphur Dioxide (SO ₂)	35	65 *

(*conservative higher level assumption, since dry process may incorporate less sulphur in the clinker)

CO₂ Emissions

Despite the more than 50 % increase of clinker production, the overall carbon dioxide (CO₂) emissions of the Garadagh Cement plant will increase by only 40 % from present 739,000 t/a to 1.03 Mio t/a due to an increase in plant efficiency with the new technology. The specific net CO₂ emissions per tonne of cement will however only be reduced by 1 % due to the fuel switch from natural gas to hard coal: For the first year of full operation (2013), the specific CO₂ emission is estimated at 587 kg CO₂/t cement compared with the present situation of 594 kg CO₂/t cement.

Water Demand

The current water demand for slurry preparation of the current wet process is about 600,000 m³ per year. For this, mainly treated wastewater from the Sahil waste water treatment plant (WWTP) is presently used plus in small quantities of so-called *Produced Water* from the Sangachal terminal (23,000 m³/a). In the future, this water demand will be obsolete since the dry process of Kiln 6 requires no water for the preparation of the raw-material to be fed into the kiln. Technical water will be required mainly for water injections in the process, cooling of equipment and of waste gas. Since treated wastewater does not fulfil the technical requirements of the modern plant, this water will come from the public water pipeline. In addition, fresh water will be needed, mainly for washing and for sanitary purposes. In order to use the fresh water in an environmentally responsible manner, the application of a circulating water system by the Project will reduce the annual use of cooling water to about 30,000 m³/a. The total annual water demand of the modernized plant will be about 211,500 m³/a, with peak demand of approx. 85 m³/h.

Discharge of Wastewater

After the modernization, the plant, as now, will produce wastewater from sanitary and cleaning purposes, and in addition blowdown water from the cooling system. About 72,400 m³/a of wastewater will be discharged via the sewer (compared to 168,000 m³/a at present). The Garadagh Cement plant wastewater is currently pumped for treatment to the wastewater treatment plant (WWTP) of Sahil Settlement. However, this is in poor physical and operational condition and cleaning stages are not functioning. Therefore,

Garadagh Cement has decided to install an own waste water treatment facility on site, with the effluent to meet the quality required by Azeri and international standards for direct discharge to a receiving water body. In case that existing plans by the Garadagh District Administration to refurbish the Sahil WWTP should materialise before the on-site treatment facility is constructed, this Project component may become obsolete and the Sahil WWTP would be utilised.

Solid Wastes

In general, cement plants generate only limited wastes mainly related to maintenance. Most of the captured dust in the filters is recycled as feed material. As with present plant operations, wastes generated by the modernized plant will be disposed of by contracted licensed disposal companies.

Noise Emissions

Present plant operations do not cause significant noise impact at the nearest residential areas at Sahil Settlement. The noise impact generated by the new Kiln 6 operations will be kept within internationally acknowledged levels by fitting noise generating equipment with adequate controls.

Raw Material Supply

The daily raw material demand will amount to about 6,320 tonnes/day of crushed limestone, clay and corrective material (The raw meal to clinker factor will be 1.58, *i.e.* it remains the same as in the present process).

Waste limestone from dimensional stone cutting in the backcountry of the plant will continue to be used as the major raw material source for the plant. In addition, *Shakhgaya-West* quarry will be re-opened to ensure long-term limestone availability and to stabilise raw material quality input. It is foreseen that the *Shakhgaya-West* quarry will continuously provide about 35 % of the demand of Kiln 6 operation. This deposit holds 45–60 Mio tonnes limestone and could be exploited over some 50 years.

The quarry was originally opened in Soviet times with drill blast operation. However, the quarry, including the railway line and loading station, was abandoned after initial exploitation since variations in limestone quality were found to be not adequate for production at that time and could not be

controlled due to missing knowledge and analysis technology. Garadagh Cement carried out a comprehensive study, including test drilling and sampling of the limestone quality variations, and setup a detailed exploitation plan which takes into consideration the different raw limestone properties found in the quarry area. As a result, in order to attain flexibility in materials blending, the quarry will be exploited starting simultaneous from 3 different locations. It is foreseen to establish a conventional drill - blast and load - haul operation. The quarry will be exploited by taking down shallow benches of 5 metres depth from the surface. Garadagh Cement investigates if non-explosive methods, such as surface mining or ripping could be applied to avoid environmental effects of blasting operations.

Garadagh's existing clay quarry (12.3 ha current) provides a sufficient deposit for long term supply. In addition, 24 ha of reserves are available.

Project Set-up

The Project is developed by Garadagh Cement, supported by its parent company Holcim, which includes inter alia *Holcim Group Support* (HGRS) who developed the plant's basic engineering concept according to Holcim group standards.

The new Dry Kiln 6 and related plant modernisation will be constructed pursuant to a turnkey engineering, procurement, and construction (EPC) contract. New infrastructures, plant services and ancillary buildings will be constructed by Garadagh Cement with local contractors.

The EPC Contractor will be responsible for the entire construction work of the new Kiln 6. The turnkey contract includes the Holcim Group-wide "Owner Standards", i.e. obligations for contractors. These refer next to technical design (referring to best practice environmental standards) and quality of work requirements, project reporting and control, inspection and testing, occupational health & safety and social responsibility clauses relating to the *International Labour Organisation (ILO) Core Labour Standards* to be fulfilled by the EPC contractor. The EPC Contractor's compliance will be supervised and audited by Garadagh Cement and Holcim Group Support (HGRS).

After construction completion, Garadagh Cement will take over the new installations to commence operation after training of the Garadagh operation

staff. Maintenance will be carried out by Azeri and international contractors.

Refurbishment of roads and railway tracks will be performed by Azeri companies. Railway operations will continue to be part of Garadagh Cement's own operations.

The quarry base infrastructure such as crusher, conveyer belt and train loading station will also be established by the EPC turnkey contractor. The quarry will be operated by an Azeri contractor (present waste limestone collection and clay quarry operations are also carried out by local contractors) under supervision by Garadagh Cement.

Employment and Staffing

Present operation: At the CG plant presently 462 people are employed in cement production. Production is running on a four shifts basis 24 hours a day and 7 days a week. Mining activities at the limestone and clay quarries are outsourced to contractors since 2002. Presently 76 contractor employees are working in the quarry operations. Further there are several maintenance and subcontractor companies with an average staffing around 50 persons and in peak times approximately 300.

Project Construction: Construction works for the Project are labour intensive and will generate significant employment opportunities. It is anticipated that a large number of workforce, up to 700-900 people at construction peak, will be involved in constructing the project. It is estimated that during mechanical and electrical erection there may be up to 250 Third Country Nationals (TCN's) employed on site; however, depending on the EPC contractor's procurement, for a short period the total number of TCNs could reach up to an order of 500 staff at construction peak. The vast majority of on-site construction personnel will be male.

Project Operation: Introduction of state of the art technology with the Project will lead to increased productivity and as a result will lead to redundancy of obsolete working places and eventually to reduction of 72 staff in cement production once dry Kiln 6 is in full operation in 2013. The number of staff for subcontracted work including quarry operations is anticipated to stay about the same level as present.

Project Implementation Schedule

In the first half of 2008, the area for the new dry Kiln 6 was prepared by excavating the cement kiln

dust and clearing of construction debris which had been land filled in this area in earlier years before privatisation. Permits to start the civil construction activities for the Project were obtained in August 2008

In September 2008, based on the project requirements defined in the Feasibility Study, Garadagh Cement concluded selection of a qualified international EPC contractor through a process of international competitive bidding. Start of construction works on site for the new Dry Kiln 6 is foreseen by the beginning of 2009. It is planned that establishment of the complete new dry Kiln 6 Project will be accomplished within an scheduled 3 years period. The main civil and structural works will require about 22 months in total.

Based on the project implementation time schedule, the first clinker would be produced by the new Dry Kiln 6 in the 2nd Quarter of 2011.

3 Description of the Environment

Regional Context

The Project is located in the east of Azerbaijan on the south-west of the Absheron Peninsula about 34 km south-west of Baku and 1.5 km from the shore of the Caspian Sea. The Garadagh Cement plant is located in *Garadagh Administrative District* which is a subunit of the *Greater Baku District*. The district administration (*Executive Power*) is based in Lokbatan, a town located some 16 km to the northeast of the plant.

Topography

The Project area is characterised by plains and low mountains adjacent to the Caspian Sea which presently has an average level of -28 m below sea level (bsl). The CG plant is located at elevation -10 m bsl. in the coastal plain. The area towards the north and north-west is characterised by higher elevations *inter alia* originating from extinct volcanoes with heights between 100 m and 400 m above sea level. The surrounding area is sloping from north-west to south-east towards the Caspian Sea. The topography is the result of mud volcano activity and denudation occurring with the subsequent creation of relatively steep slopes, gorges, gullies and the local exposure of the limestone bedrock. Towards the coast the topography is extremely flat and arid, with very

few trees, hedgerows or fences to obscure long distance views in all directions.

Land use

There is very little agricultural production in the region due to the arid climate and poor soils. There is no notable agricultural use, except small scale herding of predominantly goats and sheep. Along the coast, occasionally there are small patches devoted to fruit and vegetable production. The primary land use of the Garadagh region however, is given over to heavy industrial activities (see below).

Settlements

Only two settlements are within the vicinity of the Garadagh Cement plant and the quarries. The nearest town to the CG plant is Sahil Settlement (pop. 22,700) which is the biggest settlement of the Garadagh Administrative District. Sahil is located 1.5 km to the east of the CG plant, separated by both a major highway and a railway. The settlement of Umid (pop. 2,000) is located at 3.5 km distance to the south-west of the plant. This village was originally established to house internally displaced persons¹ (IDPs), however has grown considerably in recent years.

Military facilities are located close to Shakhgaya-West quarry to the south-west of the ridge, and there is a prison camp to the south of the clay quarry.

Infrastructure

The coastal area is traversed by a number of linear infrastructures running parallel to the coast north to south. A transportation corridor comprising the Baku-Astara/Tbilisi highway and the parallel main railway passes between Sahil Settlement the Garadagh Cement plant. Further, there are infrastructures like a main gas pipeline, high voltage transmission lines and the *Kura River-Baku* main water supply pipelines which traverse the coastal area often in parallel to the transportation routes. A number of oil and gas export pipelines are routed in hinterland of the Sangachal oil and gas terminal located 5 km south of the plant, the closest to the Project being the *Northern Route Export Pipeline* (NREP) which passes west of the *Shakhgaya West* and *Caravansarai* limestone deposits, before continuing to Sangachal terminal

¹ People displaced from their homes by the *Nagorno-Karabakh* conflict.

to the south of the project study area. The road infrastructure in the hinterland of plant throughout the quarries area is in a poor state of repair.

Industrial activities

The Garadagh district is characterised by high levels of industrial activity. There are around 180 registered companies, firms and co-operatives in the Garadagh district, including 15 foreign and joint companies. In the coastal stretch to the south-west of Baku, industry development is growing. A number of industry enterprises are located within a 10 to 15 km radius of the plant, including *inter alia* the large-scale commercial ports at Sahil, the SPS deepwater offshore platform construction facility approx. 8 km north east of the plant and Sangachal Oil and Gas terminal, approx. 8 km to the south west. Furthermore, Azerbaijan Gas-Transferring approx. 9 km north-east of the GC plant, Azturqaz joint company, Avangard-N modern gypsum factory, the Gilan Holding Brick Factory, approximately 1km inland from the GC plant, as well as other smaller petrochemical plants and oil field logistics companies are located in the vicinity of the Garadagh Cement plant site. An oil terminal is planned 1.8 km to the south-west of the plant next to the highway bridge. A large proportion of the hinterland of Sahil including Shakhgaya region is currently and has historically been used for limestone quarrying, or dimensional stone cutting.

Geology

The Absheron Peninsula is characterised by a complex geological structure due to its location at the crossing point of the south-eastern lowland of the Greater Caucasus and the tectonic depression of the Caspian Sea. The regional structure is dominated by compressional deformation of sedimentary rock, which led to the formation of *nappes* verging towards the south-east. There was some volcanic activity during this long period of tectonic activity. Thrust faulting in the Late Miocene period lifted Jurassic and Cretaceous rocks over the Pliocene deposits of the Great Caucasus.

In the project area, surface near strata are predominantly composed of limestone and clays, with occasional sandy layers. These strata are underlain by a basaltic basement at approximately 20 km depth.

Tectonics and Seismicity

The Caspian region, which is part of the Eurasian continental plate, has a convergent plate boundary with the Arabian and Indian continental plates. Convergent plate movements are generally associated with relatively high levels of seismic activity and accompanied by earthquakes and volcanism. The Absheron Peninsula is a large tectonic block with a high intensity of neo-tectonic processes. Five earthquakes with a magnitude greater than 6.0 on the Richter scale have occurred since 1842 with the most recent on 25th November 2000, measuring 7 points on the Richter Scale at its epicentre 30 km east-north east of Baku. The Garadagh region is located adjacent east to the Absheron Peninsula and is in a zone of moderate to high seismic activity.

The geological faults in the region are occasionally accompanied by lines of mud volcanoes. Their distribution is related to anticlines and they are orientated in chains along the axes of these folds and/or along the lines of larger faults, in a north-west to south-east orientation. A particularly concentrated area of mud volcano activity exists some 25 km south of the project area, close to the town of Gobustan. In addition new mud volcano vents have been recorded several kilometres to the west of the *Shakhgaya West* and the *Caravansarai* limestone deposit.

Soils and Subsurface Contamination

In the project region, limestone, clay and sand stone are exposed at the surface. The substrates in the study area generally comprise grey brown, silty and stony clays and loams. Soil types developed include *Brown soils*, *Light-chestnut soils*, *Solonchaks* (salic soils), *Serozems* (gray soils). Soils are typically thin and low in organic matter (not more than 2 %) and in consequence with low agricultural productivity and conditions for vegetation are poor. The fine grained soil in combination with the semi-arid to arid climate and strong winds expose the dry soils to denudation. Due to the high amount of clay, the soils can become waterlogged after rainfall mainly in winter time and are susceptible to compact erosion.

The results of several site investigations on the Garadagh Cement plant show that soil and subsurface at the premises is selective contaminated by oil and large areas are covered with cement kiln dust (CKD) from previous operations and dumping of CKD on site. However,

the clay layer in the soils has the effect of sealing underlying soil layers and groundwater. Underlying soils and groundwater that was tested in the course of previous site investigations show no detectable contamination. CKD was dumped on site at significant quantities (total estimated 185,000 m³ on 8.6 ha in layers of 1-4.5 m). For preparation of the construction field for the Project, 148,100 m³ of the CKD was excavated and disposed of at the Lokhbatan industrial waste disposal site during the first half 2008.

Hydrogeology and Ground Water

Ground water is rarely developed in the project region due to the characteristic of the non water bearing subsurface strata. A poor ground water resource is mainly discovered in a locally present perched aquifer in Quaternary sandy deposits in a variable depth of a few meters below ground. In general this water is of poor quality, also due to contamination by domestic and industrial waste. In greater depth, poor aquifers logged by the upper fine-grained clay layers can be found. This ground water has a high salinity level and is characterized with high chloride and sulphate corrosiveness. In addition, due to the low rates of precipitation the ground water recharge is very slow. It is considered most likely that the direction of groundwater flow in the coastal Garadagh region is from inland towards the Caspian coast. A 150 m deep test drilling at the GC site detected no usable aquifer. Water supply of the settlements and industrial installations in the whole region including Baku City is via the main water pipeline bundle (capacity: 3 x 4 m³/s) from the *Kura River*.

Hydrology/Surface Waters

There is no running water course with direct relation to the GC plant or the Shakhgaya-West quarry. The nearest principal river to the Garadagh Cement plant is the *Djeyrankechmes River*, which enters the Caspian Sea at Sangachal Bay, close to the town of Sangachal (>10 km distance SW to the GC plant site). Throughout the area, there are numerous *wadi*-systems that carry water only following heavy rain. In some low lying areas, surface water accumulates during winter and spring months; this can be found to the north east of the GC plant, and inland to the north and north-west, where large very flat expanses of standing water can form. These areas are predominantly dry during the summer. Due to the evaporative regime, nature of the soil, and the duration of

water cover during winter to spring; these areas are almost completely unvegetated.

The Garadagh Cement plant is located about 1.5 km inland from the Caspian Sea. The present water level is - 28m bsl, however water levels are subject to significant long term fluctuations (from 1901 to 1977 a constant decrease in sea-level from - 25.58 m bsl to -29.01 m bsl was recorded).

Climatic Conditions

The region has a medium-hot semi-desert to dry-desert climate. It is affected by atmospheric processes in the Eurasian desert zone, the relief of the Caucasus Mountains and the Caspian Sea. *Puta* meteorological station is located some 15km to the northeast of the GC plant and is representative for the Project area.

Temperature: The average annual temperature is 14.1°C (summer 25.5°C; winter 3.9°C.). The coldest month is usually January; and the warmest are July and August. Mean January air temperatures in Puta is 3.4°C (mean min. 0.7°C; absolute min. - 17°C). In July, due to the cooling effect of the Caspian, the average monthly temperatures at Puta is 25.8°C (mean max 30.4°C, absolute max. 41°C).

Precipitation: The Garadagh region is one of the driest areas of Azerbaijan. Average annual precipitation is 105 mm but the annual amplitude varies from the recorded maximum of 390 mm (1968) to the minimum of 78 mm (1925). The majority of precipitation occurs between September and April, while July and August are the driest months. However year to year variability is high. Extreme events with rainfall (recorded up to 68 mm/day) occur mostly in summer, but they can also arrive in winter, especially near the coast. Precipitation occurs almost entirely as rain with only few days of snow.

Wind: The areas surrounding the Absheron Peninsula are among the windiest areas of Azerbaijan with an average wind speed of 4.6 m/s. Typically, wind speeds of over 15 m/s are recorded for 114 days or more annually. The main wind directions are north and northwest. Especially in winter the strong north wind known locally as the "*Hazri*" can bring sudden reductions in temperature and occasionally snow. Furthermore, it frequently results in dust storms. The area around the Garadagh Cement plant is very windy, especially during the winter season and stormy wind velocities >25 m/s (90 km/h) occur. Moreover, along much of the Garadagh

coast there exists a more localised thermally induced wind system. The effects of this *land-sea-wind-system* are most noticeable mainly in summer, resulting in a slight offshore wind during the early hours of the morning, which then drops and becomes a stronger onshore wind as the land heats up. This thermal influence coupled with the meteorological dynamics of the region can result in strong winds occurring in the region with little forewarning.

Air Quality

The GC plant is the largest single emission source in the area, mainly emitting nitrogen oxides (NO_x), carbon monoxide (CO), and dust (particulate matter -PM) from stack emissions and diffuse sources (e.g. mills and open storage areas). Other industries in the wider area such as the oil and gas industries contribute NO_x, CO, sulphur dioxide (SO₂), and volatile organic carbons (VOC). Further emissions of NO_x, CO, SO₂, VOC, and PM are related to traffic and settlements and burning of waste. Wind erosion of soils in the arid lands and the stone cutting in the Sahil hinterland areas are a significant source of dust which is dispersed by the wind and considerably contribute to the PM concentrations in ambient air. Dust storms are a frequent occurrence in the region. Due to the fact that strong winds often blow from the North and Northeast, long-range transportation of pollutants emitted in the northern Garadagh District and in the Baku area is likely also to influence the ambient air quality in the project area.

No continuous ambient air quality data are available for the vicinity of the Garadagh Cement plant and its air shed. The closest permanent ambient air quality monitoring station is located in the vicinity of Lokbatan about 16 km northeast of the GC site. Since the Garadagh Cement plant is the most significant local emission source, the incremental concentration of air pollutants caused by the plant's emissions in the vicinity including nearby settlements was calculated by means of air dispersion modelling (*Lagrange* particle model *AUSTAL2000*) to establish the ambient air quality baseline.

The results for the GC plant's airshed show that for gaseous substances, the maximum annual ambient air impact of the present plant operation is located about 3 km to the south out in the Caspian Sea. Short term concentrations are highest on the slope and top of the 400 m high volcanic hill which

extends to the NW of the plant and constitutes a topographic dispersion hindrance in the else flat coastal plain. The prevailing northerly winds also determine the dispersion pattern of plant borne particulate matter and dust deposition in the plant vicinity. With the exception of short term values in the localised area of the hill top, none of the calculated annual average or short term concentrations for the various gaseous air pollutants, organic substances and particulate matter (PM₁₀) incl. heavy metals, exceeds relevant Azeri limits or the EU air quality standards.

In the settlement areas (Sahil and Umid), for NO₂, 75% of the Azeri short term limits and 30% of EU/IFC short term limits are reached due to plant borne emissions, whereas only 3% of the long term average of the relevant EU/IFC limits. In the same insignificant range as the latter, are the calculated values for the other relevant air pollutants including particulate matter both long and short term. Despite the fact that high dust deposition levels are attributed to the GC plant by opinions voiced in Sahil, the annual average dust deposition from the plant reaches only 2% of the German threshold for public nuisance level at the settlement areas.

It has become known from stakeholder meetings at Sahil that besides dust deposition, occasional odour is another potential nuisance which is attributed to the present GC plant operation. The usage of waste water for slurry preparation is a potential source of odours. The slurry water is mainly supplied from Sahil WWTP after treatment, and, to a minor extent, *Produced Water* from the Sangachal oil terminal (use of this is planned to be terminated after October 2008) which occasionally may pose a source of odours in case the slurry water contains incompletely decomposed organic substances. Generation of odours may happen during slurry preparation, in particular as fugitive emissions from the open slurry basins. Results of a work exposure level study from Garadagh Cement however, show that such emissions pose no health concern. Also, after the slurry is fed into the kiln, some organic compounds including odorous substances will be evaporated and emitted through the kiln stacks as gas temperatures are not sufficient for a complete destruction. However, there are a number of potential other sources for smell in the area which comprise burning of waste at the municipal waste dump, and the Sahil municipal wastewater treatment plant (WWTP).

Ambient Noise

The main determining noise source for the Sahil settlement is the Baku-Astara highway. Average noise levels at the Sahil residential areas adjacent to the highway are in the range of 60 dB(A) at daytime and 50 dB(A) at night. It was established by spot measurements in the vicinity of the GC plant and at the fringe of Sahil settlement towards the GC plant (distance plant to settlement: ca. 1.5 km across the road/rail corridor), and further by calculation of plant borne noise emissions, that present plant operations are within applicable limit values. Plant noise emission levels are slightly reduced during night time since certain equipment like the raw mills are less operated at night.

Ecological Resources

Flora and Habitats: Due to the climatic conditions, vegetation in the vicinity and backcountry of the GC plant is composed of semi-desert plant communities are dominated by Wormwood (*Artemisia lerchiana*) and saltwort species (*Salsola spp.*). These are not rare, but all develop slowly and are particularly susceptible to disturbance, since they take many years to recover under the arid and windy conditions that prevail in the area. However, the majority of the region has undergone extensive disturbance by industrial developments in the coastal plains and extensive stone cutting activities in the hilly hinterland, and as such cannot be regarded as pristine semi-desert habitat. Vegetation cover is typically in the 60-80% range, however in more upland areas, such as at the Caravansari limestone deposit and the Shakhgaya West quarry location there is a more complete vegetative coverage. Vegetation in these upland areas is also dominated by Wormwood (*Artemisia lerchiana*) with a subdominant coverage of grasses (dominated by *Poa bulbosa*). The stone cutting areas show extensive scarring from quarrying activities and are completely disturbed. The GC clay deposit area has been exposed by the almost complete quarrying of the overlying limestone bed. The exposed clay substrates have started to become colonised by some semi desert plant species (e.g. *Artemisia fragrans* and *Salsola nodulosa*). The relatively minor disturbed area of the Shakhgaya-West quarry is populated by a species of conservation note: Azerbaijan red-listed species *Iris acutiloba* C.A. Mey occurs with abundance on very thin topsoil which is typical of the Shakhgaya region.

Fauna: Faunal diversity in semi desert environments is also relatively poor; sightings include hare (*Lepus europaeus*), fox (*Vulpes vulpes*) and a number of rodents, a number of reptiles are represented including snakes (*Vipera libertina*) and lizards and a number of bird species. The wolf (*Canis lupis*) is also reported in the literature to have home ranges in the Shakhgaya area. However, no recordings of any rare or protected fauna species were made during baseline surveys. In general, there is significant habitat pressure from the widespread stone cutting operations which constitute permanent disturbance of the semi-desert habitats in the backcountry and of the Sahil area.

Protected Areas: There are no protected areas in the vicinity of the GC plant or the quarry areas. The closest area of note is the *Shelfprojectstroi (SPS) Lagoons* located some 5-8 km to the north-east of the GC plant. They comprise two adjacent shallow, sheltered lagoons almost isolated from the Caspian Sea by sand and shingle banks and reedy strips. This site is on the route an important migratory pathway for waterfowl (*The Central Asian Flyway*) and several red-listed species occur on passage or in winter. The area is reportedly hunted extensively and is unprotected under Azeri legislation, despite its proposed candidature as a *Ramsar Site*.

Cultural heritage

The eastern coast of Azerbaijan is rich in archaeological remains, as it formed a narrow passage between the Caspian and the Great Caucasian Mountain range and served as an important trading route to the north. However, there are no known cultural heritage objects at or in the immediate vicinity of the GC plant or the Shakhgaya west quarry. Within 1 km of the south-western boundary of the Caravansari limestone deposit, the 16th century *Shah Abbas Caravanserai* (trade route inn) is located. This historic monument has no confirmed formal protection status and the structure is in a fragile state and is presently used as part of a small farm complex. The vicinity of the historic site is devastated by lime stone cutting.

Landscape and Visual Amenity

The GC plant is located in the flat, semi-desert coastal strip which stretches along the Caspian Sea. In the backcountry rocky hills with bare surfaces are rising to elevations close to 400 metres. Greyish-brown colours from the dominant

limestone and clay strata are prevailing. The terrain surfaces in the stonecutting areas to the north of the plant are largely disturbed. Prominent landscape features in the vicinity of the GC plant is a 389 m high extinct volcano hill located 3.5 km to the north-west of the GC plant. Further to the east – about halfway between Sahil and Lokbatan, and about 8.5 km distance to the GC plant, another prominent hill with a double peak and an elevation of 383 m is located. This feature is a protected natural monument named “Baku Ears”. The GC plant itself with its three 65 m high stacks is a significant landmark in the flat coastal strip, which is emphasised by the plume which is visible from as far as 10 km. Other anthropogenic landscape elements in the close and wider vicinity of the GC plant include Sahil Settlement (with residential 9 to 10 storey block housing units along the highway, older town areas and seaside promenade), Umid Settlement (with a uniform appearance since dwellings are all one-storey buildings of similar size and construction) and further to the south-west, Sangachal and the oil and gas terminal. Off the coastal highway, along the coastal stretch further industries are located to the north-west of the plant, the SPS factory at a distance 7 km with a large semi produced, but abandoned deepwater structure being the visually most striking feature.

Socio-economic Situation

The Project area is located along the highway which connects Baku with Astara and Tbilisi and offers a good connection to the major centres, also by public transport. Economic activities in the Garadagh District, which has a population of approx. 110,000 inhabitants, is dominated by the industrial sector; nearly 50 % of the working population is employed in the industrial sector and 20 % in construction. The main sector is oil and gas and related industries and services.

In 2007, the portion of people working in non-governmental enterprises was about 62 %. The registered employment rate in Garadagh district in 2007 was about 56 %. During the last two years, in connection with the completion of construction works in the Sangachal oil and gas terminal, larger numbers of local workforce was discharged. In September 2008, there were about 400 persons officially registered as unemployed in the Garadagh District, about half of them are receiving social support from the district administration. The total number of open jobs in September 2008 was about 1,550. According to district administration,

young persons with low qualification and persons older than 55, are especially exposed to the risk of unemployment. 15 % of the region’s population are registered as pensioners; pensions are generally low and usually not sufficient for living. Thus, pensioners usually have to generate additional incomes or have to apply for social support at the district administration. The average monthly household income in Garadagh District is about 400 Manat (*ca.* 365 EUR).

The majority of the 458 Garadagh Cement employees live in the two neighbouring settlements Sahil (~400 employees) and Umid (~30 employees). Sahil is one of the largest settlements of the Garadagh district (residential population about 22,700), both in terms of population and industrial prominence. The history of Sahil settlement is densely connected with the Garadagh Cement Plant as it originally was established (under the name *Primorsk*) as worker’s settlement for the Cement Plant during the USSR period. Today the proportion of Garadagh employees in the total population of Sahil is relatively low. Nevertheless, the settlement is the focus area of Garadagh Cement activities in the context of the company’s corporate social responsibility program. Umid settlement was originally established in 1999 to house 250 internally displaced persons (IDPs) from the *Nagorno Karabagh* conflict (IDPs in Garadagh District amount for 10% of the total district population). Umid today has about 2,000 inhabitants, of which three quarters are IDPs. BP, as the company which operates the *Sangachal* terminal, is active with social support projects in Umid. The working population of the settlement was recently affected by loss of jobs after the completion terminal construction works.

Living conditions in the settlements provide for basic standards. Piped water is supplied to households in Sahil two times a day during 5 hours and to Umid 24h/day; electricity is supplied to both settlements 24h/day.

School attendance rate for primary and secondary education is virtually 100 % in Garadagh District. Practically all children and teenagers of school age attend the 11-years secondary or vocational education. In Sahil, there is the only school for disabled children in Azerbaijan. The school is run by a private initiative and supported by Garadagh Cement. A sport school in Sahil offers after school training in different disciplines. It hosts almost

1,000 children and is supported by Garadagh Cement.

All people of the Garadagh district have access to free out-patient and stationary medical services. Sahil settlement is provided with one hospital and emergency station with ambulance cars. These facilities also would provide service in case of emergencies at the Garadagh Cement Plant.

4 Alternatives

Project Location: The plant modernisation with Kiln 6 will take place on the premises of the existing Garadagh Cement plant. Components are being sited on internal brown field ground which was previously used or disturbed. This land saving approach by recycling of unused site area also provides for the side effect that previously dumped cement kiln dust and demolition debris and remains from previous Kiln 5 and other installations will be cleaned up.

Plant Operation Scenario: It is planned that the new dry Kiln 6 will replace the present four old wet process kilns which will be decommissioned after commencement of production with the New Dry Kiln 6. It is intended that the wet kilns will eventually be dismantled within the next years. As an option, Garadagh Cement has investigated to continue the operation of two wet kilns for a limited period of time (between 5 and 10 years), parallel to the New Dry Kiln 6. This option was considered due to the continued deficit of local cement production in Azerbaijan which will continue to exist despite the significant increase of production output of the Garadagh Cement plant with the new dry Kiln 6. A decision in this regard has not yet been made. Any continuation of operating the old wet kilns would include an environmental upgrade to conform to international and local standards, and an environmental study including stakeholder consultation.

Production Process: The present GC plant operation is based on four so-called long wet kilns. The technology is dating back from the 1940s. Today, the dry process is considered to be the most effective and preferable technique (EU BREF). Dry process kilns produce almost 80 percent of cement manufactured in Europe. For new plants and major upgrades, good international practice (IFC) for the production of cement clinker involves the use of a

dry process kiln with multistage preheating and precalcination (PHP kilns). In line with international best practice, the modernisation of the Garadagh Cement plant will be based on the dry kiln technology with PHP.

Fuel: The present kilns are fired with natural gas. In order to be flexible in response to the future fuel market developments (availability, price) and future natural gas export strategy of Azerbaijan, the new dry Kiln 6 is designed so that it can be operated with different fuels. It is planned that operation will be based on imported hard coal, or pet-coke if available (preferably from Azeri refineries), but also firing with natural gas will be possible. Besides pet-coke, other alternative fuels and raw materials (so-called AFR, such as e.g. oil sludge, bituminous waste, waste tyres, waste sludge, contaminated soil, waste with high calorific value etc.) are currently not considered as a reliable source but may become interesting in the future since the clinker burning process is highly suitable to utilize and treat such materials in an environmentally sound and safe way Both EU BREF and IFC guidance documents recommend the use of AFR to save fossil fuels. The use of such AFRs use would require a separate permit and environmental study.

Limestone Supply: Presently, GC plant operations completely rely on waste limestone from stone cutting operations in the backcountry. To secure reliable long term availability and stable limestone quality input to the plant, GC intends to re-open the Shakhgaya-West quarry which was transferred to GC as part of the privatisation of the plant. The planned blending in of about one third of the limestone demand from the quarry provides the flexibility to respond to variations in the waste limestone quality and allows using low limestone quality from Shakhgaya West as long as the waste limestone quality is stable.

Also, the waste limestone material delivered to site contains significant amounts of dust stemming from the stone cutting process. This is disadvantageous for the new vertical roller mill which will be used at the plant site for raw meal grinding. Blending of waste limestone with freshly fractured quarry limestone will provide the possibility to better control the physical properties of the material used in the process.

Overall, the planned sourcing from both waste limestone and the quarry generates a desirable redundancy regarding limestone quality stability resulting in maximum utilisation of all limestone reserves.

In addition, the significant Project capital investment for the long term operation and production commitment with the Kiln 6 project requires not only a strong demand side, but also a reliable supply base for the raw materials.

Currently waste limestone available in the direct vicinity of the plant is estimated to correspond with a new Kiln 6 running time of about 15 years. To realize a project of the size of the new Kiln 6, based on its company policy, Garadagh requires limestone resources of 50 to 100 years. At present Garadagh Cement relies on waste limestone only from third party operations. With the Shakhgaya-West quarry, about one third of the daily demand will come from a source directly owned by Garadagh Cement and in combination with the waste limestone available a lifetime of about 55 years of limestone resources controlled by Garadagh Cement in the vicinity of the plant will be ensured. The Caravanserai limestone deposit, for which mining rights have also been given to Garadagh Cement in the privatisation agreement, provides a future long term option for access to freshly broken limestone.

Quarry operation: The present quarry mining concept includes surface mining in shallow benches accomplished by conventional blasting operations. Garadagh Cement presently is investigating the feasibility of alternative mining methods which have been introduced in limestone quarrying in other parts of the world and which do not require blasting. This would comprise exploiting the limestone deposit with so-called "Surface Miner" equipment, which scrapes off thin layers of limestone, or ripping using excavators or bulldozer with appropriate ripping devices. Assuming the technical and economic feasibility, Garadagh Cement would prefer such options since it makes special measures and constraints connected with blasting obsolete and avoids environmental effects of blasting.

No Action: Holcim, in the years after privatisation of the GC plant has already made significant efforts and investments to reduce plant emissions. Further retrofitting of existing emission controls

would imply additional costs without gains in plant production output and efficiency. With the investment in the new dry Kiln 6, further substantial improvements in environmental performance and efficiency of the GC plant will be achieved.

At present, Garadagh Cement is the only clinker producer and the largest producer of cement in the country. In view of the anticipated continued and steeply rising domestic demand, a "no action" on the project would result in an increasing domestic clinker and cement production deficit, thus increasing the demands for imports to Azerbaijan in future years which could constrain future economic development and investment.

"No action" would also have long term impacts on the viability of Garadagh Cement as a company. The investment in plant modernisation based on the new dry Kiln 6 will improve the production cost base through productivity increase and energy efficiency. With the capacity increase enabled by the new dry Kiln 6, Garadagh Cement will be able to keep its present market share aligned with the growing demand. In the long run, the plant modernisation with the new dry Kiln 6 will secure competitiveness of the operations of Garadagh Cement.

5 Anticipated Environmental Impacts and Mitigation Measures

Land Loss and other Land use Impacts: The Project requires no land acquisition, since all land necessary for the Project is in the ownership of GC. The new dry Kiln 6 will be built within the GC premises and requires no additional land. The re-opening of the Shakhgaya-West quarry results in no land use impacts since the area comprises arid land which is neither under permanent nor temporary use. The rail and road infrastructures to be rehabilitated remain in the same alignment and require no additional land either. Overall, there is no land or land use related impact by the Project. The project will not impact on public roadways. No modifications or additions to the existing highway junction and local road leading towards the GC plant are necessary. It will be discussed between GC and the road authorities if the junction of plant road and local road should be modified. The abandoned railway line which connects the Shakhgaya-West quarry and the previous loading

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station will be refurbished on the existing route and does not require additional land or cause any additional land use restrictions. Railroad crossings will be secured by signalling.

Ambient Air Impact: To determine the ambient air impact of the Project, and to demonstrate the differences to the existing plant, dispersion modelling with a *Lagrangian* particle model was undertaken for the ESIA. Such models are international standard and consider local topography and meteorological situations in more detail compared to the *Gaussian* model used in the local EIA. The dispersion model results reported in the local EIA confirm compliance of the Project with Azeri ambient air standards. The results of the additional ESIA calculations are summarised in Table NTS-3 below.

In summary, the Project will, despite substantial increase in production capacity by 40 % and the switch from gas to coal as fuel, have a reduced net air impact compared to the existing plant, which already is within internationally acceptable air impact levels. Compared to present operation, notably suspended particulate matter in ambient air will decrease. The general spatial distribution of the air impact looks similar to the existing situation, however at a generally lower impact level: The annual average of the Project's

maximum impact area for gaseous substances is located south of the plant off shore out in the Caspian Sea. The reach of suspended particulate matter air impact and dust deposition however, is shorter from the plant and at smaller magnitude compared to the existing operation. The modelling calculations show for adverse low wind dispersion short term maxima which exceed limit values at the hill top NW of the GC plant. This hill however comprises uninhabited, bare rock lands, while the relevant limit values relate to settled areas. Also the exceedance level is significantly reduced with the Project compared to present operation, and moreover, calms are extremely rare in the generally windy environment around the area.

The results of the dispersion modelling show that no further mitigation measures are required to reduce the stack emissions, *i.e.* beyond the use of low-NO_x burners and high efficiency bag filters for particulate matter. The proposed plant design already reflects best available techniques. The stack height of 140 m satisfies the requirement of undisturbed dispersion of the emitted pollutants. The modelling predicts that emissions will meet the applicable national or international emission and ambient air quality standards. The emission concentrations of stack exhausts will be measured and recorded continuously during plant operation.

Table ES-3: Ambient Air impact of existing plant vs. future Kiln 6 operation (Project)

Pollutant	Reference Period	Present plant (4-wet kilns)		Kiln 6 Project		Limit / Guideline Values
		Calc. max impact in airshed	Calc. max impact at settlement areas	Calc. max impact in airshed	Calc. max. impact at settlement areas	
NO ₂ (µg/m ³)	Annual	2.1	0.9	1.6	0.7	40 (EU)
	1 hr. average*	72	55	51	49	200 (EU)
	1 hour max	840	63	250	54	85 (Az**); 200 (IFC)
SO ₂ (µg/m ³)	Annual	0.4	0.18	1.3	0.5	20 (EU/IFC)
	1 hr. average*	8	5	25	24	350 (EU)
	1 hour max	880	9	430	37	500 (Az**; IFC+)
PM ₁₀ (µg/m ³)	Annual	18	1.2	2.6	0.7	40 (EU)
Dust deposition (mg/m ²)	Day	299	5	21	6	350 (German TA Luft)***

*excl. the 18 highest 1 hr averages of the year; **Az. limit value applies to settlement areas only; + 10 mins; *** public nuisance level;

Noise Impact:

For the future operation, the noise sources will change as follows: the old kilns will be decommissioned, the movement of trucks and loaders on site will be drastically reduced since there will no longer be open storage and handling of raw material for clinker production. New sources are the new kiln, the raw mill, the coal mill and belt conveyors. The train unloading is moving further away to the NW of the site, and train unloading will take place during the daytime. Site related traffic will increase due to the higher transportation volumes for raw material and cement shipping. However, this will be mainly during daytime.

The EPC Contractor will be required to design the Project so that it achieves Holcim design requirements regarding plant community noise impact: the noise impact generated by the new Kiln 6 operations at the nearest residential area (*i.e.* of Sahil) shall not exceed levels of 45 dB(A) at daytime or 40 dB(A) during night time. This requirement is even more stringent than international standards (IFC) of 55 dB(A) day /45 dB(A) night for residential), while there is no Azeri noise standard. Also, the international criteria (IFC) that a project should not increase existing background noise impact by more than +3 dB(A) will be met.

Noise impact modelling for the ESIA has shown that reaching international standards will be achievable by relatively small sound power level reductions at the source (magnitude of up to -7 dB(A)). GC anticipates that the more stringent Holcim requirement can be reached by applying appropriate noise abatement measures to the key noise source. The EPC contractor will have to optimise the plant design accordingly. In particular, significant noisy components such as the mills will be enclosed in buildings with noise absorbent cladding. Noise generating equipment will be provided with noise reducing dampers or shielding as necessary to achieve compliance with these limit values. The noise modelling also shows, that the highway traffic will continue to be the dominant noise source for Sahil.

Also, against the background of traffic flow on the highway, any construction or production related traffic will have negligible noise impacts. During construction at the GC site, short term noise peaks can occur such as from piling, this

however will be a limited period. In general, noisy construction works will not be carried out during night time hours.

At the Shakhgaya West quarry area and the crusher and loading site, noise will be generated by blasting activities (if blasting method will be employed), usage of exploitation equipment, and operation of the crusher and loading and transportation activities (mining dump trucks, trains). Since no sensitive receivers are in the vicinity, the operational health and safety limits for noise exposure of workers is relevant. These will be maintained by respective equipment and procedures.

Vibration: Design of the new Kiln 6 will ensure that rotating machinery is correctly balanced and that equipment is vibration isolated. Operational vibration will be imperceptible beyond the site boundary.

Measurement of vibration from construction sites have shown that, even from heavy construction activity, *i.e.* percussive piling, vibration levels typically fall to imperceptibility beyond approximately 100 m from the vibration source. From other sources of vibration, such as excavators, bulldozers and heavy goods vehicles, imperceptibility levels are reached at much shorter distances. Furthermore, construction activities are expected only for a limited period of time and will be limited to the daytime.

In summary, no operational or construction impacts from vibrations are anticipated for the settlement areas in the plant site vicinity.

Due to the absence of any sensitive receivers in the backcountry, quarry and quarry base facility (crusher) operation will not cause adverse vibration impacts.

Impact on Water

Groundwater: due to the subsurface clay strata and the absence of a usable aquifer, groundwater contamination risk during construction is not given. Also operation poses no significant risk to subsurface or groundwater contamination, since only very limited substances with pollution potential will be used (*e.g.* lubricants for drives *etc.*).

Surface Water: The waste water amount will be reduced by about 56 % compared to present operation. Project waste water will be treated at the new on-site treatment plant to international

effluent standards and afterwards discharged to the sewer. No impacts on surface water are anticipated.

Water Resources: overall the Project will use about 65 % less water compared to the existing operation. While present operation uses treated waste water, the use of freshwater from the main pipeline will be necessary for the Project production process. However, a water-saving, closed water cycle is planned for production. The plant will at peak use about 0.2 % of the main water pipeline capacity.

Soil and Subsurface Impact:

Due to the characteristics of the soils and subsurface conditions at the plant site, in particular the lack of any sensitive features, no relevant impacts on soil and no risks of ground pollution are anticipated. The project provides for cleanup of previous cement kiln dust dumping and clean-up of historic localised oil spills on site.

The extremely shallow soils prevalent at the Shakhgaya-West quarry site will be lost since there are too thin to be recovered.

Solid Wastes: The quantities of solid waste generated by the operation of the Project will be very small (in the order of kilograms per day). Wastes will mainly consist of household type waste, cooling water makeup treatment and effluent treatment residuals.

All wastes generated at and by the plant will be disposed of from the site by licensed contractors. Final disposal of wastes will be to waste treatment plants or local landfill sites, as agreed by the relevant competent administrative authority.

Flora, Fauna and Habitats: The installations of Kiln 6 and the other plant components will be built on a brown field area on the cement plant premises which is free of vegetation. The vegetation in the region consists of semi-desert type plant communities with sparse ground cover.

No effects are anticipated from the presence of the 140 metres high stack structure on bird populations and habitat functions (including stopover for migratory birds) at the *SPS lagoons* located some 5-8 km to the north-east of the plant. The plant does not discharge hazardous

wastewater which could endanger aquatic life on the Caspian coast.

Also for the rehabilitation of the transportation infrastructure to the quarries, no impact on vegetation and habitats will occur since the alignment of the existing railway track and road will not be changed.

The exploitation of the Shakhgaya-West quarry will completely affect 152 hectares of semi desert hill slope with scarce brush type vegetation cover. The affected area can to some extent still be considered a *natural habitat*, despite some disturbance from the exploration drilling campaign, and some previous initial and small scale illegal stone cutting by third parties. Previous quarry activities at Shakhgaya area in Soviet times took place at the lower slope to the south of the now designated quarry area. The spring flowering *Iris acutiloba*, which is an Azeri red book listed species, is widely present on the stony ground which carries only very thin soil. While this species is found in the whole region, it is, however, under habitat pressure by the spreading of stone cutting activities and loss of natural habitats by other developments.

Therefore, the impact from the Shakhgaya-West quarry is assessed to be significant and requiring mitigation measures. Therefore, transplanting of the protected species is planned. In order to minimise the net loss, GC will carry out a transplantation program for the iris rhizomes. This will be developed and implemented within the timeframe available until actual quarry exploitation will start with the commencement of Kiln 6 operation in 2011. This program will draw experience from the vegetation transplantation program which was conducted in the course of the construction of the Sangachal terminal and the related oil pipeline in the same region. Also, the detailed quarry rehabilitation plan to be developed by GC will consider the aspect of re-vegetation and habitat restoration.

Visual Impact: Photorealistic simulations for different far and near views towards the Project were made and compared against the present situation (see Images 1 - 3 below) .

For far-distance views, the future plant will be a much more pronounced as a visible landmark compared to the present plant. The modernised Garadagh Cement plant with the new Kiln 6 will be the highest artificial landmarks in the entire

region. The physical structure of the new plant (mainly pre-heater tower (132 m) with new stack (140 m) will be more than twice as high compared to the existing stacks (65 m) and have a bigger cubature (storage silos 62 m high), which makes the plant highly visible from all directions within a distance of more than 10 kilometres.

While the present plant can be identified from the distance mainly by its plume which is often extending widely downwind and visible throughout the region, the plume of the future Kiln 6 operation will most of the time be hardly visible. The dry process produces much less vapour when compared to the present wet process, where the large amounts of slurry water are evaporated, and the high efficiency filters will significantly reduced particulate matter emission.

For near-field views from Sahil settlement, the increase in plant cubature of the GC plant will be the determining element, more than the increased height, but since the new installations will be located further away to the NW from the settlement, no significant impact is anticipated.

The increased height and cubature volume will not significantly obstruct important views or lines of sight. The natural monument *Baku Ears* located some 8.5 km to the east of the GC plant is mainly visible from the highway and coastal plains and the views will thus not be affected by the Project.

Visual impacts of the plant structures will be moderated by using greyish-brown façade colours, which visually blend the installations with the prevailing background.



Image NTS-1:
Simulated view of New Dry Kiln 6 from the railway bridge west of Sahil



Image NTS-2:
Simulated view of New Dry Kiln 6 from the highway next to Sahil



Image NTS-3:
Simulated view of New Dry Kiln 6 from Umid Settlement

Archaeology, Historical and Cultural Heritage:

The erection of the new dry Kiln 6 and related installations will take place on the existing cement plant site. There is no indication that any archaeological, historic or cultural remains of significance are in the ground on or next to the site, thus no impact is anticipated. Also, since the rehabilitation of the road and rail infrastructure to the quarries will remain on the same alignment and no enlargement of the road or railway track footprint is planned, interference with any potential subsurface archaeological features is unlikely.

There is no indication of any obvious presence of archaeological, historical or cultural heritage objects and soil is very shallow to non-existent at the quarry site, there is a low likelihood that objects would be buried in the ground. However, in line with the pertinent regulatory Azeri requirements, GC will commission an archaeological walkover survey at the quarry by mandated specialists.

GC will set-up a *chance finds procedure* to be implemented by the EPC contractor at the cement plant construction site and the contractor for constructing the quarry base facilities (crusher etc.), and the operator subcontracted for the quarry. Contractors will be required to report any chance finds to GC's supervisors who will inform relevant authorities to arrange for the recording and recovery of finds of significance, should this be required.

If in the future Garadagh Cement also uses the *Caravansarai* limestone deposit, Garadagh Cement would consider financing reconstruction and conservation measures for the 16th century *Shakh Abbas Caravansari* building, such as improving the physical status of the historic structure in agreement with competent authorities and experts.

Social and Socio-Economic Impacts

Construction: The construction period of the project will have a temporary (about 3 years), overall positive impact on the local labour market as a high proportion (more than 60%) of the estimated peak construction workforce of 700-900 persons will be locally employed. About 60 – 80 % of the labourers for civil and structural works will be unskilled or semi skilled. It is estimated that during mechanical and electrical erection up to 250 qualified Third Country

Nationals (TCN's) will be employed on site. However, depending on the EPC contractor's procurement, for a short period the total number of TCNs could reach up to an order of 500 staff at construction peak. The great majority of construction staff will be male.

Information with regard to construction recruitment will be comprehensively and timely communicated to the local population by GC and the EPC Contractor. Employment opportunities will be announced on notice boards in the communities. The appointment of a GC community liaison officer will facilitate the continuous contact to the local population and will at the same time allow GC and the EPC Contractor to explore local potential hires effectively.

Besides direct employment, the construction phase of the project will have positive impacts for local economy and Azeri enterprises as it will offer a wide range of opportunities with regard to the delivery of services, such as catering and accommodation for construction workforce or the delivery of sub-contractor services and goods within the frame of construction works. The potential for local procurement of works, goods and services, either directly via Garadagh Cement or the EPC contractor, is presently estimated to be in the range of 50 – 80 million Euro. Garadagh Cement plans to hold an information event for interested local companies about business opportunities in relation to the Project. This will be undertaken in coordination with the Azeri Ministry of Economic Development (MED) and the Baku Chamber of Commerce and local entrepreneur organisations. A positive effect which extends past the construction period is the increased professional experience which individual workers will gain. This will improve their perspectives to obtain a new employment elsewhere after the completion of the project's construction.

The large total number of workers and the presence of foreign workforce could potentially lead to friction, related to misconducts behaviour or culturally related differences, amongst the workforce or between workforce and local population. To minimise the chance for this to happen, a *Work Site Regulation* and a *Workers Code of Conduct* will be set-up and workers' compliance with rules will be supervised. If on-site issues arise, conflicts will be managed by the

official representatives of the Garadagh Cement plant who will receive respective training in advance. Garadagh Cement will establish community liaison, including a complaints and grievance procedure in order to identify conflict issues early and to facilitate their resolution together with local residents.

Operation: A general positive effect in context of Project operation will be created by the raising of the skills level of Garadagh Cement workforce by working with the advanced production technology. In the frame of the project, significant investment will be made to enhance current skills of the company personnel, technical staff in particular. Internal, on-the-job training sessions for technical staff and visits to other Holcim companies using the dry kiln technology will be organized to bring staff to the required level of proficiency.

On the other hand, introduction of state-of-the-art technology will lead to increased productivity and as a result will lead to redundancy of obsolete working places and eventually to staff reduction. The total loss of employment in cement production will be 72 full time positions once dry Kiln 6 is in full operation in 2013. Mainly positions for low level skills will be redundant. A comprehensive retrenchment plan will be developed by Garadagh Cement's human resources department in order to minimise potential negative impacts of loss of employment and to strengthen the capacity of affected workforce on the labour market. Garadagh Cement will provide comprehensive assistance programs guided by international best practice to the employees subject to redundancy on top of what is prescribed by Azeri labour legislation. Since the company intends to expand business further into other construction material sectors, also internal transfer options will be considered. Outside of Garadagh Cement's own staff, no significant employment effect will occur since contractor staff figures remain in similar order as today.

Public Health and Safety

The Project will significantly reduce the plant's present ambient air impact, especially regarding particulate matter.

An information and awareness campaign for local population with regard to key issues of the

construction period will be conducted, including information on public health and safety issues.

Operational Health and Safety Issues

Construction: EPC Contractor will issue a health & safety plan which has to be complied with by both workers of the contractor and all subcontractors. This plan shall be guided by the IFC General EHS Guidelines and must meet the specific requirements of Holcim. The EPC Contractor will be responsible for regular inspections and controls of compliance. Besides general construction site EHS hazards, particular attention will need to be paid at working at great heights. Specific OHS provisions will need to be in place under consideration that the production with the existing wet kilns will continue to be running during construction of the new dry Kiln 6, in particular existing stack emissions.

General supervision of construction activities will be exercised by Garadagh Cement as part of the owner's responsibility. An appropriate staff team will be assigned for this.

Construction site entry will be restricted by a vigilant Security system with Identity Cards complete with photograph and only those with legitimate ID cards will be allowed to enter the site and enter the buses to and from work. No camp is foreseen at the plant Site; workers accommodation will be provided using existing local lodging capacities. Fully operating medical and social facilities (canteen; sanitation, amenities) and services will be provided within the confines of the Site and inside the Garadagh Cement boundary walls.

Operation: Plant modernisation will lead to a general cleaner work environment (reduction of fugitive dust) and improved safety on site (reduction of vehicle movements for materials handling).

The existing Environmental Management System (EMS) which Garadagh Cement implemented in 2003 (according to ISO 14001 in parallel to the ISO 9001 Quality Management System), will be expanded to meet the requirements of the Project. The modernised plant with Kiln 6 will be operated according to an operation manual and present environmental and occupational health and safety plans for the present plant operation will be modified and amended for the requirements of the Project in line with Holcim Standards and manufacturer equipment

recommendations. The staff unit for operational health and safety, and environmental and security issues will be trained accordingly. For the quarry access route, a traffic safety plan will be developed to address safety issues interference between public traffic and Garadagh Cement operation related traffic on the quarry access roads.

6 Environmental and Social Management Plan

The Project will implement an Environmental and Social Management Plan (ESMP) which includes management and monitoring activities to address relevant issues and mitigate impacts identified during the impact assessment process. A summary of the ESMP is presented in the Annex to this *Non-Technical Summary*.

The ESMP outlines the organizational requirements and monitoring plans required to ensure that the necessary measures are taken to avoid potentially adverse effects of the Project on environmental, health and safety (H&S) and social aspects. Some of these measures have already been specified by Garadagh Cement at the present state of project planning. The ESMP continues to evolve in scope and depth with subsequent stages of the project preparation and implementation.

Overall responsibility for the ESMP lies with Garadagh Cement for all project phases, *i.e.* project design, construction, operation, and decommissioning. Responsibility for measures related to the construction phase will be with the selected EPC Contractor. His activities, however, will be supervised by staff of the project owner Garadagh Cement to ensure that adverse effects during the construction phase will be avoided.

Detailed stand-alone sub-plans may be developed or existing programs amended to specify ESMP issues in its further progress (*e.g.* detailed environmental monitoring plan, emergency response plan, and community development plan). In case of responsibility delegation, sub-plans shall be developed by contracted companies according to their area of responsibility in order to show how they implement Garadagh Cement's ESMP requirements.

Annual monitoring reports will be compiled and made available to the relevant authorities and the financial lenders, as requested and appropriate. The reports shall cover the status of EHS related aspects like permits, status of compliance with obligations arising from such licences or permits, exceeding of regulatory environmental standards with root cause analysis, corrective measures.

7 Public Involvement

Garadagh Cement, as a policy for this project, in line with international good practice and also recommended practice by the MENR, is offering information and consultation opportunities for stakeholders and the public on a voluntary basis. Garadagh Cement has committed to a public consultation and disclosure plan (PCDP) which guides the stakeholder involvement process. Within the PCDP frame project information documents (comprising a leaflet, a brochure, the PCDP, and comments and grievance forms) were provided to relevant stakeholders and were made public (also on the company website www.garadagh.com). Public meetings were held in Sahil and Umid in June 2008 and the project was initially presented to stakeholders including the MENR and NGOs. A number of comments were received from these consultations. In general, the introduction of modern production technology with increases in efficiency and environmental performance was positively received. However, also doubts were expressed regarding future plant borne air pollution due to the increase of production capacity and the fuel switch from natural gas to coal. During community consultations in Sahil, controversial opinions were voiced regarding the past and present influence of Garadagh Cement plant on air quality (dust and smell nuisance was attributed to the plant) but overall improvements with plant modernisation were generally anticipated. In Umid, where jobs were lost with the completion of the Sangachal terminal construction works, the expectation for Kiln 6 Project related employment opportunities, in particular during construction was voiced and experience and qualifications gained from the terminal construction by local workforce was highlighted. General community comments requested continuation of the Garadagh Cement social community investment programmes. Comments received were

considered by Garadagh Cement and concerns and suggestions are addressed in the Draft ESIA Report: As was demonstrated by the assessment, the present plant operates within internationally accepted limits and the Project will significantly improve the environmental performance. Garadagh Cement will facilitate that employment and procurement opportunities will be timely communicated in Sahil and Umid and the region. Further Garadagh Cement will further develop its community support activities. The Draft Final ESIA document will be made available for the public and further comments and suggestions will be considered for the Final ESIA. During a 60 days disclosure period for the ESIA, Garadagh Cement will organise a 2 day open room event (foreseen December 2008) in Sahil, where concerned public and stakeholders can directly bring forward any concerns or suggestions to GC and receive answers to specific questions they may have.

Garadagh Cement will nominate a *Community Liaison Officer (CLO)* responsible for continuing communication with the public during construction and operation. Further, Garadagh Cement will implement a grievance mechanism whereby the CLO will be responsible for recording and responding to comments and grievances. Written comments in response to information disclosed for the New Dry Kiln 6 Project or general grievances related to the plant can be sent to Garadagh Cement per mail, e-mail, fax or be left at Garadagh Cement drop boxes which is installed in Sahil at the Palace of Culture and in Umid at the Social Hall. Comments and grievances forms are made available to the public respectively. Should the need arise Garadagh Cement will consider the establishment of a conflict resolution *committee* (Garadagh Cement representatives, village council representatives) for the management of complex grievance issues.

NTS Annex:

Summary of the Environmental and Social Management Plan (ESMP)

General Notes:

Any plan or procedure/work instruction set-up by the EPC Contractor (EPC) will be based on the contractual environmental, health & safety and social responsibility provisions of Garadagh Cement (GC) and requires approval by GC before implementation.

Implementation Supervision will be provided by GC. Plans and measures are subject to revision for performance improvement if monitoring reveals weaknesses in implementation. Action item implementation will be benchmarked against key performance indicators.

All activities related to construction and operation, will subject to official Azeri environmental and social inspection within the mandate of the relevant authorities.

Action Item #	Potential Impact / Issue	Mitigation / Management	Responsibility Implementation
Construction (New Dry Kiln 6, Shakhgaya West Quarry Base Facilities, Roads/ Rail Rehabilitation)			
C1	Environmental & Social Performance of construction activities	<ul style="list-style-type: none"> • <i>Construction Supervision Plan</i> • Appointment of GC supervisor team; • Regular site inspections and meetings of GC with EPC; • Regular review of reports of EPC and supervision of implementation of EPC Contractor's <i>Management Plans</i>. 	Set up by GC before construction; Implementation GC throughout construction; monthly reporting of environmental, health & safety and social performance issues
C2	Environmental, Performance of construction activities / Good Practice	<ul style="list-style-type: none"> • <i>Construction Site Management Plan including sub-plans:</i> <ul style="list-style-type: none"> - <i>Spill Prevention and Contingency Plan;</i> - <i>Materials Handling and Storage Instructions</i> - <i>Hazardous Material Handling Plan</i> (incl. international labelling system) - <i>Construction Waste Management Plan;</i> - <i>Construction Site Closure Plan;</i> - <i>Construction Traffic Management Plan</i> (on site and off site) • Designated EPC's <i>Site Manager and EHS-Responsibles</i> 	Setup by EPC prior to construction; implementation by EPC throughout construction under supervision of GC.
C3	Construction Health and Safety	<ul style="list-style-type: none"> • <i>Construction Health and Safety Plan</i>, inter alia including provisions for: <ul style="list-style-type: none"> - workplace risk-assessments and personal protective equipment requirements - construction workers training and awareness - working at great heights and confined spaces - working under ongoing plant operation / stack emissions - construction traffic safety • <i>Emergency Preparedness Plan</i> for accidents response 	Setup by EPC before construction; Implementation by EPC throughout construction under supervision of GC. (in coordination with relevant agencies: Sahil Settlement fire brigade; hospital and relevant district agencies; EHS checks by Azeri Work Inspection)

Environmental and Social Impact Assessment Non-Technical Summary
Garadagh Cement New Dry Kiln 6 Project

Action Item #	Potential Impact / Issue	Mitigation / Management	Responsibility Implementation
Construction (New Dry Kiln 6, Shakhgaya West Quarry Base Facilities, Roads/ Rail Rehabilitation)			
C4	Construction workers welfare /workforce social issues	<ul style="list-style-type: none"> • <i>Social Facilities and Services Plan;</i> • Provision of sanitation, social and medical facilities and services; workers accommodation (TCN) and transport (TCN and local workers); • Provision of facilities and opportunities for workers' recreation and social after work activities • Social supervision audits incl. workers interviews • <i>Workers Grievance Mechanism</i> 	Setup by EPC in coordination with GC before construction starts (site specific conditions) Implementation by EPC under supervision of GC. (in addition: official supervision by Azeri Work Inspection)
C5	Worker issues/disputes; Potential friction amongst workforce / TCN - local workers grievances	<ul style="list-style-type: none"> • <i>Work Site Regulation</i> • <i>Workers Code of Conduct</i> • <i>Grievance mechanism</i> • Workers information/training (under consideration of specific socio-cultural aspects of TCN, local Azeri workforce) 	Setup by EPC before construction starts in coordination with GC; Implementation by EPC under supervision of GC.
C6	Construction workforce demobilisation	<ul style="list-style-type: none"> • <i>Assistance Program</i> for supporting the re-employment of local workforce • <i>Return Procedure for TCN</i> 	Set-up and Implementation by GC one year before end of peak employment period. Set-up by EPC within 6 months after commencement of construction and Implementation by EPC under supervision of GC.
C7	Community relationship Construction related community grievances	<p><i>Community Liaison Plan</i> inter alia including:</p> <ul style="list-style-type: none"> - Appointment of EPC Community Liaison Officer (EPC-CLO) and CL supervisor (GC-CLO); establishment of local community liaison committees (based on present GC community liaison) - Public Information and Awareness campaign; - measures for maintaining good relationship (social events); - Public grievance mechanism incl. conflict resolution procedure 	Setup by EPC in coordination with GC at start of works; Implementation EPC under supervision of GC
C8	Construction Traffic Safety on-site and off-site	<ul style="list-style-type: none"> • <i>Construction Traffic Management Plan</i> <p>Instruction of construction workforce and permanent GC workforce Information of local communities Instruction of contractors (e.g. drivers, suppliers)</p>	Setup by EPC before start of works in coordination with GC; Implementation by EPC throughout construction; supervision of implementation by GC.

Environmental and Social Impact Assessment Non-Technical Summary
Garadagh Cement New Dry Kiln 6 Project

Action Item #	Potential Impact / Issue	Mitigation / Management	Responsibility Implementation
Construction (New Dry Kiln 6, Shakhgaya West Quarry Base Facilities, Roads/ Rail Rehabilitation)			
C9	Construction site access and site security	<i>Site Access and Security Plan</i> ; installation of ID swipe card system; training of guards/security staff	Setup by EPC + GC before start of works; Implementation by EPC + GC
C10	Public Health and Safety issues (Road safety; construction noise/vibration and dust)	<i>Public Health & Safety Plan</i> Addressing public road safety (construction transport and traffic); vibration, noise and dust; health risks related to presence of large number of construction workforce (e.g. sexually transmittable diseases (STD), and public safety issues (such as: potential risk of social unrest because of presence of TCN); <i>Grievance Mechanism</i> (in coordination with <i>Community Liaison Plan</i>)	Set up by EPC before start of works; participation of local community administration and representatives (arranged via established GC community relations); implementation by EPC and supervised by GC.
C11	Local employment opportunities	<i>Local Workforce Recruitment Plan</i> as a framework for recruitment procedure; aiming at providing opportunities for employment of local workforce; considering unskilled, semi-skilled and skilled workforce	Setup by EPC before start of works, implementation by EPC during construction.
C12	Local economy opportunities	<i>Local Procurement Plan</i> Aiming at providing opportunities for procurement contracts with local / Azeri companies in the context of all areas of service requirement during construction (under consideration of Holcim/GC contractors policy)	GC and EPC before start of works; implementation during construction
C13	Archaeological finds during ground works	<i>Chance Finds Procedure</i> , Awareness training of workforce	Setup: by GC before construction works Implementation by EPC under supervision of GC.
C14	Cleanup of localized historic contaminations on-site (CKD, hydrocarbon)	<i>Site Remediation Plan</i> (sampling, if required cleanup, removal and disposal)	CKD removal already accomplished for Project construction ground. Set up of plan by GC within 1 year for remaining site areas.

Environmental and Social Impact Assessment Non-Technical Summary
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Action Item #	Potential Impact / Issue	Mitigation / Management	Responsibility Implementation
Operation of New Dry Kiln 6			
O1	Air emissions	<i>Air Emissions Control Plan:</i> Regular (i.e. daily) evaluation of continuous stack emissions monitoring (PM10, NO _x , SO ₂) against standards, control of pressure drop at bag filters; immediate exchange of damaged filter bags; optimization of operation in order to reduce the emissions; ensure calibration of monitoring equipment; For organic substances and heavy metals in PM emission single measurement campaign every 3 years.	Procedure set-up and implementation by GC with start of operation
O2	Impact on ambient air quality	<i>Ambient Air Monitoring Plan:</i> Passive sampling (diffusion tubes) of NO _x and dust deposition sampling and analysis at defined locations (envisaged: 16 points) in the plant's vicinity and airshed; evaluation against international standards	Procedure set-up and implementation by GC Monthly over 12 months before commencement of operation, and monthly 12 after start of operation (total 24 continuous months)
O3	Discharge of wastewater	<i>Waste Water Monitoring Plan:</i> Regular monitoring of on-site WWTP effluent (at start up per manufacturer recommendation, for regular operation: monthly).	Set up and implementation by GC
O4	Noise emissions/impact	<i>Noise Monitoring Plan:</i> Regular (monthly) monitoring of work place exposure noise on site and off site community noise at dedicated reference locations (envisaged: 10 points); day and night time measurements	Set up and implementation by GC; Reference measures before start of Project operation.
O5	Greenhouse gas (GHG) emissions	<i>GHG Emissions Reduction Plan:</i> Annual reporting of GHG emissions; including evaluation of potential reduction measures (clinker ratio, AFR, fuel); implementation of reduction measures	Set up and implementation by GC; reporting and review starts with first year of operation of the new dry Kiln 6 Project.
O6	Explosion risks	<i>Explosion Prevention and Protection Plan:</i> Identification of explosion risks; explosion prevention measures; explosion zones designation; regular inspection of areas and safety equipment	Procedure set-up prior to start of operation and implementation: GC
O7	Storage and	<i>Work Place Risk Assessments & Exposure</i>	Procedure set-up and

Environmental and Social Impact Assessment Non-Technical Summary
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Action Item #	Potential Impact / Issue	Mitigation / Management	Responsibility Implementation
Operation of New Dry Kiln 6			
	handling of hazardous materials and Noise Exposure	<i>Monitoring Plan:</i> Identification of hazardous materials related work places; identification of work places with high noise levels; prevention and mitigation measures; potential exposure; regular monitoring of exposure and employee health check-ups	implementation: GC Prior to start of operation
O8	GC production workforce reduction due to new technology and increase in plant efficiency	<i>Retrenchment Plan</i> Including provisions for timely consultation of employees, assessment of on-site job opportunities, interviews to analyse social profile, skills and competence, special training	Set up 1 st Q. 2009 and implementation by GC Human Resources Department until commencement of operation with new dry Kiln 6
O9	Community relations and benefit sharing	<i>Community Support Program</i> Continuation of GC community support activities in consultation with the project affected communities Sahil and Umid and based on community needs assessment (GC 2008) (in line with the GC / Holcim Group principles, <i>i.e.</i> support be of public interest, public welfare enhancement, transparency).	Set-up and implementation by GC - CSR Department on annual basis.

Environmental and Social Impact Assessment Non-Technical Summary
Garadagh Cement New Dry Kiln 6 Project

Action Item #	Potential Impact / Issue	Mitigation / Management	Responsibility Implementation
Operation of Shakhgaya West Quarry			
Q1	Loss of a habitat for the red listed plant <i>Iris acutiloba</i>	<i>Translocation Plan</i> Identification of transplant area for the red-listed iris, Location and Dig-up Survey and transplantation (autumn 2008 and 2010) to be accomplished before start of quarry operation; annual spring growth success monitoring (first 5 years).	Set up and implementation by GC before start of quarry operations
Q2	Quarry operation, and closure	<i>Detailed Quarry and Quarry Base Operation Plan</i> Incl. environmental aspects: - Stripping of soil/ weathered surface and storage of material for rehabilitation - Cleanup of site, - Surfacing, securing of slopes and habitat restoration with semi-desert plant seeds	Set up and implementation by GC before start of quarry operations
Q3	Workers Health and Safety	<ul style="list-style-type: none"> • <i>Workplace risk assessment</i> for all quarry operation related activities (Shagkhaya West and Clay quarry sites, S.-West quarry base/crusher & train loading, transportation routes (materials hauling, rail transport, staff transportation) • <i>Health and Safety Plans</i> for each quarry related activity incl. special EHS instructions and provisions for extraction method (blasting). 	Set up by Contractors and GC Supervision by GC
Q4	Use of explosives at quarry	<i>Explosives Transport, Storage and Handling Plan</i> (In case of blasting method will be applied)	Set up by GC in cooperation with contractors; implementation by contractors and GC, supervision by GC
Q5	Traffic interference of GC operational traffic (incl. contractors) and public traffic/stone cutters on quarry access and transport roads	<i>Road and Rail Traffic Safety Plan</i> road safety measures (Warning signs, speed limit, entry control of the road at the quarry base; signalled rail crossings) drivers training Road usage procedure for GC private road used by stone cutters.	Set up by GC in cooperation with contractors; implementation by contractors and GC, supervision by GC

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