CONTENTS of Section 4

4 ALTERNATIVES

This section provides a summary of the alternatives considered by Garadagh Cement for the development of the Project for various aspects including their environmental relevance.

4.1 THE "NO ACTION" ALTERNATIVE

The need for the project has been described in *Chapter 2*. The "*no action*" alternative, *i.e.* not to pursue with the implementation of the Project, would possibly have a number of implications of which the key ones are related to:

- Plant emissions and environmental situation;
- Azeri dependency on clinker/cement imports, and
- Long term economic viability of Garadagh Cement.

These aspects are discussed below.

Plant emissions and environmental situation

Holcim in the years after privatisation of Garadagh Cement has already made significant efforts and investments to reduce and monitor plant emissions, such as repaired and upgraded the ESPs and other measures to reduce plant borne particulates emissions. At present the GC plant operates in compliance within the permissible environmental Azeri limits. However, it must be acknowledged that the plant is a major pollutant emission source in the area, in particular for NO_x and particulate matter. Compared to international standards and best practise in the cement industry, to which Garadagh Cement's parent company Holcim is committed, the environmental performance of the present day plant is not satisfactory in particular to fugitive dust emissions. With the investment in the new dry Kiln 6 and related measures, further substantial improvements in environmental performance will be achieved as described in *Sections* 2 and *5*. "*No Action*" would perpetuate the present situation. Further retrofitting of existing emission controls would imply additional costs without gains in plant production output and efficiency.

Azeri dependency on clinker/cement imports

At present, Garadagh Cement is the only clinker producer and the largest producer of cement in the country. 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. A continued domestic shortage of cement and increased dependence on imports could have an adverse impact on costs in the construction industry. In view of the anticipated continued and steeply rising domestic demand, a lack of a secure and reliable domestic cement production would constrain future economic development and investment.

Long term economic viability of Garadagh Cement

"*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.

In summary, the "no action" alternative is not a viable or acceptable option to the proposed Project, neither for Garadagh Cement and its shareholders, nor for the Azeri construction economy, and no environmental improvement would take place.

4.2 PLANT SITE LOCATION

The plant modernisation with Kiln 6 will take place on the premises of the existing GC 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 Kiln 5 and other installations will be cleaned up.

4.3 PROCESS TECHNOLOGY

There are four principle techniques available for clinker burning (per the *EU BREF*):

- Wet process:
  Raw materials (often with high moisture content) are ground in water to form a pumpable slurry which is fed into the kiln;
- Semi-wet process:
  The slurry is first dewatered in filter presses. The filter cake is either extruded into pellets and fed o a grate pre-heater or directly fed to a flash drier for raw meal production;

- Semi-dry process:
  Dry raw meal is pelletized with water and fed into a grate pre-heater in front of the rotary kiln, or to a long kiln equipped with crosses;

- Dry process:
  Raw materials are ground and dried to raw meal in the form of flowable powder. The dry raw meal is fed into a pre-heater and/or pre-calciner kiln or, more rarely, into a long dry kiln;

The present GC plant operation is based on four *so-called* 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. According to IFC Guidelines, for new plants and major upgrades, good international practice for the production of cement clinker involves the use of a dry process kiln with multistage preheating and precalcination (*short*: PHP kilns). PHP kilns today are the most common kiln used in the cement manufacturing industry. They have the lowest heat consumption (due to the high heat recovery from kiln gas in the cyclones, and the low kiln heat losses), and no water to evaporate (compared to wet kiln which uses slurry), while also offering the highest production capacity. As per IFC recommendation, nondry kilns should be converted to the dry process when upgraded or expanded[1]

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

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

[1] For further comparison of kiln processes see: IFC Environmental, Health, and Safety Guidelines for Cement and Lime Manufacturing (April 2007): http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_CementandLimeMfg/$FILE/Final+-+Cement+and+Lime+Manufacturing.pdf

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. If a decision was made to further pursue this option, this ESIA Report would be amended and Garadagh Cement would inform the interested public and relevant stakeholders accordingly.

4.4 FUELS

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.

As described in Section 2, it is planned that operation will be based on imported hard coal, or pet-coke if available (preferably from Azeri refineries[2]), but also firing with natural gas will be possible.

Besides pet-coke, other alternative fuels and raw materials (so-called *AFR*) *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.[3] The use of such AFRs use would require a separate permit and environmental study. Both BREF and IFC guidance documents recommend the use of AFR to save fossil fuels.

[2] availability is currently limited to one refinery in Baku

[3] Garadagh Cement is presently screening domestic options for AFR http://www.garadagh.com/contents/default.aspx?lg=2&idpt=2300&id=9161;
Holcim's general goals related to AFR as shown in the Holcim AFR policy: http://www.holcim.com/gc/CORP/uploads/Holcim_AFR_Policy.pdf. For Holcim For fact Sheet on AFRs see:
http://www.holcim.com/gc/CORP/uploads/Holcim_FactSheet_AFR_2008.pdf ;
Holcim also has established a partnership with the German Technical Cooperation Corporation (GTZ) to develop solutions for integrated waste management in developing countries and countries in transition through use of AFR
http://www.holcim.com/corp/en/id/45880/mod/gnm50/page/editorial.html

4.5 LIMESTONE SUPPLY

Quarry

Waste limestone from stone cutting operations in the backcountry constitutes a potentially very large source for raw material supply for the Garadagh Cement plant. Possibly also the increased Kiln 6 operations demand could be covered for a long time. However, to secure reliable and stable limestone 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 opening of the Shakhgaya–West quarry, despite the large potential waste limestone resource, is considered necessary mainly for process reasons:

- The waste limestone material delivered to site contains significant amounts of dust stemming from the stone cutting process. This is disadvantageous for the 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 control the physical properties of the material used in the process;
- Presently incoming waste limestone quality is within manageable variations. However, it is not known how the waste limestone properties will look in the future when stone cutting moves on. The limestone resources of the Shakhgaya-West quarry have been thoroughly explored by a test drilling campaign and variations in limestone composition and properties are reasonably well known. The variations in the deposit provide for the possibility to respond to variations in the waste limestone quality by blending of materials sourced from quarry and from waste limestone, and thus to stabilise the chemical composition of raw meal before it is entered to the clinker process.
- Parallel utilization of limestone from Shahgaya West and waste limestone also will avoid potential quality risks if Shahgaya West would serve as sole limestone source in the future. This risk will be eliminated if using low quality limestone from Shagaya West in parallel with waste limestone.

Thus, the 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 Shahgaya West as long as the waste limestone quality is stable. Overall this generates a desirable redundancy regarding limestone quality stability resulting in maximum utilisation of all limestone reserves.

In addition, the significant capital investment (roughly 300 million Euros) 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 a lifetime of about 55 years of limestone resources controlled by Garadagh Cement in the vicinity of the plant will be ensured.

The *Caravansarai* 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 (*cf.* Section 2) .

Quarry operation

The present quarry mining concept includes surface mining in shallow benches accomplished by conventional blasting operations. However, future blasting operations at Shakhgaya-West quarry entail the following:

- Blasting operations require special OHS measures for handling of explosives and special security measures for storing.
- CG has to subcontract special firms for the blasting; presently there are only 2 companies accredited in Azerbaijan who hold the necessary permits for such works.
- GC requires the consent of the military to undertake blasting in the vicinity of the army facilities which are near the quarry (principle consent was given).

Garadagh Cement presently is investigating the feasibility of alternative mining methods which have recently been introduced in limestone quarrying in other parts of the world and which do not require blasting. This comprises exploiting the limestone deposit with so-called *Surface miner equipment*[4] which scrapes off thin layers of limestone or ripping using excavators or bulldozer with appropriate ripping devices. In the case of surface mining, the cut out material is directly loaded on a truck by conveyor belt, or in case of ripping, loaded to trucks by front end loaders. Provided the technical and economic feasibility, GC would prefer such alternatives since it makes special measures and constraints connected with blasting obsolete and avoids environmental effects of blasting.

[4] basically, a variation of a road construction machine used for asphalt scraping