1. EXECUTIVE SUMMARY

1.1 INTRODUCTION

United Cement Holding (UCC) proposed to establish a Greenfield cement plant, 30 Km west of Sulaymaniyah town.

OCI carried out Environment assessment (EA) study and prepared Environmental Management Plan (EMP) for the proposed cement plant.

The study has been carried out within the framework of national, local, international environmental regulations, the World Bank and the IFC guidelines.

1.2 LOCATION

The Plant is proposed to be located 30 Km west of Sulaymaniyah town and is beside the highway connecting Sulaymaniyah and Kirkuke (1 km from the highway).

1.3 OBJECTIVE OF THE EA STUDY

The EA study report has been prepared in compliance with Iraqi laws, IFC guidelines.

1.4 APPLICABLE LEGISLATIVE FRAMWORK

Assessment of the proposed cement project in Sulaymaniyah is governed by the Iraqi Investment law number 89/2004.

1.5 PROJECT DETAILS

The following raw mix design has been considered for sizing of the machinery of the project.

- Limestone : 70 %
- Clay : 20 %
- Iron Ore : 1.2 %
- Sand : 0.8 %

The proposed plant system comprises of the following:

- Raw Materials Production
- Raw Materials Grinding and Blending
- Clinker Production
- Clinker Grinding

1.5.1 RAW MATERIAL SOURCES

The raw material requirements of the proposed plant are to be met from different sources given in Table 1.1.

S.N.	Material	Source Category	Distance from plant (Km)
01	Limestone	Captive Concession	Adjoining
02	Clay	Captive Concession	35
03	Iron Ore	Purchased	70
04	Gypsum	Purchased	20

(Table 1)

Preliminary investigations indicate an inferred deposit size of 220 million tons of limestone.

1.5.2 FUEL

Heavy fuel oil is proposed for the project and can be sourced from Kirkuke. The existing nearby refineries is not equipped for large quantities. The crude oil from Kurdistan is therefore sent to refineries in Turkey and transported back by road tankers.

1.5.3 POWER

The power from local sources is in short supply and is not reliable. A captive power plant 60,000kVA, which is equivalent to 40MW, in size and runs on Heavy Oil fuel, will therefore be constructed. The captive power plant shall comply with the Thermal Power Guidelines of the Pollution Prevention and Abatement Handbook of World Bank Group.

1.5.4 WATER SUPPLY

Underground water is identified as the source of water for the plant. During the operation phase UCC plant will need a total of 1,000 – 1,300 m3/day of water through water wells. The quality of the water obtained is suitable for multipurpose (industrial, irrigation, human domestic). The hydrological study of the project site area and potential effects ensures that the project will be designed and operated without negative effects for the other water users in the area.

1.5.5 WASTE WATER TREATMENT PLANT

Estimated effluent generated from the plant shall be mainly from domestic usages, from water treatment plant. This water shall be treated in effluent treatment plant and the treated water shall be utilized in dust suppression, greenbelt development and in process to the extent possible.

1.5.6 MANPOWER

The manpower requirement for the operation of the plant is foreseen as 450.

1.6 ENVIRONMENT BASELINE

In order to assess the baseline environmental status in the studied area, site visits were made and a comprehensive data collection program was undertaken during the study period 2005. The environmental components considered include:

- Physical and chemical components: soil, geology, surface/ground water resources, water/air quality, noise, radioactivity and climatology.
- Land use, vegetation, forestry, wildlife and archeology.
- Biological environment: which include flora i.e. trees and grasses; fauna i.e. fish, hyper fauna, mammals, threatened and/or endangered species (plants/animals), species diversity, etc.
- Socio-economic components: distribution economic indicative of human welfare i.e. education system, public services-security, fire protection and medical facilities and health impact.

The baseline information for the studied area are presented according to the following

- Geology and hydrology
- Water quality
- Soil quality
- Meteorology
- Ambient air quality
- Noise level
- Traffic movement
- Radiation level
- Land use pattern
- Vegetation
- Wild life
- Socio-economic status

1.7 ENVIRONMENT IMPACT ASSESSMENT

UCC primary purpose and need for the proposed activity is firstly to utilize the potential natural resource of limestone and clay for manufacture of cement and secondly in turn to contribute in the social development of the studied area directly or indirectly. The likely impacts of the proposed plant would be due to operation, which would be long-term impacts.
The operation phase of the proposed cement plant mainly comprises of the following:

- Blasting of limestone.
- Transportation of limestone from mines to the crusher.
- Transportation of other correctives/additives to the plant site.
- Preparation of raw meal by adding correctives to limestone.
- Clinkerisation of raw meal.
- Cooling and heat recovery.
- Blending and grinding of clinker by adding additives.
- Packing and dispatch.
- Operation of power plant.

1.8 ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Management Plan (EMP) has been designed within the framework of various regulatory requirements on environmental and socio-economic aspects aiming at the following:

- Minimize disturbance to native flora and fauna.
- Prevent air, water, soil and noise pollution.
- Avoid sites of historical, cultural and archeological significance.
- Encourage the socio-economic development.

Stack Emission Management
Fugitive Emission Management
Green House Gas Emission
Noise Level Management
Solid Waste Management
Water Resource/Quality Management
Water Pollution Management
Housekeeping
Occupational Health And Safety
Heat Radiation
Measures To Improve Socio-Economic Conditions
Green Belt Development
Water Harvesting

1.9 ENVIRONMENTAL MANAGEMENT CELL

Apart from having an EMP, it is also necessary to have a permanent organizational set up charged with the task of ensuring its effective implementation. A separate department shall be created to coordinate the activities concerned with the management and implementation of the environmental control measure of the proposed plant operation.

1.10 PUBLIC CONSULTATION

UCC has always firmly believed in Sustainable Development. The company has endeavored to maintain cordial community relations in all its areas of operation.

2. INTRODUCTION

2.1 PREAMBLE

United Cement Holding (UCC) proposed to establish a Greenfield cement plant, 30 Km west of Sulaymaniyah town.

OCI carried out Environment Assessment (EA) study and prepared Environmental Management Plan (EMP) for the proposed cement plant.

The study has been carried out within the framework of national, local, international regulation, the World Bank and IFC guidelines.

THE PROMOTERS:

OCI and FG (FARUK GROUP) have decided to jointly establish proposed cement plant through their joint venture local company called the United Cement Holding (UCC).

A brief background on the project sponsors is presented below:

- **OCI:**

Focus on two high growth business activities, construction services and cement manufacturing.
The OCI construction group provides engineering, procurement and construction services for industrial, commercial, power, water, sewage, transportation, telecommunications, maritime, tourism and railway projects to private and public sector customer in the Middle East, Africa, Central Asia and Europe.
The OCI construction group is the largest private sector contractor in the Middle East with an order booking exceeding 1 bio US dollars.
The OCI cement group owns and operates cement production plant in Egypt and Algeria with a combined capacity of around 9.5 mi tons. This capacity is expected to increase to 13 mi tons by the end of 2005.
The cement plant in Egypt is called Egyptian Cement Company (ECC) established in 1996; ECC is a 53.7% owned subsidiary of OCI with 43.7% owned by Holcim of Switzerland, with a balance being held by private investors. ECC is the largest cement company in Egypt and the Middle East North Africa region and owns the third largest cement production facility in the world.
OCI also participates as an equity investor in long-term infrastructure concessions including port operations, industrial parks and natural gas distribution systems. OCI also has investments in other building materials such as ready-mix concrete, steel fabrication, gypsum manufacturing and industrial bag production. OCI is listed on both the Egyptian and London stock exchange with a market capitalization of around 2.1 bio US dollars. OCI employs more than 30,000 persons, worldwide.

- **FG (FARUK GROUP) of Companies:**
  - Asiacell Telecommunication Company Ltd.
  - Shary Jwan Company Ltd.
  - Tasluja Cement Factory.
  - Kurdistan Factory for reinforcement iron bars and iron melting.
  - Zarya Company for General Contracting Ltd.
  - Goran Net ADSL Service Provider.
  - Talary Faruk Commercial Building.
  - Batching Plant Project.
  - PVC Factory.
  - Azady Telecom Company Ltd.
  - IraqCom Technologies Co. Ltd.
  - Baharan Residential Complex.
  - MIDYA Telecommunication Company.
  - Bazian Poultry Slaughterhouse Company Ltd.
  - Fenik Tourist Company Ltd.
  - Bahar Tourist Project.
  - Dilan Tourist Project.
  - Nahar Al-Madina Company for Advertising.
  - Kar Company- Turkey.

2.2 LOCATION AND ACCESSIBILITY

The Plant is proposed to be located 30 Km west of Sulaymaniyah town and is beside the highway connecting Sulaymaniyah and Kirkuke (1 km from the highway).

Latitude : N 35° 36́ 9.6̋ and N 35° 36́ 42.2̋
Longitude : E 45° 04́ 9.8̋ and E 45° 04́ 57.9̋

Accessibility to the site is as per details given below:

- ◊ Road: The proposed plant is linked by road connected to Sulaimaniah-Kirkuke road.
- ◊ Communication: VSAT technology shall be the most appropriate solution for the proposed plant.

2.3 OBJECTIVES

2.3.1 PROJECT OBJECTIVES

The objective of the proposed plant is to produce cement by using available limestone and clay resources, whilst achieving a balance between impacts on the local environment, community needs and economic viability.

For the proposed project, UCC aims at the following objectives:

PRODUCTION AND OPERATIONAL

- Establish new cement unit
- Develop and manage the plant in an environment friendly manner according to the regulatory requirements and best environmental practices, whilst ensuring economic viability.
- Maximize operational flexibility.
- Optimize resource use.
- Develop and operate the plant to meet community expectations in terms of environmental outcomes and cost.

ENVIRONMENTAL

- Protect the surrounding during operation of plant with appropriate environmental safeguards.
- Protect native flora and fauna.
- Protect quality of local surface and groundwater.
- Minimize public health risks.
- Ensure that ecological balance of the area is not adversely affected by air pollutants.
- Minimize noise and vibration impacts on surroundings.

2.3.2 EA STUDY OBJECTIVES

The EA study report has been prepared in compliance with Iraqi Investment Law No. 89-2004.

Under the principles, the standard set by IFC and/or The World Bank has been followed.

The EA addresses compliance with Iraqi laws and regulations, the minimum standard applicable under The World Bank and IFC guidelines.

2.3.3 APPROACH & METHODOLOGY

The EA study has been designed to take into account the natural environment (air, water and land), human health and safety, social aspect (involuntary, resettlement, indigenous people and cultural property), transboundary and global environmental aspects. The study considers natural and social aspects in an integrated way. It also takes into account the variations in project and country conditions, the findings of the country environmental studies, national environmental action plans, the country's overall policy framework and national legislation, the project sponsor's capabilities related to the environment and social aspects and obligations of the country, pertaining to project activities, under relevant international environmental treaties and agreements.

The EA study is a planning tool to confirm environmental acceptability in addition to the statutory requirements. This report presents the results of the Environment Assessment (EA) process, which is intended to:

- Establish and review existing conditions pertaining to the plant site and surrounding areas.
- Identify and assess the environmental impacts of the proposed plant during construction and subsequently during operation.
- Advise and assist in identifying appropriate measures to mitigate adverse impacts to be adopted under Environment Management Plan (EMP) for all specified significant environmental impact likely to emerge.

This report on Environmental Assessment (EA) is based on the observations made by OCI team during visits to study area and collection of environmental data. Literature has also been reviewed and relevant information has been collected for environmental and social baseline.

OCI has followed the standard EA methodology and technique during the entire study and whenever necessary it has used its own judgment based on its own experience and knowledge base. During the entire study appropriate quality checks have been taken into consideration and best management practice have been followed for a quality output.

Impacts are identified based on the actual and foreseeable events, including operational events and typical events of the proposed project activities. Processes that may create risks to the natural environment and socio-economic environment are considered in terms of key potential environmental impacts.

Mitigation measures to be adopted under Environment Management Plan (EMP) for all specified significant environmental impacts likely to result out during the construction and subsequently during operation is also a part of the EA study.

The likely impacts identified and recommended mitigation measures are based on the following:

- Project information provided by project proponent.
- Baseline information and reconnaissance survey of the study area.
- OCI past experience in similar projects.
- Standard National and International environmental management guideline.

3. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

3.1 PREAMBLE

This EA is carried out within the framework of local, national and international regulations. Various guidelines have been stipulated by various local organizations, International Union for Conservation of Nature and Natural Resources (IUCN), IFC and World Bank. This chapter reviews the applicable legislation and guidelines and standards governing the proposed new cement plant in Bazian, Kurdistan.

3.2 THE WORLD BANK GUIDELINES

The World Bank (WB) provides guidelines for the Environmental Assessment (EA) process in its document "The Pollution Prevention and Abatement Handbook" (PPAH). The PPAH also includes specific guidelines for cement manufacturing as a part of the Industry Sector Guidelines.

The proposed cement plant falls under Category B as per WB's Operational Directive (OD) 4.01. Category B projects are those whose "potential adverse environmental impacts on human populations or environmentally important area-including wetlands, forests, grasslands and other natural habitats- are less adverse than those from Category A. These impacts are site specific; few if any of them are irreversible; and in most cases mitigatory measures can be designed readily" and for such projects, a full EIA is required.

3.3 MULTILATERAL ENVIRONMENTAL AGREEMENTS

International Environmental Agreements already ratified by the Federal Government of Iraq, which are relevant to the project, are:

- Kyoto Protocol on Climate Change, 1997
- Basel Convention on the Control of the Transboudary Movement of Hazardous Wastes and their Disposal, 1989
- Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemical and Pesticides in International Trade, 1998
- 1987 Montreal Protocol on Substances the Deplete the Ozone Layer, 1987
- Stockholm Convention on Persistent Organic Pollutants (POPs) especially as it concerns dioxins emission and the management of polychlorinated Byphenyles (PCBs), 2001

3.4 STANDARDS APPLICABLE TO THE PROPOSED PROJECT

The World Bank guidelines for cement manufacturing (PPAH) stipulate "limiting values" for water quality, air quality, and noise quality. For mining activities, "limiting values" for water quality, air quality and noise quality are specified in the WB guidelines on Environment, Health and Safety (EHS). The Iraqi Guidelines have also been included for cement manufacturing. The standards/ guidelines applicable to this project are given in the following table.

Sn	Element	Requirement		Standard
1	**Water Quality**			
a	***For Plant***	Treated effluent discharge should confirm to these specifications:		Iraqi guidelines Water Pollution control No.25 for the year 1976
		PH BOD5 COD Oil & Grease	6 - 9.5 40 mg/l 100 mg/l 60 mg/l	
		Treated effluent discharges should have a pH in the range of 6 – 9. Total suspended solids (TSS) should be limited to 50 mg/l.		PPAH, WB, 1998- Cement Industry Sector Guidelines
b	***For Mine***	Effluent discharged to surface waters should conform to these specifications:		WB Environment, Health and Safety (EHS) Guidelines- Mining and Milling- Open Pit
		pH BOD Oil & Grease TSS	6 – 9 50 mg/l 10 mg/l 50 mg/l	
2	**Air Quality**			
a	***For Plant***			
	Air Emission	TSP	150 mg/m^3	Iraqi Environmental protection law No. 3 for the year 1997
		TSPM SOx NOx	50 mg/Nm^3 400 mg/Nm^3 600 mg/Nm^3	PPAH, WB, 1998- Cement Industry Sector Guidelines
	Ambient Air Quality	TSP	0.2 mg/m3	Iraqi Environmental protection law No. 3 for the year 1997
		TSPM SO_2 NO_x	50 µg/m^3 annual arithmetic mean 70 µg/m^3 Max. 24-hour average 50 µg/m3 Annual arithmetic mean 125 µg/m^3 Max. 24-hour average 150 µg/m^3 Max. 24-hour average	PPAH, WB, 1998

<table>
<tr><th>Sn</th><th>Element</th><th colspan="3">Requirement</th><th>Standard</th></tr>
<tr><td>b</td><td colspan="5">For Mine</td></tr>
<tr><td></td><td>Ambient Air Quality</td><td>PM10

SO_2

NO_x</td><td colspan="2">100 µg/m³ annual arithmetic mean
500 µg/m³ Max. 24-hour average

100 µg/m³ annual arithmetic mean
500 µg/m³ Max.24-hour average

100 µg/m³ annual arithmetic mean
200 µg/m³ Max.24-hour average</td><td>WB Environment, Health and Safety (EHS) Guidelines- Mining and Milling- Open Pit</td></tr>
<tr><td>3</td><td colspan="5">Noise Quality</td></tr>
<tr><td>a</td><td colspan="5">For Plant</td></tr>
<tr><td></td><td></td><td colspan="2">A maximum increase in background levels of 3 dB (A) or the following levels:
Receptor | Day (7:00-22:00)/ Night
Residential | 55/45 dB (A)
Industrial/ Commercial | 70/70 dB (A)</td><td colspan="2">PPAH, WB, 1998- Cement Industry Sector Guidelines</td></tr>
<tr><td>b</td><td>For Mine</td><td colspan="3">Personnel must wear hearing protection when exposed to noise levels above 85 dB (A).</td><td>WB Environment, Health and Safety (EHS) Guidelines- Mining and Milling- Open Pit</td></tr>
</table>

4. PROJECT DETAILS

4.1 PREAMBLE

UCC propose to commission a cement plant to produce Portland cement with a kiln capacity 7,000 tpd.

4.2 RAW MIX SOURCES AND PLANT SYSTEM DESIGN

Based on the preliminary investigation the following raw mix design has been considered for sizing the machinery of the project.

- Limestone : 70 %
- Clay : 20 %
- Iron Ore : 1.2 %
- Sand : 0.8 %

The clinkerisation factor works out to 1.65 the moisture content considered in raw materials for calculation of capacities is indicated in following table

Material	Moisture Content %
Limestone	**12**
Clay	**4**
Iron Ore	**2**
Gypsum	**2**

The system described hereunder:

4.2.1 MIX (LIMESTONE/CLAY) CRUSHING

The capacity of the crusher has been considered as 2,000 tph. The increased capacity of 2,000 tph shall also enable to take care of higher percentage of limestone additionally in cement in case it is allowed in the future. As per European standards (EN197) an addition of up to 35% is permitted. The brief technical details of the proposed crushing system are as under:

- Type of crusher : Double-shaft hammer crusher
- Crushing location : Plant
- Feed size : Limestone max. 800 x 1000 x 1500 mm
  Clay 0 - 500 mm
- Output size : 90 % > 80 mm
- Crushing feed hopper : Two hoppers (limestone and clay)
- Hoppers extraction : Sealed Apron conveyor
- Crusher discharge system : Covered Impact belt conveyor 3200 mm width
- Transportation to stockpile : Covered Troughed belt conveyor 1600 mm width
- Environmental control : Element controlled is fugitive dust from crusher and transfer points. Method of control adopted is with the help of bag filters.

4.2.2 MIX (LIMESTONE/CLAY) PRE-BLENDING STOCKPILE

A covered circular mix stockpile of 51,000 t has been considered. The capacity of stacker shall be 2,000 tph. The required capacity of reclaimer shall be around 1500 tph. The brief technical details of the proposed system are as under:

- Storage capacity : 51,000 t
- Stacking capacity : 2,000 tph
- Type of stacker : Boom
- Reclaimer capacity : 1,500 tph
- Type of reclaimer : Bridge reclaimer

The reclaimed limestone/clay mix shall be transported to the raw mill feed bin with the help of a mix reclaim belt conveyor. Environmental control measures include totally covered mix storage area and installation of bag filter at raw mill feed bin.

4.2.3 ADDITIVE CRUSHING

The project envisages independent crushing system for additives. Two additives namely Limestone and/or Gypsum shall be required for producing Portland Cement. The brief technical details of the proposed crushing system are as under:

- Type of crusher : Double-shaft hammer crusher
- Crushing location : Plant
- Feed size : 300 x 400 x 900 mm
- Output size : 90 % > 60 mm
- Crushing feed hopper : One dump hopper
- Hoppers extraction : Sealed Apron conveyor
- Crusher discharge system : Covered Impact belt conveyor
- Transportation to stockpile : Covered Belt conveyor
- Environmental control : Element controlled is fugitive dust from crusher and transfer points. Method of control adopted is with the help of bag filters.

4.2.4 CORRECTIVE AND ADDITIVE STORAGE

A covered linear stockpile for correctives and additives with 1500 t storage for sand, 2000 t for iron ore, 3000 t for gypsum, 8000 t for additive limestone and 10000 t for corrective limestone are considered adequate. Stacking shall be with the help of boom stacker and reclaiming by side scraper. This solution allows flexibility in adjusting the material storages spaces as per operational needs.

The capacity of the stacker shall be around 900 tph considering a 25% margin over the crusher capacity. The reclaimer capacity shall be around 450 tph considering the various materials to be handled and a safety factor of 1.25.

Environmental control is by virtue of having totally closed material storage shed, bag filters at transfer points and bag filters at all discharge points of covered conveyors.

4.2.5 RAW MATERIAL DRYING AND GRINDING

Raw Mill Hoppers	: 4 steel mill feed bins (raw material mix 900 t, limestone 350 t, sand 200 t, iron ore 100 t).
Raw Mill Feeding	: Sealed Apron conveyor scale for mix Weigh belt feeders for corrective limestone, iron ore and sand.
Mill System	: Roller mill with a high efficiency separator SEPOL-555-RMR.
Mill Dedusting	: The dedusting of raw mill gases is with gas conditioning tower and electrostatic precipitator.

Since the entire mill system is a closed system and operating under negative pressure, environmental control is by dedusting of cyclone gases followed by an electrostatic precipitator.

4.2.6 RAW MEAL BLENDING AND KILN FEED

A 20,000 t continuous flow silo has been considered. Pneumatic system for both silo feeding as well as preheater feeding, is suggested. In addition, the kiln feed system shall be provided with gravimetric control by installation of a bin-weighing device at the discharge point of the kiln feed bin air slides.

4.2.7 PREHEATER, PRECALCINER, KILN AND COOLER

For the proposed Clinkerisation capacity of 7,000 tpd, a rotary kiln in conjunction with a five-stage double string preheater - Precalciner and grate cooler are proposed. As suggested for the raw mill, electrostatic precipitator (ESP) shall be installed for dedusting of raw mill kiln system.

For dedusting of cooler vent gases, electrostatic precipitator has been considered. Clinker transport from cooler to clinker silo has been considered to be with the help of apron conveyor. Pan conveyors are sized with a capacity of 350 tph (nominal) and 440 tph (max.).

4.2.8 CLINKER STORAGE

Reinforced concrete construction clinker silo of 50,000 t is considered. For transport of clinker from clinker storage to cement mill bin(s), **troughed belt conveyor** has been considered.

4.2.9 CEMENT GRINDING SYSTEM

Closed circuit Ball Mills of 180 tph capacity are proposed for the project. Broad technical features of each of cement mill systems are as follows:

- Cement mill Bin(s) : 3 bins for each mill system comprised of 1 x 600 t capacity for clinker
  1 x 280 t capacity for gypsum
  1 x 280 t for high grade limestone
- Cement Mill Feeding : Sealed Apron conveyor scales for extraction of clinker, covered weigh belt feeders for extraction of gypsum and high grade limestone.
- Mill System : The ball mill has an external recirculation of 600 tph. A chain type bucket elevator coupled with air-slides achieves external recirculation.
- Product Collection : A high efficiency separator in conjunction with cyclone system has been considered for product collection.
- Mill Dedusting : The solution envisaged for dedusting of cement mill gases is with a bag filter.
  The separator circuit shall also be de-dusted by means of bag filters.

4.2.10 CEMENT STORAGE

3 x 20,000 t tangential concrete construction cement storage silo has been considered. Cement from the grinding system is transported to the silo with the help of air-slides and bucket elevator. From the silo, cement shall be transported to the bags and bulk loading, with the help of a set of air-slides and bucket elevators.

4.2.11 CEMENT DISPATCH

4 x 120 tph electronic 8 spout packers have been considered. 2 x 200 tph mobile loading spouts for filling of tank wagons (bulk loading).

5. BASELINE ENVIRONMENT

5.1 PREAMBLE

In order to assess the baseline environmental status in the study area, site visits were made and a comprehensive data collection program was undertaken during the study period. The environmental components considered include:

- Physical/Chemical components: soil, geology, surface/ground water resources, water/air quality, noise and climatology.
- Land use, vegetation, forestry, wildlife and archeology.
- Biological environment: which include flora i.e. trees and grasses, fauna i.e. fish, hyper fauna, mammals, threatened and/or endangered species (plants/animals), species diversity, overall ecosystem stability, etc.
- Socio-economic components: distribution economics indicative of human welfare i.e. education system, transportation networks and other infrastructure like water supply, public services security, medical facilities and health impact.

5.2 GEOLOGY AND HYDROLOGY

5.2.1 TOPOGRAPHIC AREA

The area is located on the right hand side of Kirkuke - Sulaimaniah highway, 30 km from Sulaimaniah and 70 km from Kirkuke. The area is mountainous with high relief, extends from Northwest to Southeast. Small valleys spread in the area in the same direction NW-SE and supplied with water from springs that present in the area.
The highest level on the top of the area (mountain) is 975 meter above the sea level and 150 meter above the main road.
Some valleys are located near to the plant site but isolated by limestone scraps.
A lot of fresh water coming from natural springs are found in the area.

5.2.2 STRUCTURE OF THE AREA

The area is composed of symmetrical anticline folds dip to SW direction.
Limps of folds are broken down by several local small faults.

5.2.3 STRATIGRAPHY OF THE AREA

Kolosh, Sinjar, Gercus, Pila spi, these Formations by recent deposit of different origin and thickness, playing an important role in the rate of infiltration of surface water and recharge potential.

A)- SINJAR FORMATION:
It is underlain and overlain conformably by Kolosh and Gercus Formation respectively. Lithologically this formation is composed of thick, massive to well bedded gray limestone, in some location this formation contains the bands of chert and iron, In all location within the basin the formation is regard as a good aquifer especially where suitable topography and structure are available. The main effective porosity is fracture, joint and cavities in addition to some inter-granular porosity. A vertical section of Sinjar Formation in the basin and near by area shows many caves at the contact with underlying Kolosh Formation.

B)- KOLOSH FORMATION:
Predominantly composed of calc- black shale, thin layer intercalation of light blue marly limestone and thin layer of friable coarse grain sandstone. Also in the Bazian area Kolosh
Formation recognized by including layer of conglomerate within Kolosh Formation with (1-3m) Thickness.

C)- GERCUS FORMATION:
This Eocene unit overlies Sinjar Formation conformably. It is composed of alternation of thick massive beds of red silty claystone and thin to medium bedded sandstone with occasional lenses of conglomerate. Hydro geologically all the beds of this formation have the aquiclude characterize. The sandstone and conglomerate beds are also impervious as clay forming greywacke fill the interstices of the grain.

D)- PILA SPI FORMATION:
This upper Eocene unit is covering the side of the mountain or limbs of anticline, forming high peak, ridge and gorges. Lithologically this formation consist of well bedded, fine grained dolomitic limestone and occasionally changes to chalky limestone. Its thickness is variable and changes between 50-150 m. the stratigraphic relation of the formation with the underlying Gercus Formation is observed to be conformably in some geographic localities and unconformable in the other. The main porosity is fracture, joint and cavities. Due to presence of large solution cavities in the area out side the basin (darbandikhan) this formation conceder to be fissured karstic aquifer. Some of wells drilled in this formation are characterized by artesian nature and that returned to the fact that the formation is sandwiched between the two impervious beds of lower Fars Formation and Gercus Formation from above and below.

E)- RESENT DEPOSIT:
The area is composed of:
A) Delluvial deposit is composed of destroyed blocked of marly limestone block and mixed with secondary calcite (Travertine) and brown clay maximum thickness (5m).
B) Alluvial deposit consists of limestone fragment and gravel, sand, silt, brown clay estimated thickness randomly (70-80 m) specially in the flat area for Bazian Cement
Factory.

5.2.4 HYDROGEOLOGY:

WATER SPRINGS QUALITY IDENTIFICATION

WATER SPRINGS SAMPLES LOCATION

Sample 1: **N 35° 36' 19"**
E 45° 05' 32.7"
Z 861 m

Sample 2: **N 35° 36' 19.2"**
E 45° 03' 57.6"
Z 874

Chemical Examination of Water Springs

CHARACTERISTIC	*SAMPLE 1*	*SAMPLE 2*	*MAX. PERMISSIBLE LEVEL*
Turbidity	0	0	25 F.TU
pH	7.5	7.6	6.5 – 9.2
Acidity as ($CaCO_3$)	Nil	Nil	-
Alkalinity as ($CaCO_3$)	170	210	200 ppm
Total Hardness as ($CaCO_3$)	160	220	500 ppm
Calcium as (Ca^{2+})	48	56	200 ppm
Magnesium as (Mg^{2+})	10	19.5	150 ppm
Chloride as (Cl^{-1})	4	9	250 ppm
Sulfate as (SO_4^{-2})	2.2	13.5	250 ppm
Sodium as (Na^{+1})	9.1	7	200 ppm
Potassium as (K^{+1})	0.31	0.41	3.0 ppm
Total Dissolved Salts (TDS)	242.5	328.3	1500 ppm
Total Suspended Solids (TSS)	0.0242	0.0328	-
Residual Chlorine (Cl_2)	0	0	1.0 ppm

BACTERIOLOGICAL EXAMINATION OF WATER SPRINGS

CHARACTERISTIC	*SAMPLE 1*	*SAMPLE 2*
T.B.C. (Total Bacteria Count)	$5*10^2$ cell/ml	$15*10^2$ cell/ml
Fungal Count	5 f.f.u/ml	6 f.f.u/ml
Coliform Count	240 MPN/100ml	460 MPN/100ml
BOD (Biological Oxygen Demand)	1.5 mg/L	1.5 mg/L

Note: f.f.u – Fungal Forming Unit, MPN – Most Probable Number

HYDROGEOLOGICAL REPORT FOR KHALDAN SUB-BASIN / BAZIAN AREA

Reference Made To Nokan Company/Unit Of Drilling Deep Well And Geological Consultant

For understanding the Bazian basin should be separated into two sub-basins:
A)- Bainjan-Bazian sub basin.
B)- Khaldan - sub basin.

Khaldan - sub basin:
Predominately consist of Pila spi Formation (u. Eocene) recognized by highly fractural and jointed limestone, which developed to karstic aquifer the estimated thickness of this Formation inside the syncline about (82) m. This Formation underlying by Gercus Formation
(M.U. Eocene) (Impermeable layer) which consider as aquiclude aquifer.
The Sinjar Formation (Paleocene-L. Eocene) underlying by Kolosh Formation (Paleocene- L. Eocene) impermeable layer black shale.

According to collected data from the geological and hydrological data this area specially the place of (Cement Factory) consist of:

A)- Karstic Aquifer: Sinjar Formation represents this type of aquifer (confined aquifer) that has a good yielding amount of water and water quality is C2-S1 (according to Anderson
1993 classification) (medium - low sodium) water.

B)- Inter granulla (unconfined aquifer): recent deposit characterized by a good amount yielding, the important point of view this recent deposit especially in the cement factory underlying by impermeable layer of Kolosh Formation.

TECTONIC:

After the Laramide orogeny at the end of cretaceous period, new subside basin is developed which represent by flysh like deposit as Kolosh Formation. By the end of Paleocene,
Several ridge are developed within this depositional basin, along this ridge reefal carbonate faces was generated known as Sinjar Formation. Pyrenean orogeny affected.
The previous sequence up lifted then as anticline structure and two conjugated sets of joints.
During early Eocene anew phase of sea transgression covered this area and started by deposition of clastic Gercus Formation and ended by lagoonal carbonate faces of Pila spi Formation. The Van phase orogeny by the end of Eocene uplifted all the mentioned sequence.
As a result, refolded fold occur such as Hanjera, Khaldan and Tasluja Mountain, they are also subjected to intensive stress leads to development of Bazian strike slip Fault parallel to
Bazian anticline structure, as well as diagonal Bainjan fault which is responsible for generation of subsided Bainjan -Bazian sub basin. In this sub basin the thickness of recent deposit ranged between (57-130) m (valley

polysyngenetic sediment). The northern and southern boundaries are affected by several faults. During Paleocene -Eocene period, the main structural features, associated by narrow and relatively hanged synclines such as Khaldan

TYPE OF AQUIFERS

1)- QUATERNARY AQUIFER:

This type of aquifer consists of recent river deposit (alluvial), mainly sand and clayey sand gravel reach to boulder with the thickness ranging from 25-110 m. The aquifer is often unconfined and contains fresh water.

2)- SINJAR FORMATION:

Generally composed of Karstic limestone and marly limestone, this means the type of aquifer which producing in this formation is karstic aquifer. Kolosh Formation generally defined as aquiclude, but in the Bazian area this formation (Kolosh) recognized by presence of conglomerate layer, which found with thickness (l-2) m this cause producing (inter-granullar aquifer). Further to presence limestone Sinjar Formation beds inter-fingering with Kolosh Formation beds, in this case the type of aquifer is karstic aquifer.

EXPLANATION:

During the drilling process for these three 'wells which drilled inside the Bazian Cement Factory area these point are observed:

1)- WELL NUMBER ONE

The thickness of Delluvial recent from beginning of drilling is two meter thickness and till depth 78 m we have the weathered Karstic yellow marly limestone recognized by Sinjar Formation but the important point of view is from depth (59) m we drilled by blind drilling that mean we reached the karstic aquifer after finishing the drilling the static water level is arrived to 45-25 that mean the type f aquifer hydrogeologically is karstic aquifer and confined aquifer.

2)- WELL NUMBER TWO:

Its near the well number one the depth of this well is (111) m and the important point of view is the apparent thickness of Sinjar Formation in the limb of Sinjar Formation in the upper side of cement factory is (89) m after that we reached the contact between Sinjar Formation and Kolosh Formation (conformable contact) thickness about (8m-9m), that consist of marly limestone and secondary calcite horizon.
The presence of several faults in the area with presence of water in the aquifer may cause damage and deformation of all beds and (sink hole) are occurred in the area between the failed well (20m) and well two toward well number one this sink hIe mean subsidence and lowering this area with all associated feature that may cause filling all joint and fracture by clay a impermeable sediment and making obstacle (sediment permeable) to move water and migration of ground water movement toward the margin of the basin (well number one, well number three) the indication of this presence discontinuous bed of limestone from well one to well three and rupture bed located in the area of well two failed well and that cause change in flow direction of ground water to ward (down ward) the valley in recent deposit and water presence in the old well (30m)(private well) in addition to presence of springs.

3)- WELL NUMBER THREE:

located near the local plunging formed by Sinjar ridge we expect that the karstic aquifer in this side second aquifer separated from the local aquifer for well number one. The drilling continuous till (5m) the static water table is (26A5m) the yielding more than 10 L/sec for period more than (4-5) hours with out draw dawn (0.4 m) that mean the dynamic water level reached to (26.85m)

Hydro-geological expect:

For future the drilling deep well should be:
1)- Toward the north or north western of the cement factory place (edge of flat area) near around the well number one from toward north to north western direction. Directly on the Sinjar Formation.
2)- Toward the north to north eastern of well number three directly on Sinjar Formation.
3)- Drilling deep wells directly in flat area of cement factory especially in the recent deposit till reaching the Kolosh Formation.

DATABASE FOR DRILLING DEEP WELLS INSIDE THE BAZIAN CEMENT FACTORY

S.N	Site	Coordination	Depth (M)	S.W.L (M)	D.W.L (M)	Q L/Sec	Protective pipe (14")	Design of well	Type of pump
1	Cement Factory well number one	X: N 35° 36' 696" Y: E 45° 04' 321" Z: 2955 ft	78 m	45.25	45.25	8	(5)m	Open hole	Grund fos Rpm=2840
2	Cement Factory well number two	X: N 35° 36' 636" Y: E 45° 04' 429" Z: 2945 ft	111 m	41.3	63	2.8	(5)m	Open hole	Grund fos Rpm=2840
3	Cement Factory well number three	X: N 35° 36' 21" Y: E 45° 04' 698" Z: 2865 ft	50 m	26.45	26.85	10	(10)m	Open hole	Grund fos Rpm=2840

CLASSIFICATION OF WATER QUALITY ACCORDING ANDERSON 1993

Well name	Ca^{+2} mg/l	Mg^{+2} mg/l	Na^{+} mg/l	Class Define of Sodium	Total hardness	PH	T.D.S	SAR	EC, in µmohs/cm at 25^0	Class conductance
Cement factory deep well No.1	42.2	25.8	2.23	Excellent	212 (fresh water)	7.5 (Common range for most natural water)	398.7 (fresh water)	C2 – S1	623	**Good**
Cement factory deep well No.2	36	40.3	4.1	Excellent		8.1 (Common range for most natural water)	398 (fresh water)	C2 – S1	622	**Good**
Cement factory deep well No.3	44	29.6	2.31	Excellent	234 (fresh water)	7.7 (Common range for most natural water)	385 (fresh water)	C2 – S1	603	**Good**

Note: C2= Medium salinity water
S1= Low sodium water
Note: The water classified by Anderson 1993 for multi purpose used water and after classification the water for all deep well that drilled in the cement factory are suitable for human drinking and industrial uses.

CHEMICAL ANALYSIS FOR BAZIAN CEMENT FACTORY

Well name	PH	EC, in µmohs/cm at 25^0	Acidity as caco3	Total Hardness as caco3	Alkalinity as caco3	Ca^{+2} mg/l	Mg^{+2} mg/l	Cl^- mg/l	Na^+ mg/l	K^+ mg/l	T.D.S	T.S.S
Cement factory deep well No.1	7.5	623	Nil	212	190	42.2	25.8	9	2.23	0.11	398.7	0.0398
Cement factory deep well No.2	8.1	622	Nil	256	200	36	40.3	11	4.1	1.01	398	0.0398
Cement factory deep well No.3	7.7	602	Nil	234	140	44	29.6	12	2.31	0.21	385	0.0385

CONCLUSION:

1)- The main structure of area is asymmetrical syncline. The drilling of deep wells is suitable generally in the area from edge upper side of cement factory (north to north western) and (north to north eastern) expects the distance between the well number one and well number three from the edge line of the cement factory place.

2)-The flat area (recent deposit):
Compose of accumulation of destroyed block for Sinjar Formation and mixed with brown clay which accumulated during the late of Eocene and early Miocene that formed the inter-granular aquifer.

3)- Drilling deep well in the Gercus Formation (thin thickness in the area) estimably (25-30m) Thickness continental deposit should be continued till you reached the Sinjar Formation. The Gercus Formation in this area like a impermeable cover for Sinjar (karstic) Formation.

4)- Water quality is suitable for multipurpose (industrial, irrigation, human domestic)

5)-The direction of ground water movement is toward north –to- northwestern direction and the second direction is north-to-northeastern direction, but the recent deposit is accumulated from the movement in each direction of Sinjar and Gercus Formation.
6)- The important point of view is in this area the ground water is recharging the surface water and evidence of this case is the static water table inside the well move higher from the Khaldan stream.

It's clear that the project will be designed and operated without negative effects for the other water users in the area.

5.3 SOIL QUALITY

Seven samples were taken randomly within the project area.

Sample ID	Location	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	Na_2O	K_2O	Cl	LOI
		%	%	%	%	%	%	%	%	%	%
S1 04/06	**N 35° 36' 24.5'' E 45° 04' 46.2'' Z 896 m**	35.30	5.80	3.42	24.79	4.27	0.020	0.00	0.58	0.008	26.51
S2 04/06	**N 35° 36' 22.5'' E 45° 04' 46.7'' Z 894 m**	43.50	11.37	6.28	11.95	2.96	0.016	0.00	1.32	0.007	17.89
S3 04/06	**N 35° 36' 22.4'' E 45° 04' 36.6'' Z 890 m**	45.63	11.56	6.58	11.87	3.13	0.017	0.00	1.24	0.015	17.43
S4 04/06	**N 35° 36' 23.8'' E 45° 04' 21.8'' Z 891 m**	49.93	8.31	4.87	13.97	4.37	0.006	0.00	0.87	0.006	18.99
S5 04/06	**N 35° 36' 26.6'' E 45° 04' 23'' Z 891 m**	43.84	10.40	5.71	15.42	2.84	0.012	0.00	1.16	0.010	20.22
S6 04/06	**N 35° 36' 41.9'' E 45° 04' 10'' Z 906 m**	36.20	9.28	5.59	20.18	3.87	0.022	0.00	0.98	0.016	24.22
S7 04/06	**N 35° 36' 27.5'' E 45° 04' 7.2'' Z 901 m**	43.40	10.46	6.10	15.82	3.99	0.021	0.00	1.28	0.004	20.99

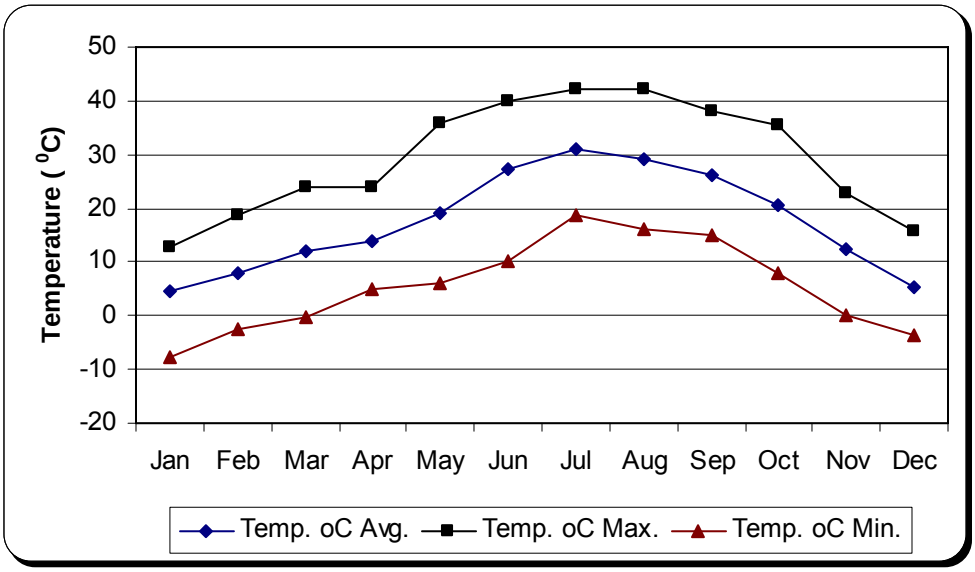
5.4 CLIMATE

This region falls within the Mediterranean climate, cold rainy in winter and dry hot in summer.

TEMPERATURE AND HUMIDITY

The maximum temperature is about (42 °C) and the minimum temperature is about (-7.8 °C).
Based on a daily measurements consisting of a monthly average, maximum and minimum temperature and humidity ranges.
Source: FAO REPRESENTATION IN IRAQ
FAO Coordination Office for Northern Iraq – Bazian Station 2002

Month	Temp. °C			Relative Humidity %		
	Avg.	Max.	Min.	Avg.	Max.	Min.
Jan	4.4	12.9	-7.8	81	100	33
Feb	8	18.9	-2.5	64.1	100	26
Mar	11.9	24.1	-0.1	62.3	98	20
Apr	13.7	24	5	69.4	97	27
May	19.1	36	6.1	52.6	96	24
Jun	27.2	40.1	10.3	35	64	20
Jul	30.9	42	18.8	32	44	22
Aug	29.3	42	16	32.9	46	22
Sep	26.1	38	15	35	56	22
Oct	20.5	35.3	8	49	100	23
Nov	12.4	23	0	51	100	18
Dec	5.3	15.8	-3.6	77	100	35



RAINFALL

The following table shows the data available for rainfall during 2002 and 2003 in Bazian.
The annual total rainfall in Bazian is about 950 mm.

Day	2002								2003				
	Jan	Feb	Mar	April	May	Oct	Nov	Dec	Jan	Feb	Mar	April	May
1	0	0	0	0	0	0	45.2	0	0	0	0	0	0
2	9	0	0	7.4	0	0	52.2	0	0	0	0	0	0
3	14.5	0	0	8	5.7	0	0	0	0	1.9	5	0	0
4	46	0	0	7.3	0	0	0	0	9.8	0	4.7	0	0
5	0	0	0	11.2	1.1	0	0	0	30.5	0.8	0	0	0
6	3.5	0	0	0.5	0	0	0	0	0	0	17	0	0
7	64.3	0	0	0.8	0	0	7	7	0	0	1	1	0
8	1.2	0	0	6.8	0	0	0	73	0	0	0	0.3	0
9	2	0	0	0	0	0	4.2	4.2	0	0	0	0	0
10	1.2	0	0	0	0	0	0	0.5	0	10.6	0	0	0
11	0	0	0	0	0		20	20	0	0.6	0	0	0
12	1	17.8	0	0	0	0	2.2	2.2	0	0	16	0	0
13	0	1.6	0	2.9	0	0	3.3	3.3	0	52.7	8.7	0	0
14	0	13.3	0	0	0	0	0	0	1.7	5.8	0	0	0
15	0	1	2.8	0	0	0	0	0	14.7	10	0	3.5	0
16	0	0	0	2.1	0	0	0	1	0	8	0	12.1	0
17	0	0	0	0	0	0	1	15.5	0	0	0.8	0	0
18	0	0	29	9.1	0	0	0	39.9	0	13	11.7	0	0
19	0	0	52.1	19	0	0	0	85.5	0	10	7.5	0	0
20	0	0	0.7	0	0	0.8	0	13	0.4	6.7	12	0	0
21	0	0	7.3	9.2	0	1	0	0	5	7.5	0.3	0	0
22	0	0	13.9	6	0	0	0	0	0	7	0.8	0	0
23	21.5	0	18.7	0.4	0	0		0	0	0	0	0	0
24	23.3	0	0	3.1	0	0	0	10.9	0	4	4.3	0	0
25	0	1	0	1.3	0	0	10.9	0	0	0.4	20.9	0	0
26	0	0	0	0	0	0		0	22	28.6	31.9	0	0
27	0	6.7	2.3	0	0	0		0	35	0	1.1	7.7	8
28	0	0	0	0	0	0		0	1.3	0	0	12.7	0
29	48.9	0	1.3	0	0	0.2		0	0	0	0	0	0
30	1	0	6.1	0	0	0.2		0	0	0	0	0	1
31	0	0	13.8	0	0	0		0	0	0	0	0	3
Total	**237.4**	**41.4**	**148**	**95.1**	**6.8**	**2.2**	**146**	**276**	**120.4**	**167.6**	**143.7**	**37.3**	**12**

5.5 METEOROLOGY AT PROJECT SITE

The meteorological parameters have been monitored. The measured climatic condition of the project area is as summarized in the following table

Point	*Location*	*Atmospheric Pressure (mbar)*	*Ambient Temperature (°C)*	*Relative Humidity (%)*	*Wind Speed (m/s)*	*Wind Direction*
1	N 35° 36' 22.1" E 45° 04' 57.9" Z 896 m	918	35.8	17	2.26	SE
2	N 35° 36' 30.2" E 45° 04' 41.3" Z 909 m	914	37	13	1.55	SW
3	N 35° 36' 21.6" E 45° 04' 41.4" Z 894 m	914	35	14	3.19	SW
4	N 35° 36' 22.4" E 45° 04' 15.2" Z 886 m	912	33.2	16	2.59	SW
5	N 35° 36' 29.8" E 45° 04' 10.6" Z 901 m	911	30.9	14	3.45	SW

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5.6 AMBIENT AIR QUALITY

The potential air contaminants addressed in this study are nitrogen oxides, Sulphur oxides, carbon monoxide, particulate matters, oxygen and VOC.
The applicable World Bank's limits are presented in the following table

Pollutant	***World Bank Limit for Plant***	***World Bank Limit for Mine***
Particulate Matter	50 µg/m^3 annual arithmetic mean 70 µg/m^3 Max. 24-hour average	100 µg/m^3 annual arithmetic mean 500 µg/m^3 Max. 24-hour average
Nitrogen oxides	150 µg/m^3 Max. 24-hour average	100 µg/m^3 annual arithmetic mean 200 µg/m^3 Max.24-hour average
Sulphur dioxide	50 µg/m3 Annual arithmetic mean 125 µg/m^3 Max. 24-hour average	100 µg/m^3 annual arithmetic mean 500 µg/m^3 Max.24-hour average

METHODOLOGY

Sampling and testing of the chemical constituents of atmospheric pollutants were carried out using:
Passive samples for (SO_x, NO_x), solid adsorption/solvent extraction and gas chromatograph/mass spectrometer GC/FID for VOCs, electrochemical sensor gas monitor for (O2, CO), and portable laser photometer for PM10.
The results are given in following tables

Point	***Location***	SOx (µg/m3)	NOx (µg/m3)	CO (PPM)	O2%	PM10 (µg/m3)
1	N 35° 36' 22.1" E 45° 04' 57.9" Z 896 m	22.03	4.37	< 1 ppm	21	146
2	N 35° 36' 30.2" E 45° 04' 41.3" Z 909 m	20.30	4.49	< 1 ppm	21	34
3	N 35° 36' 21.6" E 45° 04' 41.4" Z 894 m	21.00	4.22	< 1 ppm	21	65
4	N 35° 36' 22.4" E 45° 04' 15.2" Z 886 m	19.51	4.27	< 1 ppm	20.9	69
5	N 35° 36' 29.8" E 45° 04' 10.6" Z 901 m	19.80	4.32	< 1 ppm	21	69

AMBIENT AIR MONITORING (VOC's)

#	Pollutant	Concentration (µg/m3)
1	1,1dichloroethene	5.74
2	Dichloromethane	ND
3	t-1,2-dichloroethene	ND
4	c-1,2-dichlooethene	ND
5	Chloroform	ND
6	1,1,1-trichloroethane	ND
7	Carbon tetrachloride	ND
8	1,2-dichloroethane	ND
9	Benzene	0.82
10	Trichloroethene	ND
11	1,2-dichloropropane	ND
12	Bromodichloromethane	ND
13	c-1,3-dichloropropene	6.56
14	Toluene	3.28
15	t-1,3-dichloropropene	ND
16	1,1,2-trichloroethane	ND
17	Tetrachloroethene	ND
18	Dibromochloroethane	ND
19	Xylene	2.9
20	Bromoform	ND
21	p-dichlorobenzene	16.89
22	Ethyl benzene	0.41
23	Styrene	0.82
24	Bromobenzene	6.97
25	1,3,5-trimethylebenzene	2.05
26	1,2,4- triethylebenzene	1.85
27	N-Butyl benzene	6.97
28	Naphthalene	6.85
90	p-Isopropyletoluen	4.92
30	1,2,4 trichlorobenzene	11.89

5.7 NOISE LEVEL

Noise from the project is expected to be from stationary and mobile sources/equipment especially noise from ancillary operations e.g. generators, compressors, construction activities, noise from cars and trucks.
The noise levels as recorded within the project area range from 34.6 Db to 42.1 Db.

5.8 TRAFFIC MOVEMENT

The total roads length in Bazian region is 118.8 km.

- 63% of these roads are paved (75 km) and 37% are unpaved (43.8km).
- The average traffic on the main road (Sulaimaniah – Kirkuke) is 950-1100 cars and 2400-2500 trucks per day.

The following table describes all the roads present; it's length, and pavement condition at Bazian region.

#	Road	Road length (km)	Pavement condition
1	Sulaimaniah-Kirkuke (2 ways)	15	Paved
2	Bazian-Deleza-Sankaw	30	Paved
3	Kubalah-Gamirigan	30	Paved
4	Bazian- Kweek	1.7	Unpaved
5	Bazian Be Be Jack -Bakh	12	Unpaved
6	Tainal quarry- Murtaka	5.5	Unpaved
7	Tainal quarry- Hayasi Julmak	3.5	Unpaved
8	Payenjan-Allah Koly	4.5	Unpaved
9	Mafrak Deblejah-Hanjera	15	Unpaved
10	Mafrak Hanjera-Ibarahim Aawa	1.6	Unpaved

5.9 RADIATION LEVEL

The radiation level within the project location and the quarry site was measured and found to be generally very low (< 1.0 μS/hr).

5.10 LAND USE PATTERN

The project site will cover an area of 500,000m². Approximately 26,000m² (5.2%) of the land designated for the plant site is under rain-fed cultivation of barley yielding one crop per year. This land was farmed by former residents of neighboring villages , which were destroyed by the former regime in 1988, who have since dispersed to surrounding villages or the town of Sulaymaniyah. The rest of the designated plant and quarry sites are barren, rocky hillside providing intermittent grazing for domesticated livestock. The site of the proposed clay quarry is likewise barren, uncultivated and uninhabited.

The project area is located in the Kurdish area of northeastern Iraq, south of the Kirkuke - Sulaymaniyah highway, 30 km from Sulaymaniyah and 70 km from Kirkuke. The area is mountainous with high relief, which extends from Northwest to Southeast. The highest level on the top of the area (mountain) is 975 meter above the sea level and 150 meter above the main road. Some valleys are located near to the plant site but isolated by limestone scraps.

Bazian itself covers an area of 145,825,000m² including 132,914,000m² of government-owned land and 12,910,000m² of family owned land. Bazian is an agricultural area having 53,461,000m² (37% of Bazian's area) of agricultural land including 44,125,000m² of agriculture from rain and 9,336,000m² of agriculture from irrigation. Crops included are: wheat, barley, lentil, chickpeas, sunflower and tobacco, along with summer and winter vegetables alongside with fruits including apples, pears and quince.

- There is 10,112,000m² (7% of Bazian's area) of rocky land that is not suitable for agriculture
- There is a grazing area of 44,615,000m² (30% of Bazian's area)
- There is 2,904,000m² (2% of Bazian's area) of land with trees and fields
- There is 2,712,000m² (1.8% of Bazian's area) of jungle land
- There is 4,426,000m² (3% of Bazian's area) of residential land

5.11 VEGETATION

Methodology

The University of Sulaimaniah supported the required EIA study for the proposed cement plant in Bazian through Biologist professors from its colleges of science and agriculture to cover the Vegetation and wild life base line environment. A detailed study was undertaken with a view to identify and describe the vegetation types of the plant site and surrounding area. A visual inspection of the plant site and nearby area was done to gain an overall impression of the plant species in the study area. Unidentified species were collected and taken to the university for identification. The university professors used the following references during the study:

1. Amin, Aumeed Noori, 2005, Policy Dialogue Model for The Future Of AgricultureActivities In Iraqi Kurdistan 2000-2025, In Press.
2. Flora of Iraq, 1966-1985, Vol. 1, 2, 3, 4, 8, 9, Ministry of Agriculture & Agrarian Reform, Baghdad, Iraq.
3. 3Tikriti, R.A., T.Y. Ruziq, and H.A. Rumi, 1981, Forage Crops & Pasture, University of Musal Press
4. Chakravarty, H., 1976, Plant Wealth Of Iraq, Vol. 1, Ministry of Agriculture & Agrarian Reform, Baghdad, Iraq. India Press.
5. IUCN Red Book, Internet web site.
6. Tylor, T. & J. Gerared, 1980, General Biology, 2nd Ed, EWP.
7. www.slate.com/id/2108823

Findings

The proposed plant region mostly is of sub marginal in sustainability for economical agricultural production. In addition, most of the region is of low mountain formation. The soil there is brown, cultivated through rain fed during the wet season from October- June, mostly with common wheat (Triticum aestivum), durum wheat (T. durum), barley (Hordeum vulgare), chickpea (Cicer arietinum), lentil (Lens culinare), and sunflower (Helianthus annus).

During the summer, rice and summer vegetable are cultivated in limited farms. The region is classified according to the amount of precipitation during the wet season as a semi wet climate of 720 mm/year as an average. During the dry season, the climate is characterized by a very hot and dry weather conditions, which resulted in a very low carrying capacity for the flora Vegetation, member of the fauna and wild life. Herding small group's animals such as sheep's and goats are common in the vicinity of the region.

The flora of the region is consisting of a group of annual vegetation, with no perennial shrubs or trees of any kinds. These vegetations are of winter habitat, and mostly finish live cycle at the end wet season in June. The most common of the flora in the region are cool season Mediterranean weeds in the cultivated winter fields. Even though, part of the vegetation is economically part of the pasture species of the region and suitable for grassing. The most common flora of the area in density is:

Sn	Common Name	Scientific Name
1	Wild barley	Hordeum bulbosum, and H.geniculatum
2	Wild oats	Avena clauda, A.fatua, and A.ludoviciana
3	Bermuda grass	Cynodon dactylon
4	Meadow grass	Poa bulbosa
5	Several legume trefoils	Medicago spp, Triflium spp, Melilotus spp, Vicia spp, Lathyrus spp
6	Iberian star thistle	Centaureacalcitrapa
7	Syrian seabious	Caphalaria syriaca
8	Common bishops	Ammi majus, and A. visnaga
9	Wild mustards	Sinapis arvensis
10	Cow cockle	Vaccaria pyramidata
11	Pale starthistle	Centaurea pallescens
12	Wild safflower	Carthamus oxyacanthus
13	Italian thistle	Carduvs pycnocephalus),
14	Globe thistle	Prosopis faracta

And some other minor weeds

As indicated with Sulaimaniah university literatures regarding the Flora of Iraq, the Flora of Turkey, and the Flora of Iran, all the vegetation of the area of Bazian, and Sulaimani Governorate, none of the above species are rare, or endangered or will be threatened by any activities concerning the establishment of a cement factory. In addition, Sulaimaniah university reported that the proposed location in the area specifically, and the region generally does not contain any endangered flora.

5.12 WILD LIFE

As mentioned before, The University of Sulaimaniah supported the required EIA study for the proposed cement plant in Bazian through Biologist professors from its colleges of science and agriculture to cover the Vegetation and wild life base line environment. The harsh weather conditions of the region have influenced the nature of both, the flora and the fauna present in the region. The wild life present in the region is consisted of the following species:

Sn	Common Name	Scientific Name
1	House or field mousse	Mus musculus, and Psendomys fieldi
2	Wolfs	Canis lupus
3	Foxes	Urocyon cinercoaregnteus
4	Rabbits	Oryctolagus cuniculus
5	Sparrow	Passer domesticus
6	Black rat Snakes	Elaphe obsoletaobsoleta
7	Kurdistan viper snake	Vipera raddei
8	Lizard	Teratoscincus keyzerlingi
9	Yellow scorpions	Leiurus quinquestrainus
10	Black scorpion	Androctonus crassicauda

In addition to many species of insects

Sulaimaniah University reported that all above wild life species are not of endangered, rare or threatened fauna. In addition, there are no any migratory species of any kind in the region.

5.13 SOCIO-ECONOMIC STATUS

The socio-economic survey is the available information acquired from the Iraqi Authorities, Kurdistan Governorate and was carried out to provide a baseline data on the socio-economic status of inhabitants around the proposed plant.

FINDINGS

SOCIAL ORGANIZATIONS

- Agriculture and breeding are the principle of the inhabitants and crops cultivated includes barley, wheat, rice, lintel, chickpea, vegetables, and sunflower.
- There are four Kurdish clans in Bazian; the Homond Clan, Shinki Clan, Minmi Clan and Kafroushy Clan, all which follow the Iraqi laws in their entire lifestyle.
- The dominant religion is Islam.

DEMOGRAPHIC STRUCTURE

The population structure of Bazian is collected from the authority and presented in the following table:

Population Distribution in Bazian

No .	District	Village	Males	Females	Total	Families	Houses
		Be Be Jack Koran	0	0	0	0	0
1	Be Be Jack	Be Be Jack Samakan	4	6	10	1	1
		Klash Kirani Kiwarah	0	0	0	0	0
2	Klash Koran	Klash Kirani Bajouk	0	0	0	0	0
3	Solaymaniya Korda	Solaymaniya Kurda	60	50	110	20	22
		Ellahi Sero	0	0	0	0	0
		Ellahi Khowaro	34	33	67	8	9
4	Ellahi	Mira Di	42	38	80	12	8
5	Kweek	Kweek	22	26	48	8	8
		Tabbah Shwan Kari Kiwarah	0	0	0	0	0
		Tabbah Shwan Kara	0	0	0	0	0
		Kani Kiwarah	0	0	0	0	0
		Tasluja	0	0	0	0	0
		Twiawilia	0	0	0	0	0
6	Tabbah Shwan	Kosh Kaya	42	48	90	12	12
7	Kosh Kaya	Kani Binge Sham	0	0	0	0	0
8	Kani Shaya	Kani Shaya	14	16	30	5	6
9	Dari Killy	Dari Killy	230	210	440	70	65
		Darkazin Hamawind	0	0	0	0	0
10	Darakzin	Darkazini Baba Ali	0	0	0	0	0
11	Balajo	Balajo	44	38	82	11	46
12	Sheikh Mand	Sheikh Mand	42	47	89	14	14
13	Darband Sowato	Darband Sowato	0	0	0	0	0
14	Latif Awah	Latif Awah	0	0	0	0	0
		Mahmoudia	82	78	160	26	21
		Zeekia	58	62	120	20	27
		Hala Sirjawa	100	110	210	30	36
		Hala Mam Kadir	72	68	140	30	47
15	Hala w Mahmoud	Hala Hajji Rashid	66	64	130	14	33
16	War Miziyar	War Miziyar	50	48	98	15	30

No.	District	Village	Males	Females	Total	Families	Houses
17	Kawany	Kawany	63	57	120	20	44
18	Biranan	Biranan	0	0	0	0	0
19	Baroy Kiwarah	Baroy Kiwarah	78	72	150	21	81
20	Elli Bazow	Elli Bazow	67	57	124	16	20
21	Baroy Bajouk	Baroy Bajouk	18	14	32	4	13
22	Bakka Janni	Bakka Janni	0	0	0	0	0
23	Satiar	Satiar	0	0	0	0	0
24	Juleek	Juleek	32	28	60	10	9
25	Kani Sheyatan	Kani Sheyatan	256	230	486	80	60
26	Barika	Barika	0	0	0	0	0
27	Allaho Kowli	Allaho Kowli	18	192	210	59	55
28	Lazian	Lazian	7	10	17	3	3
29	Sirjawah	Sirjawah	190	185	375	70	62
30	Bainjan	Bainjan	250	230	480	80	80
31	Khiotah	Khiotah	38	36	74	9	15
		Kehlakn	0	0	0	0	0
32	Hinjera	Hinjera	68	72	140	23	30
		Kani Smile	12	13	25	4	4
33	Nali Koran	Nali Koran	31	27	58	12	18
34	Mortico	Mortico	26	25	51	7	7
35	Komatah Kej	Komatah Kej	8	11	19	3	3
36	Oloo Balakh	Oloo Balakh	11	9	20	3	3
37	Baloolan	Baloolan	27	30	57	11	16
38	Ibrahim Awah	Ibrahim Awah	50	56	106	18	17
39	Khalidan	Khalidan	95	105	200	25	60
40	Be Be Jkeewis	Be Be Jkeewis	0	0	0	0	0
41	Hayasi	Hayasi Kon	0	0	0	0	0
		Hayasi Iskan	0	0	0	0	0
Total	**41**	**58**	**2478**	**2401**	**4879**	**774**	**963**

ANALYSIS OF THE DEMOGRAPHIC STRUCTURE

The survey concluded the following:

- The male to female ratio is balanced. Males constitute 51%, while female constitute 49% of the population.
- The population density in Bazian is 33.45 person/km^2
- The average number of persons in one family in Bazian community is 6.3 persons
- The average number of persons occupying a household in Bazian community is 5.1 persons
- The minimum wage for employment in Iraq is US$100 per month
- The majority of households are made of mud bricks and wooden thatched roofs.

The project is located in the district of Hayasi (No. 41), which does not include any inhabitants due to its complete destruction by the former regime in March and April 1988.

OCCUPATION

Agriculture and shepherding are the principle occupations of the inhabitants in the Bazian community, representing about 70% of the total workforce, while the remainder are involved in governmental authorities, textiles and handmade carpet-making and nearby facilities in the Sulaymaniyah Governorate.

INFRASTRUCTURE FACILITIES, EDUCATION & HEALTH CARE

Medial Centers and Services in Bazian

No.	District	Village	School	Medical Center	Electricity	Drinking Water Station
		Be Be Jack Koran	0	0	0	0
1	Be Be Jack	Be Be Jack Samakan	0	0	present	0
		Klash Kirani Kiwarah	0	0	0	0
2	Klash Koran	Klash Kirani Bajouk	0	0	0	0
3	Solaymaniya Korda	Solaymaniya Kurda	present	present	present	present
		Ellahi Sero	0	0	0	0
		Ellahi Khowaro	0	0	present	present
4	Ellahi	Mira Di	0	0	present	present
5	Kweek	Kweek	0	0	present	0
		Tabbah Shwan Kari Kiwarah	0	0	0	0
		Tabbah Shwan Kara	0	0	0	0
		Kani Kiwarah	0	0	0	0
		Tasluja	0	0	0	0
		Twiawilia	0	0	0	0
6	Tabbah Shwan	Kosh Kaya	0	0	present	present
7	Kosh Kaya	Kani Binge Sham	0	0	0	0
8	Kani Shaya	Kani Shaya	present	present	present	present
9	Dari Killy	Dari Killy	0	0	present	0
		Darkazin Hamawind	0	0	0	0
10	Darakzin	Darkazini Baba Ali	0	0	0	0
11	Balajo	Balajo	0	0	present	present
12	Sheikh Mand	Sheikh Mand	present	0	present	present
13	Darband Sowato	Darband Sowato	0	0	0	0
14	Latif Awah	Latif Awah	0	0	0	0
		Mahmoudia	0	0	present	0
		Zeekia	0	0	0	0
		Hala Sirjawa	present	0	present	present
		Hala Mam Kadir	present	0	present	present
15	Hala w Mahmoud	Hala Hajji Rashid	0	0	present	0
16	War Miziyar	War Miziyar	0	0	present	0
17	Kawany	Kawany	0	0	present	0
18	Biranan	Biranan	0	0	0	0
19	Baroy Kiwarah	Baroy Kiwarah	0	0	present	0
20	Elli Bazow	Elli Bazow	0	0	present	0
21	Baroy Bajouk	Baroy Bajouk	0	0	present	present
22	Bakka Janni	Bakka Janni	0	0	0	0
23	Satiar	Satiar	0	0	0	0
24	Juleek	Juleek	0	0	present	0
25	Kani Sheyatan	Kani Sheyatan	present	present	present	present
26	Barika	Barika	0	0	0	0
27	Allaho Kowli	Allaho Kowli	present	0	present	present
28	Lazian	Lazian	0	0	present	0
29	Sirjawah	Sirjawah	present	present	present	present
30	Bainjan	Bainjan	present	present	present	present
		Khiotah	present	0	present	present
31	Khiotah	Kehlakn	0	0	0	0
		Hinjera	0	0	present	0
32	Hinjera	Kani Smile	0	0	0	0

No.	District	Village	School	Medical Center	Electricity	Drinking Water Station
33	Nali Koran	Nali Koran	present	0	present	present
34	Mortico	Mortico	present	0	present	0
35	Komatah Kej	Komatah Kej	0	0	0	0
36	Oloo Balakh	Oloo Balakh	0	0	present	0
37	Baloolan	Baloolan	0	0	present	present
38	Ibrahim Awah	Ibrahim Awah	0	0	present	0
39	Khalidan	Khalidan	present	present	present	present
40	Be Be Jkeewis	Be Be Jkeewis	0	0	0	0
41	Hayasi	Hayasi Kon	0	0	0	0
		Hayasi Iskan	0	0	0	0
Total	**41**	**58**	**13**	**6**	**33**	**18**

CULTURAL, HISTORICAL AND ARCHAEOLOGICAL FEATURES

Based on the survey that has been made with specialists in Sulaymaniyah University and the local residents, the project area does not contain any sites, structures or resources having archaeological, paleontological, historical or religious significance.

During the construction phase and the quarry operation, if any "chance findings" occur, the Project Manager shall immediately report to the Ministry of Tourism and Antiquities or any relevant governmental department of the finding(s) in order to advise on measures to be taken to ensure their preservation.

6. ENVIRONMENTAL IMPACT ASSESSMENT

6.1 PREAMBLE

This section of the report discusses the potential impacts from the project activities during construction and operation phases. This is in line with the guidelines of IFC.

The environmental and social impacts as well as occupational health and safety impacts are described in details. The necessary actions to be undertaken to mitigate and remedy or compensate for the predicted adverse impacts of the project on site are also illustrated.

Impacts may be:

- Direct impacts on natural and social systems as a direct result of the project
- Indirect impacts on natural and social systems that may be secondary or 'knock on' effects, including direct biophysical impacts that can lead to secondary social impacts and vice versa
- Cumulative impacts on natural and social systems that accumulate over time and space

The construction and operation phases of the proposed project comprise of various activities each of which has been considered to assess the impact on one or more environmental parameters as given below:

- Topography
- Climate
- Air quality
- Nose level
- Water quality
- Water resources
- Soil quality
- Vegetation
- Wild life
- Aquatic life
- Land use pattern
- Socio-economic
- Health & Infrastructure
- Employment

UCC is committed to use the best practices/ standards in the cement industry for dust suppression and safety measures during the construction and operation phase to mitigate the adverse impacts. The identification, prediction and evaluation of the associated and potential impacts are therefore presented as follows:

6.2 IMPACT DURING CONSTRUCTION PHASE

Construction activities will include preconstruction, preparatory construction, machinery installation, commissioning stages, and induction of manpower and startup. The impact due to construction phase would be regarded as temporary or short term.
Each activity during this phase has the potential for a variety of positive and negative environmental and social impacts. The details of activities and their impacts during construction phase are summarized in the following table

Component	Activities	Impacts
Movement of manpower, machinery and material	o Increase in traffic movement o Encroachment of area of parking and camping o Washing and maintenance of vehicles	o Potential health and safety risk due to increase in traffic and access to the construction site o Dust, gaseous pollutants emissions like SO_2, NOx, CO, VOC, HC o Noise and ground vibration, dust and dirt, visual effects o Soil contamination from fuels, oil, and other hazardous materials o Nuisance to cultural and aesthetic features o Job creation and business opportunities to local residents
Site clearing, leveling & excavation	o Heavy machinery & equipment operation o Removal of vegetation at site o Piling of soil o Storage of soil o Disturbance to ground water	o Disturbance to native vegetation and habitats o Change in land use pattern o Noise and ground vibration, dust and dirt, visual effects o Dust, gaseous pollutants emissions like SO_2, NOx, CO, VOC, HC o Nuisance of solid waste, soil contaminations, and wastewater o Job creation and business opportunities to local residents
Civil Construction	o Construction materials transportation and storage o Oil storage o Construction machinery and equipment operation o Waste materials storage o Water resources usage	o Noise and ground vibration, dust and dirt, visual effects o Dust, gaseous pollutants emissions like SO_2, NOx, CO, VOC, HC o Nuisance of solid waste, soil contaminations, and wastewater o Job creation and business opportunities to local residents

Component	Activities	Impacts
Mechanical construction	o Transportation of equipment, metal sheets etc. o Cutting and welding works o Oil storage o Waste material storage	o Dust, gaseous pollutants emissions like SO_2, NOx, CO, VOC, HC o Noise and ground vibration, dust and dirt, visual effects o Nuisance of solid waste, soil contaminations, and wastewater o Job creation and business opportunities to local residents
Camp	o Temporary accommodation construction o Supply of fuel and other material o Supply domestic water o Storage of domestic waste o Medical facilities o Supply the electricity	o Disturbance to existing nearby land users creating visual impact in vegetated area o Dust, gaseous pollutants emissions like SO_2, NOx, CO, VOC, HC o Nuisance of solid waste, soil contaminations, and wastewater o Nuisance to cultural and aesthetic features o Job creation and business opportunities to local residents

6.2.1 ENVIRONMENTAL IMPACTS

CLIMATE

Climate change is affected by emissions from vehicles using fossil fuels (as well as from other uses of energy from fossil fuels) and from clearing vegetation as a result of construction of roads. That will be limited in project site area and shall not adversely contribute to regional characteristics. Therefore there is no impact envisaged outside the plant location.

AIR QUALITY

Site clearing, vehicle movement and construction equipment operation are the sources of air emissions during the construction phase.
Dust during using heavy earth moving equipments and gaseous emission like SO_2, NOx, CO, and HC resulting from machinery and equipment operation could affect the degradation of the air quality, but are expected to be limited to the working environment and are highly unlikely to affect the surroundings of the construction site. Necessary measures shall be taken to protect construction employees especially from dust inhalation.
Hence, the impacts on the ambient air quality during the construction phase will be moderate and temporary for short duration, reversible in nature and restricted to only a small area.

NOISE LEVEL

Construction machinery (such as pneumatic and hydraulic hammers) and earthmoving equipments (such as heavy dump trucks and front-end loaders) are considered the main sources of the generation of high noise levels during the construction phase. The workers in general are likely to be exposed to an equivalent noise level of 80-90 dB (A) in 8 hours shift. Precautions will be taken to protect the employees working close to noise sources. Use of proper protective equipments such as earmuffs and earplugs shall mitigate any adverse impact of noise to the workers. By using standard practice operation, these impacts can be minimized and made insignificant.
Impact on the noise levels will be temporary for a short term and reversible in nature.

WATER RESOURCES & QUALITY

The total water requirement during construction phase of the proposed plant is estimated as 250 to 300-m3/ day. The source of water will be from an underground well.
The wastewater generated during construction phase shall be mainly from domestic activities. The proper drainage system shall be constructed on site on a temporary basis at an early stage.

Salient features of water quality management comprise the following:

- Raw water quality shall be checked on regular basis for essential parameters as per World Health Organization (WHO) guidelines
- All the waste from the site shall be treated in the septic tanks provided
- All the debris resulting from the site shall be isolated from the waste water and disposed of separately
- A sediment trap shall be provided to prevent the discharge of excessive suspended solids
- An oil trap shall be provided in the drainage line to prevent contamination by accidental spillage
- Wash down area for cleaning of vehicles wheels shall be provided and wheel wash waste shall be drained properly
- No untreated discharge is to be made to water courses
- To prevent contamination from accidental spillage of oil, the storage areas will be bounded, inspected and cleaned at regular intervals

Minor adverse impact on water resources and water quality is anticipated during construction phase.

SOIL QUALITY & SOLID WASTE

- Clearing, excavation, topsoil removal, soil disposal, road construction and waste disposal could have adverse impact on the soil. Site cleaning and soil compaction could expose the soil to erosion by rainstorm therefore depleting the soil nutrients. Erosion can be minimized by, for example, replanting any exposed soils as quickly as possible.

- The main negative impacts of the overburden generated during the construction phase are related to poor location of topsoil and other stockpiles, which can affect the visual image of the site.

- Waste produced during the construction phase of UCC plant and/or quarry exploitation process will be primarily solid waste resulting from mechanical and electrical installation operations.
- Excavated soil, debris, metal waste and oil and grease from construction machines will be generated. Implementation of the solid waste management plan during this phase will prevent soil contamination at the plant site.

- Accidental spills could happen while re-fueling or servicing vehicles. Procedures for maintenance of equipment would ensure that this risk is minimized and cleanup response is rapid if any spill occurs.

- Lubrication waste oil shall be through the drain ports and stored in leak-proof steel drums. The waste oil drums shall be properly identified with labels showing what is contained both in local Kurdish, Arabic and English languages and shall be disposed of as per standard practice.

Hence the impacts shall be insignificant, reversible and for short duration only. The impacts shall be limited to the construction site only.

6.2.2 SOCIAL IMPACT

TRANSITORY POPULATION INCREASE

The potential for employment and access to new services will draw people to the area around the project site. On the positive side, there may be a temporary increase in the economic activity and employment for the local community as local skilled, semiskilled and unskilled laborers will get direct and indirect employment during the construction phase. The size of the construction workforce will be approximately 2000 workers, mainly locals from Sulaymaniyah City and Bazian. Local skills development, and the possibility of increased funding for public infrastructure due to population increase are also expected. Workers will be housed in Sulaymaniyah City in suitable accommodations where shelter, water supply and wastewater and sanitary waste control will be available.

LAND USE

The land was owned by the government and currently used by five local villagers (two using 90% and three using the remainder) for farming. The government has agreed to transfer the land in the name of UCC. The villagers currently farming on this land have been compensated by UCC a total of US$300,000, which is much higher than what other companies in the area have compensated other farmers for their land. There is no existing household on the land of the project and accordingly no household families are going to be physically or economically displaced or relocated.

The negative impacts of temporary population increase during the construction phase will be managed by:

- Employing engineers, construction workers and contractors from the immediate area
- Avoiding building permanent infrastructure, which will not be used after construction
- Providing new amenities if the local infrastructure is inadequate
- Obeying the local customs of the area
- Avoiding using workers from different areas if that could result in clan, ethnic or religious rivalry

INFRASTRUCTURE

The positive impacts of the development of the infrastructure will include providing aid to development in the community, and an increase in the standard of living.

The negative impacts of infrastructure development during construction may be managed by using infrastructure that can be easily dismantled after construction (if appropriate), and by developing or upgrading the infrastructure in ways that will benefit the local community (e.g. roads)

6.2.3 HEALTH AND SAFETY

There is a safety risk related to the transportation of machinery and material through public roads due to an increase in the local traffic. There is also a requirement for warning signs to minimize damage to the third party vehicles. In addition, risks to the public need to be managed. Existing road conditions need to be further strengthened to minimize the impacts due to crossing and traffic during construction phase.

UCC shall take the necessary measures to avoid / minimize the negative health and safety impacts by, for example, training employees in off-road driving; acclimatization of workers, visitors and contractors in regions of high altitude, ensuring awareness of hygiene, hazards in the local landscape, very cold weather conditions in winter, on-site hazards (e.g. special equipment), and endemic diseases (including how to avoid and treat them).

During the construction phase the negative impacts of temporary population increase during the construction phase will be managed and UCC will comply with all international, national and local health and safety standards that may exist. Hence the negative social impact will be minimal, for a short duration only and the positive impact will be magnified.

6.3 IMPACT DURING OPERATION PHASE

Operation phase of the proposed cement plant mainly comprises of the following:

- Excavation of limestone from captive mines
- Transportation of crushed limestone
- Transportation of other additives to plant site
- Preparation of raw meal by adding additives to limestone
- Clinkerisation of raw meal
- Cooling and heat recovery
- Blending & grinding of clinker by adding additives
- Packing and dispatch
- Operation of captive power plant

The detailed activities and their impacts during operation phase are summarized in the following table

Sn	Component	Activities	Impacts
1	Transportation of raw materials and product	o Increase the traffic movement o Washing and maintenance of vehicles	o Potential health and safety risk due to increase in traffic o Dust generated during transport, storage, milling, packing o Gaseous pollutants, the air emitted from the kiln and calciner contains SO_2, NOx, CO, and HC Nuisance of noise o Soil contamination from fuels, oil, and other hazardous materials o Nuisance to cultural and aesthetic features o Job creation and business opportunities to local residents
2	Operation of plant	o Excavation of limestone o Transportation of limestone o Transportation of other additives to the plant site o Preparation of raw meal by adding additives to limestone o Clinkerisation of raw meal o Cooling and heat recovery o Blending & grinding of clinker by adding additives o Packing and dispatch o Operation of captive power plant o Payment of taxes and royalty	o Dust generated during transport, storage, milling, packing o Gaseous pollutants, the air emitted from the kiln and calciner contains SO_2, NOx, CO, and HC o Noise will be generated from the milling process, air compressors, and air blowers during operation o Wastewater generation from wastewater treatment plant o Solid waste from wastewater treatment plant as dry sludge o Oil from machinery and equipment o Waste from domestic usages o Accidental oil spillage o Regional development o Saving of foreign exchange

6.3.1 ENVIRONMENTAL IMPACT

CLIMATE

Climate change due to emissions from vehicles using fossil fuels and also from stack emissions will be limited in project site area and shall not adversely contribute to regional characteristics. Therefore there the impact will be localized and negligible.

AMBIENT AIR QUALITY

Dust generated from the milling and screening area will be collected and treated by dust collectors. During material transportation, conveyor belts in enclosed galleries will carry all materials that can cause pollution. Electrostatic precipitators will be installed to treat gasses from raw milling, kiln firing, calcining, and clinker cooling. Dust in the air after treatment is expected to be less than 50 milligrams (mg) per normal cubic meter (Nm3), which is an acceptable level by international standards and is much lower than the Iraqi emission standard for cement facilities (150 mg/m3).

NOx gases are generated at high temperature in the kiln. By burning 50-60 percent of the fuel in the calciner system, NOx emissions can be reduced. Furthermore, the kiln's main burner, with effective fuel dispersion, can reduce NOx generation.

SO_2 gas comes in contact with calcined raw meal at 800-1000°C, and is absorbed by calcium oxide and other basic oxides to form calcium sulfate and calcium sulfite. Traces of SO_2 will be emitted.

In view of the firing technique of keeping a positive oxygen balance, emission of carbon monoxide (CO) shall be minimal.

To control fugitive dust emissions the following measures shall be adopted from the proposed unit:

- Jet Pulse bag filter at all dry material conveying and transfer points
- Dust suppression system at dump hopper of limestone/additives
- Level sensor to have a gap of only half a meter in between stacking boom and top of pile
- Plant roads and approach roads shall be made of bitumen/concrete
- Areas between various sections and truck parking area shall be made of bitumen/concrete
- Open areas within the plant premises and along the boundaries of the plant premises shall be covered with a green belt
- Raw Materials/Cement shall be fully covered during transportation to and from the site by road

In addition, UCC shall abide by the standards prescribed as given in the following table

Section	IFC Guideline			Design Data of the Plant		
	PM	SO_2	NOx	PM	SO_2	NOx
Cement mill	50 mg/Nm³	Nil	Nil	50 mg/Nm³	Nil	Nil
Clinker Cooler	50 mg/Nm³	Nil	Nil	50 mg/Nm³	Nil	Nil
Raw mill Kiln system	50 mg/Nm³	400mg/Nm³	600mg/Nm³	50 mg/Nm³	<400mg/Nm³	<600mg/Nm³
Crusher	50 mg/Nm³	Nil	Nil	50 mg/Nm³	Nil	Nil

Hence - based on the above discussion and considering the ambient air quality of the study area - dust, SO_2, and NOx have been considered as critical pollutants for dispersion modeling.

GREEN HOUSE GAS EMISSION

Greenhouse Gas Sources and Abatement Options in Cement Production

Overview of Cement Manufacturing Process

Cement manufacture includes three main process steps
1. Preparing of raw materials;
2. Producing clinker, an intermediate, through preprocessing of raw materials;
3. Grinding and blending clinker with other products („mineral components") to make cement.

There are two main sources of direct CO_2 emissions in the production process: combustion of kiln fuels, and calcinations of raw materials in the preprocessing stage

UCC recognizes that global warming is an important issue and that the industry shares in the responsibility for tackling the problem. Climate protection, and in particular reduction of CO2 emissions, is therefore an issue which UCC take very seriously.

CO_2 emission is calculated for UCC cement plant operation and the power generation.
The following table represents the estimated CO_2 emission cement manufacturing process,

Inputs		
Production Volume		**Unit**
Clinker production **)	2310000	**[t/yr]**
Cement Dispatched	2900000	**[t/yr]**
Clinker - cement Factor	80%	
Calcinations Fuel (ultra) Heavy Oil		
Consumption in tones per year	205128	**[t/yr]**
Default CO_2 Emission Factors - IPCC default *)	77.4	**kg CO2/GJ**
Heat value	41.0	**GJ/t**
Results		**Unit**
Absolute net CO_2	1,863,703	**[t CO2/yr]**
Absolute net CO_2 (calcinations component)	1,212,750	**[t CO2/yr]**
Absolute net CO_2 (fuel component)	650,953	**[t CO2/yr]**
Specific net CO_2 (per tones of clinker produced)	807	**[Kg CO2/t cli]**
Specific net CO_2 per tones of cementitious product	**643**	**[Kg CO2/t cem prod]**
Specific net CO_2 (calcinations component)	**418**	**[Kg CO2/ cem prod]**
Specific net CO_2 (fuel component)	**224**	**[Kg CO2/ cem prod]**

*) Intergovernmental Panel on Climate Change
IPCC defaults from: IPCC Guidelines for National Greenhouse Gas Inventories, Vol. III (Reference Manual), p. 1.13

**) Calculated as 7000 tpd for 330 days per year assuming that the rest days of the year are the planned stoppages for cement manufacturing regular maintenance

- The 40 MW power plant, heavy oil fired, it is estimated for a full efficiency operation to emit 276,000 ton CO2/year that is equivalent to 762 g-CO2/KWh.

UCC CO2 REDUCTION STRATEGY
CO2 ABATEMENT OPTIONS

CO2 emissions in the UCC shall be tackled by different measures.
The main categories of CO2 abatement potentials include:

- Energy efficiency: technical and operational measures to reduce fuel and power consumption per unit clinker or cement produced;
- Positive impact of using Mineral components on the grinding stage such as Slag, fly ash and limestone is by far the most efficient driver to reduce specific and absolute CO2 emission
- Increasing Alternative Fuel and Raw material AFR thermal substitution is also fairly effective.

NOISE LEVEL

- Noise will be generated from the milling process, air compressors, and air blowers during operation. Some of the design features provided to ensure low noise levels shall be as given below:

- All rotating items shall be well lubricated and provided with enclosures as far as possible to reduce noise transmission. Extensive vibration monitoring systems will be provided to check and reduce vibrations. Vibration isolators will be provided to reduce vibration and noise wherever possible
- In general, noise-generating items such as fans, blowers, compressors, pumps, motors etc. will be so specified as to limit their speeds and reduce noise levels. Static and dynamic balancing of equipment will be insisted upon and will be verified during inspection and installation
- Provision of silencers shall be made wherever possible
- The insulation provided for prevention of loss of heat and personnel safety shall also act as noise reducers
- Layouts of equipment foundations and structures will be designed keeping in mind the requirement of noise abatement
- The Central Control Room(s) provided for operation and supervision of the plant and equipment will be air-conditioned, insulated and free from plant noise. Necessary enclosures will also be provided on the working platforms/areas to provide local protection in high noise level areas
- Proper lubrication and housekeeping of equipment to avoid excessive noise generation
- In cases where the operation of the equipment requires the presence of operators in close proximity to equipment, the operators will be provided with the necessary personal protective equipment such as ear muffs, ear plugs etc.
- By provision of the green belt in and around the plant premises
- Occupational Health and Safety Administration System (OHSAS) for evaluation of exposure to noise pollution on the associated staff and comparing it with permissible exposure and subsequently taking corrective actions will be developed

- Regular noise surveys will be conducted to ensure the on-site and ambient maximum levels are not exceeded.

By these measures, it is anticipated that the noise levels in the plant will be maintained below 90 dB (A). Earth mounds and plantations in the zone between the plant and the surrounding area would further attenuate noise in the residential area.

TRAFFIC

In the operation phase of the proposed cement plant, the transport of materials to the plant site and also transport of the cement product could generate environmental and social impacts.

The negative impact could be:

- Climate change impacts from emissions from vehicles using fossil fuels
- Noise and ground vibration, dust and dirt, visual effects
- Potential soil contamination from fuels, oil, and other hazardous materials;
- Potential health and safety risk due to increase in traffic and access to the plant site
- Potential health impacts and nuisance factors due to noise, dust, vibrations, etc. The diesel storage for heavy equipment may also generate environmental impacts unless special mitigation designs are adopted.

The potential positive impacts are primarily socio-economic in nature and may include:

- Job creation and skills development, with associated increase in living standards
- Development and improvement of local physical and socio-economic infrastructure.

Potential traffic impacts are supposed to be discussed with local authorities. Applying the following practices will mitigate the negative impacts:

- Creating a new access road that will route traffic away from sensitive areas
- Minimize the use of roads by planning vehicle movements
- Advise traffic police of activities
- Road crossings to be used shall be well marked
- Spray down dirt roads if too dusty

WATER RESOURCES

During the operation of proposed plant, the water requirement is estimated at around 1000 - 1300 m3/ day, which will be available through ground water resources of the area. The expectation of water resources during the operation phase will not affect the water availability in the area to other competing users.

WASTEWATER

Estimated effluent generated from the plant shall be mainly from domestic usages, from water treatment plant. This water shall be treated in effluent treatment plant and the treated water shall be utilized in dust suppression, greenbelt development and in process to the extent possible.

SOLID WASTE

- Waste produced during clinker production at the proposed plant site will consist of unwanted rock and soil waste materials, which are removed from the raw materials during the preparation of the raw meal. Lubricated oil, sludge generated from the effluent treatment plant (ETP), empty bags, metal scrap, wood trash solid waste generated as municipal waste (Garbage & Households).
- Measures to avoid, minimize and mitigate the solid waste impact of a cement plant may will be considered as described below:

- Metal scrap, empty bags and wood trash will be gathered and segregated on a specially assigned fenced area, and by the end of each year we can offer it for bids to the contractors who are interested on buying it to be reused.

- Lubricating Oil will be collected in a pit or drums and then returned back to the supplier where it is recycled and reused again, the drums to be stored in special designated zone in the central stores area.

- The sludge generated from the effluent treatment plant (ETP) at the plant shall be used as manure for the green belt development. Regular monitoring shall be carried out to assess any adverse impact.

- The solid waste generated as municipal waste (Garbage & Households) will be collected and segregated along with the domestic waste generated from the plant and will be sent to a municipal waste disposal site allocated by local administrative authorities.

6.3.2 SOCIAL IMPACT

LAND USE

The land was owned by the government and currently used by five local villagers (two using 90% and three using the remainder) for farming. The government has agreed to transfer the land in the name of UCC. The villagers currently farming on this land have been compensated by UCC a total of US$300,000, which is much higher than what other companies in the area have compensated other farmers for their land. There is no existing household on the land of the project and accordingly no household families are going to be physically or economically displaced or relocated.

EMPLOYMENT AND ECONOMICAL GROWTH

The expected size of the workforce during operation is 450 employees. The increased quantity of cement produced shall in general result in industrial growth. Direct and indirect opportunities of employment and business in the region would be generated. The setting up this project would result in payment of excise duty and sales tax that will have positive regional impacts.

The high dependence on imported cement has caused a greater social impact on the country in restraining the development of basic social infrastructure such as roads, water supplies, hospitals, schools, houses and ports, which need large quantities of cement. The provision of this basic infrastructure in Iraq will continue to be more expensive without these kinds of projects.

In addition to payment of royalty and taxes to the government, UCC shall continue its efforts to improve the socio-economic status of local inhabitants to the extent possible which includes:

- Grant or add to education, health and infrastructure and supply of drinking water in the area to the extent possible
- Active participation and contribution to awareness programs organized by national or international agencies

ECOLOGY

The impact on terrestrial ecology can be considered positive as a green belt of appropriate width shall be developed and maintained in the area of the project.

The overall social impact of the proposed project will be positive and beneficial.

7. ANALYSIS OF ALTERNATIVES

Two options were examined and reviewed before taking the decision of establishing a Greenfield cement plant at Bazian Area. These options were:

- No project option and continued importation of cement
- Establishment of the cement plant

NO PROJECT OPTION

The no project option and continued importation is not a viable alternative because of the high cost of transporting and storing cement and the lack of foreign exchange to pay for imported cement.
The Kurdistan government wants to be self-reliant in their cement supply to sustain its development program. In terms of the global environment, importation would avoid the environmental impacts of the project in Kurdistan, but the CO2 emissions would be higher because additional energy would be required to transport the final product to Kurdistan.
The no project option would involve failure to rationalize the use of natural resource available in the project area, which can be used to manufacture cement. This option may result in loss of opportunity to create direct employment for hundreds of citizens and loss of several socio-economic benefits and improvement in the living conditions of local population in the project area.

ESTABLISHMENT OF GREENFIELD CEMENT PLANT

The cement plant will make good use of the natural resources and promote industrialization of surrounding areas. Strong demand for cement is expected to continue throughout the country. Surveys have not found an acceptable alternative location. The proposed Greenfield plant will be almost dustproof, and other pollutants such as gasses and wastewater will be controlled at acceptable levels.
Establishment of the plant close to the quarry would lead to making transport of raw material to the plant easier and more economical. A small number of transport equipment would be used which would lead to lower risks of accidents and lower air pollution from traffic movement and vehicular emissions.

Thus the alternative of establishing a Greenfield cement plant at Bazian area is the best available option.

8. ENVIRONMENTAL MANAGEMENT PLAN

8.1 PREAMBLE

The management plan for construction and operation phases of the green field cement project includes measures that minimize adverse impacts to the environment and ensure no long lasting evidence of activities.

The Environmental Management Plan (EMP) has been designed within the framework of various regulatory requirements on environmental and socio-economic aspects aiming at the following:

- Minimize disturbance to native flora and fauna
- Prevent air, water, soil and noise pollution
- Avoid sites of historical, cultural and archaeological significance
- Encourage the socio-economic development

This is in line with the guidelines of the IFC. UCC is committed to maintaining the highest standards of environmental protection. Compliance with relevant legislations shall be targeted as a minimum objective. In particular, environmental management activities include but are not limited to the compliance with the environmental requirements applicable to the project, such as:

- International Conventions/Guidelines and Agreements to which Kurdistan is a signatory
- World Bank Guidelines on the Environment

8.2 IMPACT MITIGATION TECHNIQUES DURING CONSTRUCTION PHASE

Environment protection measures/precautions shall be adopted to minimize the impacts due to activities related to pre-construction, preparatory construction, machinery installation and commissioning stages and end with the induction of manpower and startup. The impacts during the construction phase on the environment would be basically of transient nature and are expected to reduce gradually on completion of construction activities.

8.2.1 AIR QUALITY MANAGEMENT

During the construction phase, certain amount of dust shall be generated due to the transportation of men, machinery and materials, land clearing and leveling of land, operation of construction machinery/equipment, construction of foundations, buildings and other requisite infrastructure etc. closed to the construction site. The impacts shall be temporary in nature and shall marginally deteriorate the ambient air quality. However, the following measure shall further reduce the dust generation:

- Construction materials shall be fully covered during transportation to the site by road
- Land clearing for construction site will be kept at the absolute minimum practicable
- Construction site would be designed to minimize the removal of soil and vegetation
- Topsoil removed will be preserved for later reinstatement purposes by piling it along a boundary of the site
- Dust suppression systems (water sprays) shall be used as per requirement at the construction site
- Earth moving equipment, typically a bulldozer with a grader blade and ripper shall be used for excavation work

8.2.2 NOISE LEVEL MANAGEMENT

The noise shall be generated mainly due to operations of machinery/equipment used for construction and transportation of materials to the sire. The measures described below shall be able to mitigate the noise levels generated at the site:

- Provision of rubber padding/noise isolators
- Provision of silencers to modulate the noise generated by machines
- Provision of protective devices such as ear muffs/plugs to the workers

8.2.3 WATER RESOURCE MANAGEMENT

The following measures shall be adopted:

- Continuous attempt shall be made to optimize/reduce the use of water
- Continuous attempt shall be made to avoid wastage and leakage of water
- Regular record of water table in case of tube wells shall be maintained

8.2.4 WATER QUALITY MANAGEMENT

The proper drainage system shall be constructed at site on temporary basis at an early stage. Salient features of water quality management comprise the following:

- Raw water quality shall be checked on regular basis for essential parameters as per World Health Organization (WHO) guidelines
- All the waste from the site shall be treated in the septic tanks provided
- All the debris resulting from the site shall be isolated from the waste water and disposed of separately
- A sediment trap shall be provided to prevent the discharge of excessive suspended solids
- An oil trap shall be provided in the drainage line to prevent contamination by accidental spillage
- Wash down area for cleaning of vehicles wheels shall be provided and wheel wash waste shall be drained properly
- No untreated discharge is to be made to water courses
- To prevent contamination from accidental spillage of oil, the storage areas will be bonded and will be inspected and cleaned at regular intervals

8.2.5 SOIL QUALITY MANAGEMENT

The following measure shall be adapted to prevent/reduce the soil contamination:

- Litter, fuel, oil drums, used grease cartridges will be collected and removed properly
- Dust bins shall be placed at requisite locations
- Lubrication waste oil shall be collected separately in drums and shall be disposed of as per standard practice

8.2.6 LAND USE PATTERN AND ECOLOGY MANAGEMENT

Disturbance during the construction phase shall be confined to the land acquired for the proposed plant only. To keep the disturbance at a minimum, the following measures are recommended:

- Land clearing for the construction site will be kept at the absolute minimum practicable
- Construction site will be designed to minimize the removal of soil and vegetation
- Topsoil will be cleared and stored for later reinstatement purposes by piling along the boundary of the site

8.2.7 TRAFFIC MOVEMENT

- Minimize use of roads by planning vehicle movements
- Advise traffic police of activities
- Road crossings to be used shall be well marked
- Spray down dirt roads if too dusty

8.2.8 SOCIO-ECONOMIC

- Adequate dialogue with the local population and the authorities while designing compensation packages and close monitoring on the type of land and crop loss
- Regular meeting with the local community and the local authorities representing the Bazian district. The feedback and comments will be taken into serious consideration and will be documented.
- Protection of traditional water structures
- Provision of health and education services
- Loss of land and crop loss to be compensated
- Provide temporary employment generation opportunities

8.3 IMPACT MITIGATION TECHNIQUES DURING OPERATION PHASE

DUST AND GAS EMISSION

Environment protection measure/precautions will be adopted to minimize the impacts due to operation of the plant, which mainly includes stack and fugitive emissions. Dust emission is the main pollutant emitted from various stacks in a Cement Plant. Other emissions include SO_2, NO_X and CO.

- UCC settled a strict control and monitoring systems to minimize the air emissions from its operations either dust or gaseous emissions. Stacks in the plant shall be provided with automatic stack monitoring units

- As for the stacks present on site; Suitably designed ESP/Bag filters will separate out about 99.99% of the incoming dust in the flue gas and limit the dust concentration at its designed outlet concentration of 50 mg/Nm3
- In the event of failure of any pollution control equipment, automatic tripping in the control system shall be provided to ESP operations, interlocking shall be provided with supply to an electrode, which means that any disruption in the power supply to the electrode will result in the switch-off of the entire unit

- The production process is mainly operating in a compound operations, this eliminate and reduce the emissions as the hot gas stream coming out of the kiln with dust and gaseous emission is circulated back to the mills and do not pass directly to the stacks.

- The impact of CO emission is negligible in view of the firing technique of keeping a positive oxygen balance. However, regular monitoring and continuous auto regulation of fuel and air by an automatic combustion control system is proposed to be installed
- Heavy and light vehicles are the other major sources of CO. All vehicles and their exhausts will be well maintained and regularly tested for emission concentration
- Regular preventive maintenance of pollution control equipment shall be carried out

FUGITIVE DUST EMISSION

The following measures shall adopted from the proposed unit:

- Jet Pulse bag filter at all dry material conveying and transfer points
- Dust suppression system at dump hopper of limestone/additives
- Level sensor to have a gap of only half a meter in between stacking boom and top of pile
- Plant roads and approach roads shall be made of bitumen/concrete
- Areas between various sections and truck parking area shall be made of bitumen/concrete
- Open areas within the plant premises and along the boundaries of the plant premises shall be covered with a green belt
- Raw Materials/Cement shall be fully covered during transportation to and from the site by road

EMISSIONS MONITORING MANAGEMENT PLAN

UCC is committed to comply with the local authorities, Orascom Construction Industries (OCI) and IFC guidelines and regulations concerning air emission monitoring program.

The monitoring activities taking place by UCC is carried out internally through the online analyzers provided to the main stacks at the plant operations facilities as well as the portable equipment for checking and calibration purposes.

ONLINE DUST/ GAS MONITORING

The results obtained on daily basis from the Central Control Room is analyzed and reported in the daily environment report for the plant operations covering the last 24 hrs operations and emission behaviors on a hourly basis average for dust and gaseous emissions.

DISCONTINUOUS MONITORING

A contracted party is involved to check the emission monitoring performance of our plant operations and this is to ensure the liability of our measuring devices as well as the support of UCC records and other official governmental auditing records.

EMISSIONS MEASUREMENTS:

UCC measurement should follow the emission monitoring reporting system (EMR) as a guideline in their measuring techniques and reporting.

STACKS EMISSIONS

CONTINUOUS

- Total Suspended Particulates (TSP),
- Sulphur Oxides (SO_X),
- Nitrogen Oxides (NO_X),
- Others, process request

PERIODICAL (AT LEAST ONCE/ YEAR)

- Hydrochloric Acid (HCl),
- Ammonia (NH_3),
- Hydrocarbons (CxHy),
- Heavy Metals.

AMBIENT EMISSIONS:

- Total Suspended Particulates (TSP),
- Respirable Particulates (PM_{10}),
- Nitrogen Oxides (NO_X),
- Sulphur Oxides (SO_X),
- Carbon Monoxide (CO),
- Other, Process request

NOISE LEVEL MANAGEMENT

Some of the design features provided to ensure low noise levels shall be as given below:

- All rotating items shall be well lubricated and provided with enclosures as far as possible to reduce noise transmission. Extensive vibration monitoring systems will be provided to check and reduce vibrations. Vibration isolators will be provided to reduce vibration and noise wherever possible
- In general, noise-generating items such as fans, blowers, compressors, pumps, motors etc. will be so specified as to limit their speeds and reduce noise levels. Static and dynamic balancing of equipment will be insisted upon and will be verified during inspection and installation
- Provision of silencers shall be made wherever possible
- The insulation provided for prevention of loss of heat and personnel safety shall also act as noise reducers
- Layouts of equipment foundations and structures will be designed keeping in mind the requirement of noise abatement
- The Central Control Room(s) provided for operation and supervision of the plant and equipment will be air-conditioned, insulated and free from plant noise. Necessary enclosures will also be provided on the working platforms/areas to provide local protection in high noise level areas
- Proper lubrication and housekeeping of equipment to avoid excessive noise generation

- In cases where the operation of the equipment requires the presence of operators in close proximity to equipment, the operators will be provided with the necessary personal protective equipment such as ear muffs, ear plugs etc.
- By provision of the green belt in and around the plant premises
- Occupational Health and Safety Administration System (OHSAS) for evaluation of exposure to noise pollution on the associated staff and comparing it with permissible exposure and subsequently taking corrective actions will be developed

By these measures, it is anticipated that the noise levels in the plant will be maintained below 90 dB (A). Earth mounds and plantations in the zone between the plant and the surrounding area would further attenuate noise in the residential area.

SOLID WASTE MANAGEMENT

With the adoption of sustainable development as an approach to manage the environment, quality waste management techniques is essential. The principle aim of waste management is to sustain the environment by ensuring that waste does not contaminate the environment at such a rate or in such a form or quantity as to overload natural assimilative processes and cause pollution. Eliminating or minimizing waste generation is becoming crucial, both environmentally and economically, for reducing waste-related liabilities and costs.

SOLID WASTE, STEEL STRUCTURES, EMPTY BAGS & WOOD TRASH

- ❖ This kind of waste can be gathered and segregated on a special assigned fenced area, and by the end of each year we can offer it for bids to the contractor who are interested on buying it to be reused.

LUBRICATING OIL

- ❖ Lubricating Oil to be collected on a pit or drums then returned back to the supplier where it is recycled and reused again, the drums to be stored in special designated zone in the central stores area.

OTHER WASTES CONTROL

- ❖ The sludge generated from the effluent treatment plant (ETP) at the plant shall be used as manure for the green belt. Regular monitoring shall be carried out to assess any adverse impact.
- ❖ The solid waste generated as municipal waste (Garbage & Households) will be collected and segregated along with the domestic waste generated from the plant and will be sent to a municipal waste disposal site allocated by local administrative authorities.
- ❖ Water Resource/Quality Management

The following measure shall be adopted:

- Continuous attempt shall be made to optimize/reduce the use of water in the plant
- Continuous attempt shall be made to avoid wastage and leakage of water
- A regular record of water tables shall be maintained
- Raw water quality shall be checked on a regular basis for essential parameters as per WHO guidelines before use
- The drainage system that shall be used for carrying the wastewater to storage tanks shall be periodically checked for any leakage

WATER POLLUTION MANAGEMENT

Wastewater generated from plant operation, which shall be mainly from domestic usages, the water treatment plant and blow downs shall be treated in an effluent treatment plant (ETP). ETP shall consist of primary to tertiary treatment and treated water shall be used for dust suppression, green belt development and in the plant operation to the possible extent. Regular monitoring shall be carried out to assess any adverse impact.

HOUSEKEEPING

The significant features of the practices adopted for the proposed plant shall be:

- Mechanized cleaning of roads and floor areas inside the plant premises by using a road sweeper and mobile vacuum cleaner on a regular basis
- Training shall be given on a regular basis to all workers regarding awareness on the importance of cleanliness
- Careful garbage transportation to dumping site and disinfection of the transport vehicle's body
- Construction of suitably designed drains all along the roads and boundary of the plant premises

OCCUPATIONAL HEALTH AND SAFETY

HAZARD ASSESSMENT

A hazard assessment is a formalization of what is done whenever personal protective equipment is selected based on the hazards of the job. During the hazard assessment of each task to select the proper P.P.E., inspect the layout of the work place and look for the following hazardous source:

- All closed areas are equipped with the proper ventilation systems to ensure employee protection from suffocation, harmful gases and dust particles. All employees, regardless of their job description, are provided with the necessary personal protective equipment. Every employee is given safety shoes, a safety helmet, earplugs and safety goggles. Employees with specified jobs are given the necessary personal protective equipment for the job, such as heat-resistant gloves, heat-resistant jackets, earmuffs and respiratory equipment in dusty working places
- All workers engaged in the material handling system shall be regularly examined for lung diseases
- Any worker found to develop symptoms of dust related diseases should be immediately changed over to another job in a cleaner environment within the plant
- All job activity will be controlled by work permit system to make sure that risk assessment prior to work will be carried out.
- The OHS & E Department carries out constant monitoring of emissions, radiation and noise in all workplace areas. Portable measuring equipment is used to carry out measurements on a routine basis. Stacks are equipped with online monitoring systems to control the emission of dust and gases released.

HEALTH AND SAFETY TRAINING

To ensure a high level of competency and awareness in the area of occupational health and safety, training will be provided in all relevant areas. This training will be integrated with the creative LEARNING program, and place a strong emphasis on risk assessment and management.

UCC will train its employees in health and safety in a manner that is consistent with the UCC Safety Manual. Training will also comply with any legislative requirements.

Formal training for all employees (including contractors) at all levels within UCC will be provided, and shall address the following:

- Health and safety awareness
- Risk assessment principles
- Principles and practice in health and safety
- Induction for new employees and transferred personnel (general and specific safety procedures required by the job)
- Changes to plant, equipment or processes
- Personal Protective Equipment use and care as required.

Training records are to be made and maintained in a corrective manner. Such records will relate to training, competence, licenses, certificates and operating authorizations.

RADIATION SAFETY

UCC shall be equipped with the proper equipment to monitor the radiation emissions in the areas where it applies. A monthly monitoring survey shall take place via the Occupational Health, Safety & Environment representatives using the survey meter to check after the emissions and mark it on a report. These reports shall be documented and filed within the Environment department for internal review or upon request

METHOD OF PROTECTION

- Personal dosimeters are provided as well as a film badge that is collected from assigned employees working close enough to the erected radioactive materials for analysis via the authorities every 2 months. Records must be marked down and documented in order to count the exposure rate of each employee.
- Safety Signs to be posted for warning purposes on the areas where unauthorized access is completely prohibited as well as storage area for radiation materials.

- Environment Department to conduct Awareness sessions with employees to increase the awareness on the radioactive materials handling and storage as well as its health hazards on human being and how to protect ourselves

MEDICAL CHECK

Biannual medical checks should be done for all workers who work around the radiation sources according to Egyptian Law and ECC policy.

TRAINING

A radiation safety-training program must be established and maintained for all employees who may be exposed to hazardous radiation sources. The training shall ensure that the employees are knowledgeable of the potential hazards and control measures for the radiation equipment in use and should include the hazards, first-aid requirements, and safety precautions for working around radiation sources

REPORTING OF HEALTH AND SAFETY

Reporting of all incidents shall be made to the regulatory agencies and supervisory bodies as they occur. The findings of each environmental audit shall also be submitted to the Ministry of Health – Safety Department – Solaymania Governorate.

ENVIRONMENTAL AUDIT

Environmental Audits are tools used by management to systematically and periodically evaluate the performance of environmental management systems (EMS), procedures and equipment. Environmental audits are required as environmental tools to ensure that project operation is carried out according to the regulatory requirements and standards.

All the project facilities shall be regularly audited one operation commences. This audit shall check the prediction of the Environmental Assessment Report and assess the general performance of the project to ensure that environmental standards are maintained and UCC policies and environmental management guidelines are strictly maintained. Each environmental audit shall be geared towards achieving the following:

- Examine compliance with regulatory requirements
- Identify current and potential environmental problems
- Examine the line management systems, plant operations, monitoring practices and data, procedures and plans
- Check the predictions of the Environmental Evaluation Assessment and ensure that its recommendations are being implemented
- Recommend areas of improvement in operations management

ENVIRONMENT LABELING AND LIFE CYCLE ASSESSMENT

Life Cycle Assessment (LCA) is a method of checking the facts about the environmental burden of a product from its design through the production and then final disposal. It can be used in design of a new product of the evaluation of an existing product. LCA is the analysis of a product or service through all stages of its life cycle; raw materials acquisition, manufacturing, transportation, use/reuse, maintenance, recycling/waste management and relevant energy supply systems. It includes:

- Evaluation and policymaking
- Public education
- Internal decision-making
- Public disclosure of information

In the same process, the product also gets environment labeling. UCC is committed to conduct all types of studies including LCA to preserve the natural resources and to protect the environment.

MEASURES TO IMPROVE SOCIO-ECONOMIC CONDITIONS

In addition to payment of royalty and taxes to the government, UCC shall continue its efforts to improve the socio-economic status of local inhabitants to the extent possible which includes:

- Preference to locals in direct and indirect employment
- Grant or add to education, health and infrastructure and supply of drinking water in the area to the extent possible
- Active participation and contribution to awareness programs organized by national or international agencies

GREEN BELT DEVELOPMENT

UCC shall develop a greenbelt inside and outside the plant premises. Samplings shall be raised initially by purchasing them from outside and at a later stage a nursery shall be developed. Services of a professional horticulturist shall be hired for the development of the green belt and garden within the plant premises. Community plantation shall be encouraged in the surrounding area.

8.4 ENVIRONMENTAL MANAGEMENT CELL

Apart form having an EMP, it is also necessary to have a permanent organizational setup charged with the task of ensuring its effective implementation. A separate department consisting of officers from various disciplines shall be created to coordinate the activities concerned with the management and implementation of the environmental control measures of the proposed plant operation.

Basically, this department shall undertake monitoring of the environmental pollution levels by measuring stack emissions, ambient air quality, water and effluent quality, noise level etc., either departmentally or by appointing external agencies wherever necessary. In case, the monitored results of environmental pollution are found to exceed the allowable values, the Environmental Management Cell suggests remedial action and gets these suggestions implemented through the concerned plant authorities.

The Environmental Management Cell also coordinated all the related activities such as collection of statistics with relation to health of workers and population of the region, forestation and green belt development.

To achieve the objective of pollution control, it is essential not only to provide the best pollution control systems but also to provide trained manpower resources to operate the same. Training facilities would be strengthened for environmental control, which covers items listed below:

- Awareness of pollution control and environment protection
- Operation and maintenance of pollution control equipment
- Knowledge of norms, regulations and procedures
- Occupational health and safety

ENVIRONMENTAL RESPONSIBILITIES DURING CONSTRUCTION PHASE

- The Contractor's Project Health, Environment and Safety (HSE) Team during the Engineering Design shall be headed by the project HSE Coordinator (HSEC) who will be assisted for the environmental management activities. Environmental assessment responsibilities will be handled by its Site Safety & Environmental Manager (SSEM).

- On the part of UCC, these responsibilities will be managed by an Environmental Liaison Officer (ELO), working with the project Quality Assurance Engineer (QAE) and the Community Liaison Officer (CLO).

- The Site Safety and Environmental Managers (SSEM) and UCC's representatives in the project locations shall offer technical advice on protection measures and monitoring performance. The responsibility for environmental protection shall lie with the management who must ensure that all environmental considerations are integrated into project activities.

- Community Liaison Officer in the project areas, SSEM, and the facilities contractor or Superintendent of the Operations Manager, shall be involved in resolving all community issues. The representatives of FMENV shall supervise all activities geared towards environmental protection. All affairs and resolutions/agreements shall be properly documented for future reference as honored by all parties concerned.

PROJECT HSE COORDINATOR (HSEC) – ENGINEERING

The HSEC has the over all responsibility to ensure that the environmental objectives are met, through implementation of procedures and technical activities during the engineering design phase. The HSEC will report to the Contractor's Engineering phase Project Director. The HSEC responsibilities include but are not limited to the following:

- Issue a project Environmental Action Plan and procedures for the management of its implementation throughout all phases of the Project execution
- Organization and overview of the Project Environmental Management System, including planning, coordination, recording and control of environmental studies and reviews
- Liaise with Client's Environmental representative for resolving environmental issues related to the execution of the project

ENVIRONMENTAL LIAISON OFFICER (ELO)

The ELO shall be the focal point of all environmental matters in relation to the implementation of the engineering component of the proposed project. It shall be the responsibility of the ELO to ensure that the design provided for implementation and reviewed in the EIA/EMP report conforms to those in the conceptual plan. At the end of the review, using relevant checklists (prepared by the QAE), the design presented for implementation may be approved, referred or rejected if considered environmentally unjustifiable.

PUBLIC RELATION OFFICER (PRO)

The PRO shall manage project relations with the community in order to promote:

- Active participation and contribution to awareness programs organized by national or international agencies
- Any social programs that the company wishes to participate in
- Liaison with internal aid agencies

SITE SAFETY AND ENVIRONMENTAL MANAGER (SSEM)

The contractor responsible for project execution (construction and commissioning) shall provide a site Safety and Environmental Manager (SSEM), working in functional interface with the engineering Contractor's Team and interface with UCC's ELO. SSEM will be responsible for the development and implementation of the environmental activities relevant to the construction described in this EMP. He will report to the Contractor Site Representative. The SSEM's environmental responsibilities include the following:

- To ensure that all Construction personnel involved with construction related activities are aware of the objectives and appropriate environmental requirements
- To acknowledge the project organization with the environmental policy of the project
- To execute internal environmental auditing
- To carry out site inspections
- To manage the waste streams as described
- To compile and issue documents and reports required
- To design and run environmental training
- To liaise with construction departments and management
- To liaise with sub-contractors
- To plan and carry out, when necessary, studies and/or environmental analysis

From time to time there may be requirements for specialized environmental expertise. The Contractor offices will provide qualified resource support as and when required.

ENVIRONMENTAL RESPONSIBILITIES DURING OPERATION PHASE

- The HSE Team during the operation shall be headed by the Plant Quality, Safety and Environment Works Director (QSEWD) who will be assisted for the environmental management activities. Environmental assessment responsibilities will be handled by health& Safety and Environment site Manager (HSEM) manager

- The health& Safety and Environment site Manager (HSEM) manager shall offer technical advice on protection measures and monitoring performance. The responsibility for environmental protection shall lie with the management who must ensure that all Environmental considerations are integrated into project activities.

- The Plant Superintendent or the Operations Manager shall be involved in resolving community issues. All activities geared toward environmental protection shall be supervised. All affairs and resolutions/agreements shall be properly documented for future reference as honored by all parties concerned.

QSEWD RESPONSIBILITIES

The QSEWD has the overall responsibilities to ensure that the overall environmental objectives are met, through implementation of procedures and technical activities during the operation phase. The QSEWD shall report to the Plant Director. The QESWD's responsibilities include but are not limited to the following:

- Issue an Environmental Action Plan and procedures for the management of its implementation
- Organization and overview of the Environmental Management System, including planning, coordination, recording and control of environmental studies and reviews
- Liaise with statutory bodies and community concerned for resolving environmental issues related to the operation of the plant

HEALTH& SAFETY AND ENVIRONMENT SITE MANAGER (HSEM)

The HSEM shall be the focal point for all environmental matters in relation to the implementation of the Environmental Action Plan during the operation phase. It shall be the responsibility of the HSEM to ensure that the system adopted for environment protection conforms to those in the conceptual plan. At the end of the review, using relevant checklists (HSE team), the implementation system may be reviewed if considered environmentally unjustifiable.

The health& Safety and Environment site Manager (HSEM) manager shall be responsible for the development and implementation of the environmental action plan. The responsibilities include the following:

- To ensure that all personnel involved with operation related activities are aware of the objective and appropriate environmental requirements
- To acknowledge the plant organization with the environmental policy of the UCC
- To execute internal environmental auditing
- To carry out site inspections
- To manage the waste streams as described
- To compile and issue documents and reports required
- To design and run environmental training
- To liaise with construction departments and management
- To plan and carry out, when necessary, studies and/or environmental analyses

8.5 UCC'S STATEMENT ON THE PROJECT

The new cement plant shall adopt the most up to date technology in the cement industry by which, its impact on the environment is insignificant, and the local government regulations and the IFC guidelines are completely fulfilled. Designed Environmental specifications of the proposed plant are in line with of more stringent then IFC environmental guidelines,

POLICY STATEMENT:

- UCC are committed to the principles of sustainable development in order to meet the needs of the present without compromising the ability of future generations to meet their own needs.
- UCC will continuously monitor and improve our environmental performance and provide positive contributions to our business.
- UCC commitment is demonstrated by providing the necessary resources to perform our job safely and in a manner, which continuously protects people and the environment.

PRINCIPLES:

- ❖ The policy making is guided by the following principles:
- ❖ UCC will apply internationally accepted environmental management systems and monitor our performance.
- ❖ Promote eco-efficiency, conservation of non-renewable natural resources and recycling of secondary materials.
- ❖ Integrate our environmental considerations into investment decisions at all levels.
- ❖ Engage with our stakeholders and report publicly on our environmental compliance, performance and progress.

UCC's policy will be available to all the employees, regulatory authorities, and the public (on request). UCC will periodically review the policy to ensure that it adequately reflects our activities, products and services.

Culturally, the proposed project shall not have a significant impact to cultural effects. Economically, the proposed cement plant will serve the national income, provide job opportunities and a long-term economic boost and will help to supply the high demand of cement in the Iraqi market. Socially, the people's gain shall increase.

8.6 QUARRY REHABILITATION

CONTEXT

Rehabilitation plan for the limestone quarry have been designed to return the quarry area as closely as possible to the existing nearby environment. The objectives are to restore disturbed areas to a condition that achieves:

- Long term stabilization of all worked out areas to prevent degradation of the environment
- Revegetation of all worked out areas to the satisfaction of government agencies
- Minimization of the visual impact of disturbed areas from major vantage point
- Safety of all worked out areas for anticipated after-use

TOPSOIL MANAGEMENT

Topsoil shall be double-stripped 0-50mm and 50-150mm and placed in layers in proper sequence directly onto recontoured areas immediately during September-November or stockpiled in wedge-shaped stockpiles for a period less than 12 month.
Once major earthworks are completed, topsoil shall be re-spreading uniformly over the stable surfaces for revegetation, to as great a depth as possible, and measures will be taken to provide optimal substrata for plant growth.

LANDSCAPING AND DRAINAGE SYSTEM

The formation of stable landforms and adequate drainage systems is important before any revegetation work is undertaken. The loose surfaces of overburden areas shall be reworked and compacted into several benches with acceptable slopes. Drain structures shall be created to control erosion of the slopes. Drainage considerations shall be addressed in the rehabilitation design; and, upon completion, topsoiling will revegetate the areas with its native seeds.

REVEGETATION

As the objective is to restore the native nearby vegetation and fauna, the present species present in the quarry area and nearby surroundings shall be used for revegetation. A longer-term objective is to establish and maintain those species that are compatible with the desired pos-quarrying land use.
Cover crop of oats and barley shall be sown with the native seed to protect germinating native seedling. Established areas shall be re-mulched and re-sown to increase richness and diversity if needed.
The cover crop and native seed mix is sown with 200 kg/ha of superphosphate to boost early establishment.

MONITORING AND MAINTENANCE

A survey of rehabitated areas shall be made regularly in the late spring for species diversity and growth rates to assess progress and identify where additional attention is required. Remedial treatment shall be undertaken if needed. Measures that aim to establish a natural ecosystem shall be taken to encourage the native fauna to return to areas for quarrying.
Maintenance shall include:

- Replanting failed or unsatisfactory areas;
- Fire management
- Repairing any erosion problem;
- Pest and weed control;
- Control of feral and native animal population;
- Fertilizer applications,
- Watering plant in drier areas, especially in the establishment phase;
- Application of lime or gypsum to control pH and improve soil structure

8. PUBLIC CONSULTATION

UCC's has always firmly believed in sustainable development. The company has endeavored to maintain cordial community relations in all its areas of operation.

For the proposed cement plant in Bazian, the company held consultations with the standards organization of Iraq – Kurdistan state in Bazian and Sulaymaniyah, Consultations were also held with the host communities, and their neighboring communities.

UCC's took these opportunities to explain all the measures that shall be taken to protect the environment during the construction and implementation phases of the proposed project in order to allay the fears borne by the people on environmental conservation principles. The host communities used the consultation meetings to familiarize themselves with their operation and also enumerate their interests. The consultation process shall be made a functional and regular part of the execution during the project life span.

Community development packages shall be formulated keeping the requirement of the local population in view and after due deliberations with them. UCC shall consult with the local community at all stages of the project's life span through a community liaison officer to ensure ongoing consultation and grievance redressal among the communities surrounding the project site.

UCC Procedure

In order to facilitate awareness of the project by local stakeholder the Environmental Review Summary (ERS) was translated to Arabic and Kurdish languages and published in a Kurdish daily newspaper (Kurdistani Nwe) and Arabic one (Al-Ittihad) which are published by the Patriotic Union of Kurdistan (PUK-Iraq).

A local community meeting was held at Bazian district director office and the ERS document was delivered to attending persons in English, Arabic, and Kurdish languages. An open discussion was conducted involves an exchange of information and ideas between stakeholders and UCC sponsors. The opening of UCC office for employment at Bazian district was declared as the district director suggested it.

UCC intends to disclose the findings of the ESIA at the time of its submission to the Iraqi environmental authorities and to convene a public meeting in collaboration with the local administration to inform the public of the ESIA findings and mitigation plans.