



Republic of Yemen

Arabian Yemen Cement Company Ltd:

Governorate of Hadhramout – Al- Mukalla

Environmental Impacts Assessment: Al- Mukalla Cement Plant

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Prepared by:

**AL- DAR FOR CONSULTATION
Economic , Industrial , Engineering
And Management Consultants
Tel : 275893- P.O .Box .12261**



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PREFACE

Arabian Yemen Cement Company Limited wish to set up a 1.2 Million Tones per Annum Cement Plant at a location 60KM North East of Mukalla in the Governorate of Hadhramout, Republic of Yemen. The operation of the Cement Plant is expected to start by the end of August 2008. In setting up this Plant we are committed towards the environmental protection and compliance with Health Standards of the local community apart from creating employment opportunities thereby contributing to the development of the local economy. The preparation of this Environmental Assessment Study has been requested by the Environment Protection Authority and endorsed by the Management of Arabian Cement Company Limited in line with our commitment towards recognizing potential environmental impact for better control and elimination. It will be our responsibility to work on the implementation of the Environment Management Plans including monitoring and mitigation in a timely fashion as well as contributing to capacity building and strengthening. It is our conviction that the prosperity of the plant will be associated with our ability to strengthen the environmental compliance. This has led us to equip the proposed project with the state of the art environmental emission control equipment and to purchase the Best Available Technology for reducing dust emissions. We shall coordinate with the Environment Protection Authority in complementing our efforts to limit emissions and enhance Environmental Practices.

Eng. Abdulelah Mohammed Zain Haij
Project Manager
Arabian Yemen Cement Company Limited.



الجمهورية اليمنية - محافظة حضرموت - المكلا - ص.ب. (٥٠٧٦٠) - هاتف: ٥٠٧٦٠/٢/٣ - فاكس: ٥٠٧٦٠-٥-٣٢٦٩٥٠
P.O. Box: (50760) - Mukalla - Hadhramout - Republic of Yemen - Phone: 00967-5- 326951/2/3 - Fax: 00967-5-326950
website: aycccl.com
e-mail: hcp@aycccl.com

EXECUTIVE SUMMARY

This study presents an Environmental Impact Assessment (EIA) of Cement Plant of Arabian Yemen Cement Co. Ltd (CP/AYCCL). The proposed Cement Plant will be a modern plant with State of the Art Technology for the manufacture of Ordinary Portland Cement (OPC) and Sulphate Resistant Cement (SRC) with a capacity of 1.2 MMt/Year through the use of a dry manufacturing process.. The study has been prepared by Al-Dar Consultation. Arabian Yemen Cement Co. Ltd (AYCCL) have expressed commitment towards implementing the plans recommended in the study. The scope of work implemented in the preparation of the EIA study included the definition of existing legal and administrative framework, description of the proposed project, , definition of baseline environmental conditions, identification and analysis of potential environmental impacts, analysis of potential alternatives for the proposed project, and the development of an environmental management plan with mitigation, monitoring, capacity building and institutional strengthening requirements as well as coordination of local Agencies and NGO's in EA .

The EIA showed that CP/AYCCL provides a significant positive socio-economic impact related to the potential in job opportunities for locals as well as providing a product that is much needed to meet the demand for the construction and development activities that are occurring on the national scale. In contrast, several potential adverse impacts can negatively affect the environment particularly those associated with emissions, effluent discharge, and waste generation. In the absence of control measures, the assessment of projected emissions indicated that CP/AYCCL operations may result in serious exposure to particulate matter for nearby receptors and the plant workforce. Other indicators that can potentially be impacted include traffic, noise, surface and ground water quality, soil quality, terrestrial biodiversity, resource use, health and safety, landscape and visual intrusion. As such, the adoption of proper environmental management plans will likely enhance the sustainability of cement production and the expected benefits from the proposed project .

Potential adverse impacts will be associated with the construction and operational phases at CP/AYCCL can be minimized by relying on effective mitigation, monitoring, and

training plans to support management decisions. The analysis of alternative compared the site selection and the adoption of a Best Available Technology (BAT) or end-of-pipe technology for reducing particulate matter (PM) emissions to the “do nothing” or “no control” scenario. Evidently, the implementation and proper operation of a BAT will minimize emissions and will result in an acceptable impact on air quality. The advantages and disadvantages of the two most commonly used emissions control BATs, namely Fabric Filters (FFs) and Electro Static Precipitators (ESPs), were also examined in the context of CP/AYCCL. While slightly more expensive, FFs appear to be more appropriate for CP/AYCCL.

In the context of this assessment, a mitigation plan proposed several impact-mitigation or control measures that will earn CP/AYCCL more acceptability, by eliminating or reducing to the extent possible potential adverse impacts. Similarly, a monitoring plan of impact indicators outlined above as well as operations indicators was developed. The plan defines for each indicator the monitoring means and methodology, the parameters to be monitored, as well as the monitoring location and frequency. Capacity building, training, and awareness components were also defined to assist CP/AYCCL in the implementation process of environmental management plans.

CONTENTS

	Page
COVER PAGE.....	I
ACKNOWLEDGEMENTS	II
PREFAC.....	III
EXECUTIVE SUMMARY	IV
CONTENTS.....	VI
TABLES	XI
FIGURES	XII
ABBREVIATIONS.....	XIII
NOMENCLATURE	XIV
1. INTRODUCTION.....	1
1.1 BACKGROUND	1
1.2 EIA OBJECTIVES	1
1.3 ENVIRONMENTAL SCREENING.....	1
1.4 SCOPE OF WORK.....	1
2. LEGAL AND ADMINISTRATIVE FRAMEWORK.....	3
2.1 CONCERNED AUTHORITIES.....	3
2.2 EIA PROCEDURES AND GUIDELINES	5
2.3 ENVIRONMENTAL STANDARDS.....	7
3. PROJECT DESCRIPTION	11
3.1 LOCATION.....	11
3.2 PROJECT COMPONENTS	14
3.2.1 Quarry, transport, and storage of raw materials.....	16
3.2.2 Feed material preparation.....	16
3.2.3 Clinker production.....	16
3.2.4 Cement production	17
3.2.5 Packing and loading.....	17

4. DESCRIPTION OF THE ENVIRONMENT 18

4.1 PHYSICAL ENVIRONMENT 18

 4.1.1 *Topography*..... 18

 4.1.2 *Geology and lithology* 21

 4.1.3 *Structural Geology* 24

 4.1.4 *Earthquake events*..... 24

 4.1.5 *Hydrogeology* 25

 4.1.6 *Climate and meteorology*..... 27

 4.1.7 *Ambient air quality on the Locality* 29

4.2 BIOLOGICAL ENVIRONMENT 31

4.3 SOCIO-ECONOMIC ENVIRONMENT 31

4.4 PUBLIC HEALTH 33

5. POTENTIAL ENVIRONMENTAL IMPACTS..... 34

5.1 AIR QUALITY 35

 5.1.1 *Air Dispersion and Sources*..... 39

 5.1.2 *Meteorology and Topography* 41

 5.1.3 *Environmental and health impacts of cement related air emissions*..... 42

5.2 WASTE GENERATION 43

 5.2.1 *Construction wastes*..... 43

 5.2.2 *Cement Kiln Dust*..... 43

 5.2.3 *Operation and maintenance wastes*..... 44

 5.2.4 *General refuse* 44

5.3 TRAFFIC 44

5.4 NOISE AND VIBRATIONS..... 45

5.5 SURFACE AND GROUND WATER QUALITY 46

5.6 SOIL QUALITY 47

5.7 TERRESTRIAL BIODIVERSITY 48

5.8 RESOURCE USE 49

5.9 HEALTH AND SAFETY..... 50

5.10 LANDSCAPE AND VISUAL INTRUSION 52

5.11 SOCIO-ECONOMICS 52

5.12 SUMMARY OF IMPACT ANALYSIS 53

6. ANALYSIS OF THE PROJECT ALTERNATIVES..... 55

6.1 SITE SELECTION..... 55

 6.1.1 *Site A - Kuthibah*..... 55

 6.1.2 *Site B – Abdullah Gareeb* 55

6.2	THE PREFERRED SITE.....	56
6.3	IMPLICATION OF THE 'DO NOTHING ' SCENARIO.....	56
6.4	EMISSION CONTROL	56
6.4	EMISSION CONTROL	57
6.4.1	<i>Fabric Filters</i>	57
6.4.2	<i>Typical ESP</i>	58
6.4.3	<i>The “no control” scenario</i>	59
7.	ENVIRONMENTAL MITIGATION PLAN	61
7.1	MITIGATION OF AIR QUALITY IMPACT	61
7.1.1	<i>Mitigation of PM emissions</i>	61
7.1.3	<i>Mitigation of SOx emissions</i>	66
7.1.4	<i>Mitigation for the emission of trace gases</i>	66
7.2	MITIGATION OF SOLID WASTE	68
7.3	MITIGATION OF TRAFFIC IMPACT	69
7.4	MITIGATION OF NOISE IMPACT.....	70
7.5	MITIGATION OF SURFACE AND GROUNDWATER IMPACT.....	71
7.6	MITIGATION OF IMPACTS ON SOILS	72
7.7	MITIGATION FOR TERRESTRIAL BIODIVERSITY.....	73
7.8	MITIGATION OF RESOURCE USE.....	74
7.9	MITIGATION OF HEALTH AND SAFETY IMPACTS	74
7.9.1	<i>Site security</i>	75
7.9.2	<i>Site safety</i>	75
7.9.3	<i>Enhancing safety at site facilities</i>	75
7.9.4	<i>Establishing environmental controls</i>	76
7.9.5	<i>Regulating transportation</i>	76
7.9.6	<i>Developing emergency/contingency plans</i>	77
7.9.7	<i>Ensuring personnel protection</i>	77
7.10	MITIGATION OF LANDSCAPE AND VISUAL IMPACTS.....	78
7.11	MITIGATION OF SOCIO-ECONOMIC IMPACTS.....	79
7.12	SUMMARY OF MITIGATION MEASURES	80
8.	ENVIRONMENTAL MONITORING PLAN	87
8.1	AIR QUALITY	87
8.1.1	<i>Criteria</i>	88
8.1.2	<i>Methodology</i>	88
8.1.3	<i>Monitoring locations</i>	90
8.1.4	<i>Frequency</i>	90

8.2 NOISE	90
8.2.1 Criteria	90
8.2.2 Methodology	90
8.2.3 Monitoring locations	91
8.2.4 Frequency	91
8.3 SURFACE WATER AND GROUNDWATER	91
8.3.1 Sampling location and analysis criteria	91
8.3.2 Methodology	92
8.3.3 Frequency	92
8.4 SOIL	92
8.5 SOLID WASTE	93
8.6 TERRESTRIAL BIODIVERSITY	93
8.7 RESOURCE USE	93
8.8 HEALTH AND SAFETY	93
8.9 LANDSCAPE AND VISUAL INTRUSIONS	94
8.10 SOCIOECONOMICS	94
8.11 OPERATIONS MONITORING	94
8.12 SUMMARY OF MONITORING PLAN	94
8.13 DATA MANAGEMENT	98
8.14 REPORTING	98
9. CAPACITY BUILDING AND INSTITUTIONAL STRENGTHENING.....	100
10.COORDINATION AND CONSULTATION OF LOCAL AGENCIES AND NGOS	102
10.1 LOCAL COUNCIL AND NGO'S OF MODIRIAH GHIEL BAWAZEER (PROJECT AREA).....	102
10.2 GOVERNMENTAL AGENCIES AT AL-MUKALLA- HADHRAMOUT GOVERNORATE.....	105
10.3 CONCLUSION AND RECOMMENDATION	106
REFERENCES	108
APPENDIX-1 EIA CORRESPONDENCE	113
APPENDIX-2NAME AND POSITION OF EXPERTS	127
APPENDIX - 3 - TABLE SHOW THE RAW WATER ANALYSIS (BORE WELL NO.1	128
APPENDIX - 4 CONTINUOUS AIR EMIMISSON MONITORING EQUIPMENT AND METEOROLOGICAL PARAMETERS.....	129
APPENDIX - 5 - AMBIENT AIR QUALITY MONITRING EQUIPMENT	130

APPENDIX - 6 - PRESENT DRAFT MONITORING FORMS 132

APPENDIX - 7 RECORDS OF INTER AGENCY /NGO'S COMMUNICATIONS 144

TABLES

Table	Page
1. CONCERNED AUTHORITIES WITH SELECTED RESPECTIVE RESPONSIBILITIES IN THE CONTEXT OF THE CEMENT INDUSTRY	4
2. SELECTED ITEMS EXTRACTED FROM LAW 26: ENVIRONMENT PROTECTION LAW	6
3. EIA PROCEDURE IN YEMEN.....	7
4. PROPOSED STANDARD FOR AMBIENT AIR QUALITY	7
5. OCCUPATIONAL NOISE EXPOSURE LIMITS	8
6. PERMISSIBLE AMBIENT NOISE LEVELS AT RECEPTORS LOCATED IN THE VICINITY OF CEMENT INDUSTRIES	8
7. YEMENI NOISE STANDARDS.....	8
8. EMISSION LIMIT VALUES FOR CONSTITUENTS RELEASE FROM CEMENT PLANTS (AS MG/NM3)	9
9. PERMISSIBLE LEVEL FOR THE DISCHARGE OF INDUSTRIAL WASTEWATER INTO THE PUBLIC SEWER NETWORK.....	10
10. MAJOR GEOLOGICAL UNITS AND LITHOLOGY IN THE STUDY AREA.....	21
11. NUMBER OF REGISTERED DOMESTIC EARTHQUAKE EVENTS AT AL- MUKALLA.....	24
12. CHARACTERIZATION OF THE WATER RESOURCES GHIEL BAWAZEER.....	25
13. REPORTED DISEASES IN THE HADHRAMOUT GOVERNORATE – AL-MUKALLA FOR THE YEAR 2004 ...	33
14. DISTANCE BETWEEN SITE AND NEAREST RECEPTORS.....	35
15. FORMATION MECHANISMS OF PRINCIPAL GASEOUS EMISSIONS FROM CEMENT MANUFACTURING	36
16. TYPES OF DUST AND THEIR GENERATION CAUSES AT CEMENT PLANTS	36
17. PM EMISSION SOURCES FROM THE CEMENT INDUSTRY	37
18. SUMMARY OF THE MINOR GASEOUS COMPOUNDS THAT ARE EMITTED FROM THE CEMENT INDUSTRY	38
19. STACK PARAMETERS	40
20. ENVIRONMENTAL EFFECTS OF MAJOR CONSTITUENTS EMITTED FROM CEMENT MANUFACTURING ..	42
21. TYPICAL ENERGY-EQUIVALENT NOISE LEVELS REPORTED FOR THE CEMENT INDUSTRY (ETPI, 1999)	46
22. SOIL PH AND ASSOCIATED IMPACTS.....	48
23. ADVERSE HEALTH EFFECTS OF CKD	51
24 SUMMARY OF IMPACT ANALYSIS	54
25 COMPARISON OF THE CHARACTERISTICS OF FFs AND ESPs USED IN THE CEMENT INDUSTRY	59
26. COMPARATIVE EVALUATION OF PM BAT EMISSION REDUCTION VERSUS THE “DO NOTHING” SCENARIO	60
27. COMMON CONTROL MEASURES FOR PARTICULATE EMISSIONS FROM CEMENT MANUFACTURE.....	62
28. EMISSION REDUCTION FACTORS FOR MATERIALS STORAGE.....	65
29. COMMON CONTROL MEASURES FOR MAJOR GASEOUS EMISSIONS FROM CEMENT MANUFACTURE	67
30. TRAFFIC CONTROL MEASURES	70
31. GUIDELINES FOR CKD USE IN AGRICULTURE)	73
32. PROPOSED MITIGATION MEASURES.....	81
33. SUMMARY OF THE PROPOSED MONITORING PLAN.....	96

FIGURES

Figure	Page
1. OVERVIEW OF STUDY AREA	12
2. SATELLITE IMAGE SHOW PLANT SITE AND RAW MATERIAL.....	12
3. GENERAL LAYOUT OF THE PROJECT	13
4. PROCESS FLOW DIAGRAM FOR PROPOSED CEMENT MANUFACTURING FACILITY	15
5. TOPOGRAPHICAL MAP OF THE STUDY AREA	18
6. TOPOGRAPHICAL MAP SHOW PLANT SITE,EXISTING AND PROPOSED ACTIVITIESIN THE STUDY AREA	19
7. TOPOGRAPHICAL MAP SHOW MAIN IMPORTANT ACTIVITIES OUT OF THE STUDY AREA	20
8. GEOLOGICAL MAP OF THE STUDY AREA	22
9. SATELLITE IMAGE SHOW ROCKS UNITES OF STUDY AREA	23
10. HYDROGEOLOGICAL MAP OF THE STUDY AREA.....	26
11. SHOW TEMPERATURES, RELATIVE HUMIDITY AND RAINFALL PROFILES FOR AL-MUKALLA (1999-2003)	27
12. SHOW WIND SPEED DIRECTION AND WINDROSE	28
13. SHOW EXISTING SITE ENTRANCE OF MUKALLA-SAYAUN HIGHWAY AND SMALL LIME KILN PLANT IN THE VICINITY OF CP/AYCCL.....	30
14. SHOW EXISTING CRASHER IN THE VICINITY OF CP/AYCCL	30
15. TERRESTRIAL BIODIVERSITY IN THE VICINITY OF CP/AYCCL.....	31
16. AGRICULTURAL ACTIVITY IN THE GHIEL BAWAZEER	32
17. SHOW OLD MOSQUES AND CEMETERIES OF CULTURAL HERITAGE AT AL-NAQA'A TOWN.....	33
18. TOPOGRAPHICAL MAP SHOW PLANT SITE,EXISTING AND PROPOSED ACTIVITIESIN THE STUDY AREA	34
19. LOCATION OF POTENTIAL RECEPTORS FOR IMPACT ASSESSMENT	41
20. TOPOGRAPHICAL MAP OF SITES SELECTION (SITES A AND B).....	56
21. FRAMEWORK FOR IMPLEMENTING THE ENVIRONMENTAL MANAGEMENT PLAN.....	95
22. SHOW, THE MEETING BETWEEN STUDY TEAM, LEADERS OF LOCAL COUNCIL , MEMBERS OF ENVIRONMENT AND DEVELOPMENT SUPPORTER SOCIETY AND REPRESENTATIVES OF WILD LIFE AFFAIRS OF AL-EYOUN TOWN AT GHIEL BAWAZEER, REPRESENTATIVES, EPA AND CP/AYCCL AT AL-MUKALLA	102
23. SHOW, BUILDING OF LOCAL COUNCIL AT MODIRIAH GHIEL BAWAZEER	102
24. SHOW, THE MEETING BETWEEN STUDY TEAM ,CHAIRMAN OF CIVIC ORGANIZATIONS NETWORK AND SOCIAL DEVELOPMENT SOCIETY AT GHIEL BAWAZEER , REPRESENTATIVES, EPA AND CP/AYCCL AT AL-MUKALLA	103
25. SHOW, THE MEETING BETWEEN STUDY TEAM, MEMBERS OF ENVIRONMENT FRIENDS SOCIETY-SHEHEAR TOWN, REPRESENTATIVES, EPA AND CP/AYCCL AT AL-MUKALLA	104
26. SHOW , BUILDING OF ENVIRONMENT FRIENDS SOCIETY -SHEHEAR TOWN	104
27. SHOW THE MEETING BETWEEN STUDY TEAM , CHAIRMAN OF ENVIRONMENT AND SOCIAL PROTECTION SOCIETY-AL-NAQA'A,REPRESENTATIVES,EPA AND CP/AYCCL AT AL-MUKALLA...	105
28. SHOW ,BUILDING OF ENVIRONMENT AND SOCIAL PROTECTION SOCIETY - AL-NAQA'A.....	105

ABBREVIATIONS

CP/AYCCL	=	Cement Plant of Arabian Yemen Cement Co. Ltd.
GIA	=	General Investment Authority
GSMRB		Geological Survey and Mineral Resources Board
MoAI	=	Ministry of Agriculture and Irrigation
MoIT	=	Ministry of Industry and Trade
MoPH	=	Ministry of Public Health
GoH	=	Governorate of Hadhramaut
NWRA	=	National Water Resources Authority
OSHA	=	Occupational Safety and Health Administration
BAT	=	Best Available Technology
BOD5	=	Biological Oxygen Demand
CKD	=	Cement Kiln Dust
Cl	=	Chlorine
CO	=	Carbon monoxide
CO2	=	Carbon dioxide
DO	=	Dissolved Oxygen
EA	=	Environmental Assessment
EIA	=	Environmental Impact Assessment
ELV	=	Emission Limit Value
EMP	=	Environmental Management Plan
EPA	=	Environmental Protection Authority
ESP	=	Electrostatic Precipitator
EU	=	European Union
F	=	Florine
FF	=	Fabric Filter
GDP	=	Gross Domestic Product
GPS	=	Global Positioning System
H2S	=	Hydrogen Sulfide
HC	=	Hydrocarbons
HFO	=	Heavy Fuel Oil
NH3	=	Ammonia
NO2	=	Nitrogen dioxide
NOx	=	Nitrogen Oxides
PC	=	Personal Computer
PM	=	Particulate matter
PM10	=	Particulate matter with diameter less than 10 microns
PME	=	Powered mechanical equipment
PPE	=	Personal Protection Equipment
SO2	=	Sulfur dioxide
SOx	=	Sulfur Oxides

SS	=	Suspended Solids
STP	=	Standard Temperature and Pressure
TOC	=	Total Organic Compounds
TOR	=	Terms Of Reference
TSP	=	Total Suspended Particulates
TSS	=	Total Suspended Solids
USEPA	=	United States Environmental Protection Agency
VOC	=	Volatile Organic Compounds
WHO	=	World Health Organization

NOMENCLATURE

%	=	Percent
Ω	=	Ohms
μg	=	Microgram
BTU	=	British Thermal Unit
cm	=	Centimeter
<i>dB(A)</i>	=	Decibels (A)
g	=	Gram
ha	=	Hectare
Kg	=	Kilogram
Km	=	Kilometer
kW	=	Kilo Watt
kWhr	=	Kil Watt Hour
L	=	Liters
m	=	Meter
m ²	=	Meter square
m ³	=	Meter cube
mg	=	Milligram
min	=	Minute
MJ	=	Mega Joule
mm	=	Millimeter
Nm ³	=	Normal cubic meter
°C	=	Degree Centigrade
°K	=	Degree Kelvin
sec	=	Second

1. INTRODUCTION

1.1 Background

Arabian Yemen Cement Co. Ltd (AYCCL) wish to set up Cement Plant a 1.2 MMton/Year through the use of a dry manufacturing process . The operation of the proposed project expected to start nearly at the end of August of 2008. CP/AYCCL conduct an Environmental Impact Assessment (EIA) at the request by environmental protection Authority (EPA) VIA General Investment Authority (GIA), Environmental Impact Assessment (EIA) Correspondence have been show in Appendix 1.

The study presents an environmental Assessment of the CP/AYCCL and focuses on the location area of the proposed project along with the extensions in the surrounding areas.

The study has been prepared by AL_Dar for Consultation (Yemen) private Limited. The names of the experts have been shown in Appendix 2.

Cement Plant of Arabian Yemen Cement Co. Ltd who expressed commitment towards implementing the plans recommended in this study.

1.2 EIA objectives

The objectives of the EIA study include assisting CP/AYCCL and concerned stakeholders and governmental authorities in recognizing environmental, social, and economic impacts of the proposed project, recommending appropriate control, mitigation and monitoring measures, as well as increasing awareness about the plant and its potential impacts.

1.3 Environmental screening

According to the Ministerial Decision Number 148 that was issued in the year 2000, the construction and operation of cement manufacturing plants requires a full EIA. Since CP/AYCCL is proposed project which require a full EIA.

1.4 Scope of work

Besides this introductory Chapter, the scope of work implemented in the preparation of the EIA study consists of the following:

- Definition of existing legal and administrative framework (Chapter 2)

- Description of the proposed project (Chapter 3)
- Definition of baseline environmental (Chapter 4)
- Potential environmental impacts (Chapter 5)
- Analysis of alternatives to the proposed project (Chapter 6)
- Development of an environmental management plan including mitigation, monitoring, capacity building and institutional strengthening (Chapters 7,8,9)
- Public consultation and involvement of local Agencies in the EIA(Chapter 10)

2. LEGAL AND ADMINISTRATIVE FRAMEWORK

The legal and administrative frameworks related to cement manufacturing in Yemen with emphasis on the context of CP/AYCCL. Relevant policies, regulations, and standards related to the implementation of the proposed project are also outlined.

2.1 Concerned authorities

Several government bodies are directly responsible for or indirectly involved in the proper operation and management of cement plants in Yemen including:

- Environmental Protection Authority (EPA)
- Geological survey and Mineral Resources Board (GSMRB)
- National Water Resources Authority (NWRA)
- General Investment Authority (GIA)
- Ministry of Public Health (MoPH)
- Ministry of Industry and Trade (MoIT)
- Governate of Hadhramaut (GoH) in the case of CP/AYCCL)
- Ministry of Agriculture and Irrigation (MoAI)

Table 1 outlines the general functional responsibilities of these governmental authorities. At this stage, it is expected that CP/AYCCL will be responsible for implementing environmental management plans at its facilities in coordination with other governmental bodies particularly the EPA.

Table 1. Concerned authorities with selected respective responsibilities
in the context of the cement industry

Organisation/Authority	Responsibility
Environmental Protection Authority (EPA)	• Preparation of new and revised regulations • Set up EIA methodologies and procedures • Review of EIAs • Propose general policies to protect the environment and adopt environmental design research as the general framework for an adequate solution of pollution problems • Co-ordinate between concerned national agencies and follow up and assess their activities as well as coordinate with regional and international organizations intrested in the protection of the environment • Set up standards for environment pollution control and the protection of terrestrial and marine fauna and flora • Draft laws and regulations for environmental protection • Review regional and international agreements on environmental protection • Set up programs for international co-operation and environmental protection for implementation in accordance with general policies of the Government of Yemen • Collect data, carry out assessments, and prepare reports on the status of the environment, and establish environmental monitoring systems • Set up the general framework of environmental education and training programs to enhance public awareness and induce individual and collective participation in environmental protection • Record and evaluate natural resources changes and inform the Cabinet of these changes by means of regular reports • Prepare a national plan for the training of a Yemeni cadre in various environment fields • Organize local seminars and deliver lectures concerning environmental protection • Enforce air emission monitoring at polluting industries
GIA	• Project registered • Taxes and customs Exemption (Law No.22, 2002 of the GIA)
NWRA	• Strategic review with respect to national water resources • Review of water-related standards aiming at the protection of surface and groundwater sources • Establish standards for effluent reuse
MoAI	• Review of standards aiming at the protection of soil and crops
MoPH	• Develop standards aiming at protecting public health • Conduct health impact assessments • Monitor exposed groups and population segments
GOH	• Coordinate and assist in implementing local ministry functions
MoIT	• Supervise the industrial sector • Coordinate between the public cement industries in Yemen • Provide assistance and support to industrial establishments
(GSMRB)	• Lessening of Quarries and Mining(Law No.24,2002)

- EPA documents

2.2 EIA procedures and guidelines

Law 26 for the Protection of the Environment was issued in 1995 (Table 2). The law defines the organization of environmental protection, environmental information system and participation in the management and protection of the environment, as well as the responsible authorities. Within this law, provisions are proposed to conduct an EIA for developmental projects. Furthermore, the Ministerial Decision Number 148 that was issued in the year 2000 developed an Implementation List for the Execution of the Environmental Protection Law thereby approving the EIA procedures in Yemen. The Ministerial Decision provides a list of project types that require an EIA. Included in this list are projects that involve the construction and operation of cement manufacturing plants. The decision outlines the elements to be examined in an EIA report, which are consistent with the scope of work described above. Table 3 outlines EIA procedures in Yemen.

Table 2. Selected items extracted from Law 26: Environment Protection Law

<i>Title</i>	<i>Key points</i>	<i>Description</i>
General rules and principles	Definitions	Definition of environmental terms
	Aims and general basis	Objectives: 1) protect the environment, 2) prevent and combat pollution, 3) maintain natural resources, 4) include EIA within economic plans of project
	EPA	Responsibilities of EPA are defined
Protection of water, soil, and use of pesticides	Protection of water and soil and establishment of protected areas	Protection of surface and ground water Land use planning must take into account the environment Limit damage to soil Agricultural lands are protected against commercial and industrial development
	Use of eradivative substances	Control the use of pesticides and harmful chemicals
Environmentally damaging activities	Control of environmentally damaging activities	Prevention of dumping, collection, discharging or burying environmental pollutants Designation of areas clear of pollution Protection of natural resources Polluting establishments should develop a contingency plan for environmental protection
	Environment technical standards, criteria and specifications	Need to protect the environment, specially surface and ground water, air, marine and noise EPC shall decide on standards and parameter limits It is not permissible to exceed environmental standards except in case of an emergency or equipment failure
	Project permits and evaluation of Environmental Impacts	Projects and establishments which constitute potential sources of pollution or may harm the environment must be issued a permit Submission of EIA for existing projects, establishments and activities within a period of six months
	Handling of hazardous wastes and materials	List of dangerous and toxic substances along with their control Prohibiting the public as well as the private sectors from importing, storing, and/or disposing of dangerous, toxic or radioactive substances
	Protection of the environmental and economical development	Economic plans must take into account environmental impacts and mitigation measures Projects must not be issued approval in case they damage the environment All competent bodies, especially those concerned with development and economic planning, shall take into consideration the protection of the environment and control of pollution and the rational consumption and utilization of natural resources
	Environmental monitoring	EPC and other authorities may supervise and operate environmental monitoring networks EPC may impose monitoring on projects and keep records
Violation and compensation for environmental damages		Environmental inspectors are entitled to inspect establishments that are harming the environment Establishments should provide needed information to environmental inspectors Establishments are liable to pay compensation and face judicial charges for the environmental damage that they cause

EPA documents

Table 3. EIA procedure in Yemen

<i>EIA Stage</i>	<i>Action</i>	<i>Agency involved</i>
Screening	Decision on whether or not the project requires an EIA	EPA , GIA
Scope of the EIA	Developing TORs Initiating initial public consultation	EPA, GIA, Donor(s)
Managing the EIA	Consultants undertake the EIA and organize workshops or meetings for participation of stakeholders	Private Consulting Firms, Concerned Ministry or party, Donor(s)
Reviewing the adequacy of the EIA	Review contents and provide comments for necessary revisions Once EIA is acceptable, EPA issues clearance letter which may include conditions (changes in design or location, monitoring requirements)	EPA, GIA ,Donor(s)
Monitoring and supervision	Ensuring implementation of agreed mitigation measures and reporting to relevant agencies	Private Contractors, EPA, Donor(s) GIA
Evaluating the Effectiveness of the EIA	Review contents; derive lessons learned for future projects	EPA

EPA documents

2.3 Environmental standards

The EPA has been actively engaged in the preparation of national environmental quality standards for air, water, and soil. To date many of these standards are still in draft form. As such, International Standards are commonly relied upon. In the context of the CP/AYCCL, several standards will be adopted including ambient air quality (Table 4), occupational noise exposure limits (Table 5), and noise guidelines in surrounding zones (Tables 6, 7). The emission standards that were adopted in the present EIA include Emission Limit Values (ELV) for flue gas emitted by cement industries (Table 8) and ELVs for industrial effluent discharged into the public sewer network (Table 9).

Table 4. Proposed standard for ambient air quality

<i>Constituent</i>	<i>Value (µg/m³)</i>	<i>Averaging period</i>	<i>Authority</i>
PM-10	50 100	Annual Daily	Yemen
PM/TSP/dust	60-90 150-230	Annual Daily	WHO
SO ₂	50 150	Annual Daily	Yemen
NO ₂	100 150	Annual Daily	Yemen

EPA documents

Table 5. Occupational noise exposure limits

<i>Standard, dB(A)</i>	<i>Averaging time (hour)</i>
90	8
105	1

Source: Occupational Safety and Health Administration

Table 6. Permissible ambient noise levels at receptors located in the vicinity of cement industries

<i>Receptor</i>	<i>Maximum allowable log equivalent dB(A)</i>	
	<i>Day time (07:00–22:00)</i>	<i>Night time (22:00–07:00)</i>
Residential, institutional, educational	55	45
Industrial, commercial	70	70

Source: (World Bank, 1998)

Table 7. Yemeni noise standards

<i>Land use Category</i>	<i>Noise standard Leq dB(A)</i>		
	<i>7:00 AM-6:00 PM</i>	<i>6:00 PM-11:00 PM</i>	<i>11:00 PM-7:00 AM Holidays</i>
Rural residential areas and recreational area	45	40	35
Suburban residential area	50	45	40
Urban residential areas	55	50	45
Urban residential areas with some businesses	60	55	50
Industrial and business areas	70	70	70

Source: (EPA)

Table 8. Emission limit values for constituents release from cement plants (as mg/Nm3)

Constituent	World Bank	Yemen
PM Cement kilns Grinding, crushing, clinker coolers and related processes	50	200 - 500 or 3 Kg dust/Ton of cement (dry process)
SOx	400	100
NOx	600	500

¹ World Bank guidelines for cement industry (World Bank 1998)

² For new facilities

³ For existing facilities

Table 9. Permissible level for the discharge of industrial wastewater into the public sewer network

<i>Parameter</i>	<i>Unit</i>	<i>Allowable limit</i>
COD	mg/L	2,100
BOD	mg/L	800
pH		5.5-9.5
Temperature	°C	45
TSS	mg/L	1,100
TDS	mg/L	2,000
Oil and grease	mg/L	100
Phenols	mg/L	10
Sulfates	mg/L	1,000
Phosphate	mg/L	50
Cyanide	mg/L	5
Sulfur	mg/L	1
H ₂ S	mg/L	10
Iron	mg/L	50
Chlorides	mg/L	600
Fluorides	mg/L	8
Arsenic	mg/L	5
Tin	mg/L	10
Barium	mg/L	5
Boron	mg/L	5
Cadmium	mg/L	1
Hexavalent chromium	mg/L	5
Cupper	mg/L	5
Lead	mg/L	0.6
Mercury	mg/L	0.01
Cobalt	mg/L	0.05
Lithium	mg/L	5
Vanadium	mg/L	0.1
Aluminum	mg/L	5
Nickel	mg/L	5
Selenium	mg/L	0.1
Silver	mg/L	1
Manganese	mg/L	10
Beryllium	mg/L	5
Zinc	mg/L	15

Source:(NWRA, 1999)

3. PROJECT DESCRIPTION

3.1 Location

The proposed cement Plant will be located at Al ayoun (Abdullah Ghareeb), Modiriah of Ghriel Bawazeer , around 60 km North East of Mukalla City Figure 1 Overview of study area .–Mukalla -Sayaun Highway and turn off to the West for a distance of 3.0 km .Limestone Mines 1.0 km to the North of the site , Limestone Deposit 6.0 km stretch from North East to South West with a band width varying from 1200 m to 900 m , Clay & Sandstone 6.0 km to the West of the Limestone Deposit, Electricity Captive Power plant , Water Supply Ground Water , Soil Firm Strata , Altitude 220 m Above Mean Sea Level , Rainfall Scanty – 27..5mm, Temperature Max. – 31.64 degrees (⁰ C), Min. - 16.82 degrees (⁰ C) and Wind 8.5 knots /Hr.

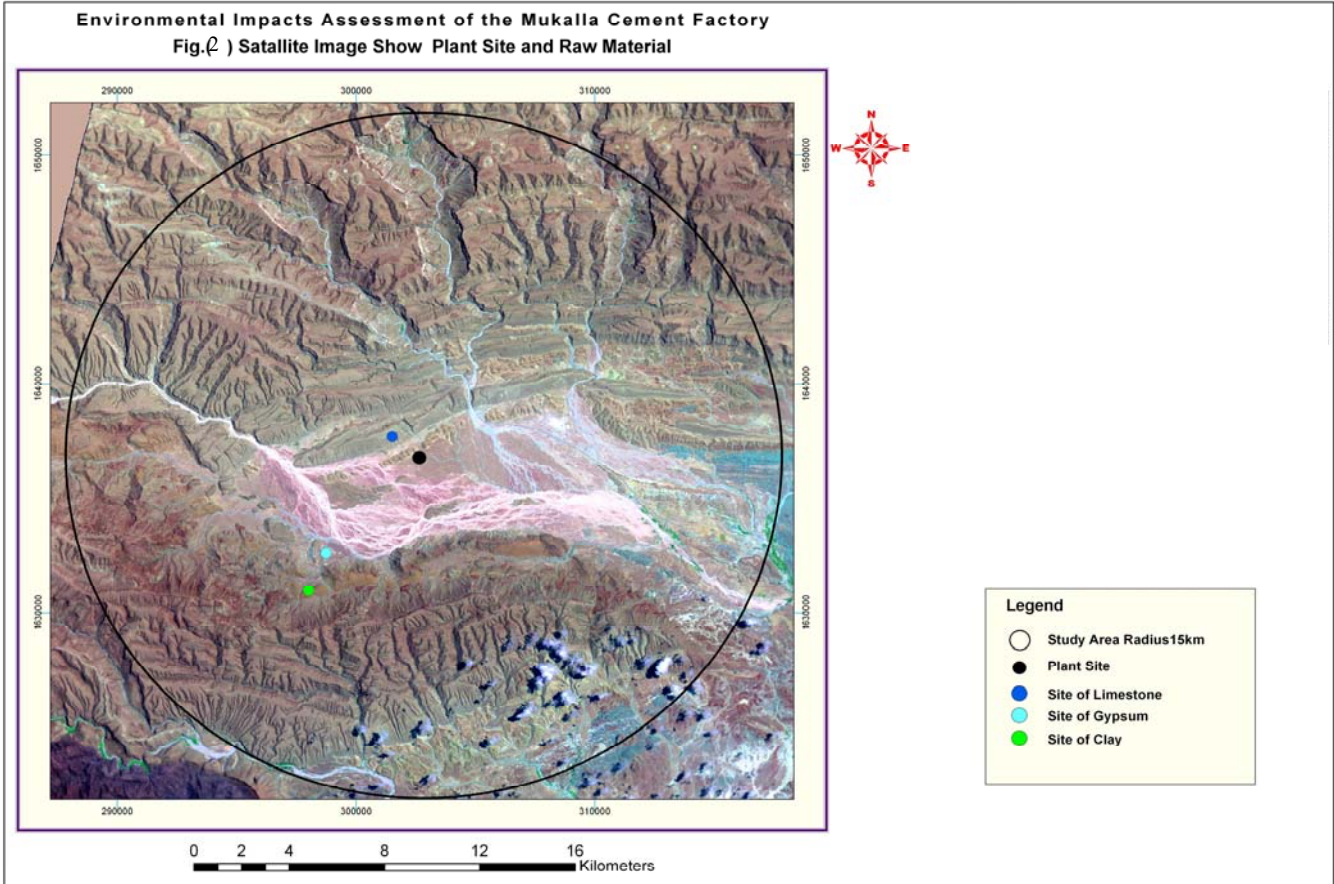
Wind Direction From South East At times South West (Minimal) , Relative humidity 20 to 70% (differs rapidly) , Seismic Data seismic zone 3 as per UBC Code , the area of land required for the proposed project and the annexed faculties is estimated at around (300 hectare) Figure 2 Plant site and raw materials .

The proposed location for the cement factory can be described as follows :

A level surface with minor undulations at random intervals ,Small Hillocks on the Northern and Southern side of the level surface ,A wadi of a level surface to the North cutting deep and moving South close to the Hillock situated on the North East side . The deeper portion is to the East of the location ,The vegetation is sparse with small shrubs scattered at long distances between one another on the level ground ,There are a number of hillocks of Marl and clay mass with hardly flora or fauna in the vicinity figure 3 General Layout of the project



FIG(1) OVERVIEW OF STUDY AREA





FIG(3) GENERAL LAYOUT OF THE PROJECT

3.2 Project components

The proposed Cement factory will be a modern plant with State of the Art Technology for the manufacture of Ordinary Portland Cement (OPC) and Sulphate Resistant Cement (SRC) with a capacity of 1.2 MMt/Year through the use of a dry manufacturing process.

Cement manufacturing processes consisting of several distinct stages that include the following :

- Quarrying, transport, and storage of raw materials
- Feed materials preparation
- Clinker production
- Cement production
- Packing, loading.

A schematic diagram showing the various stages involved in the production of cement at proposed project (CP/AYCCL) is presented in Figure 4. Mass Flow Diagram

Arabian Yemeni Cement Company Limited- Al-Mukalla

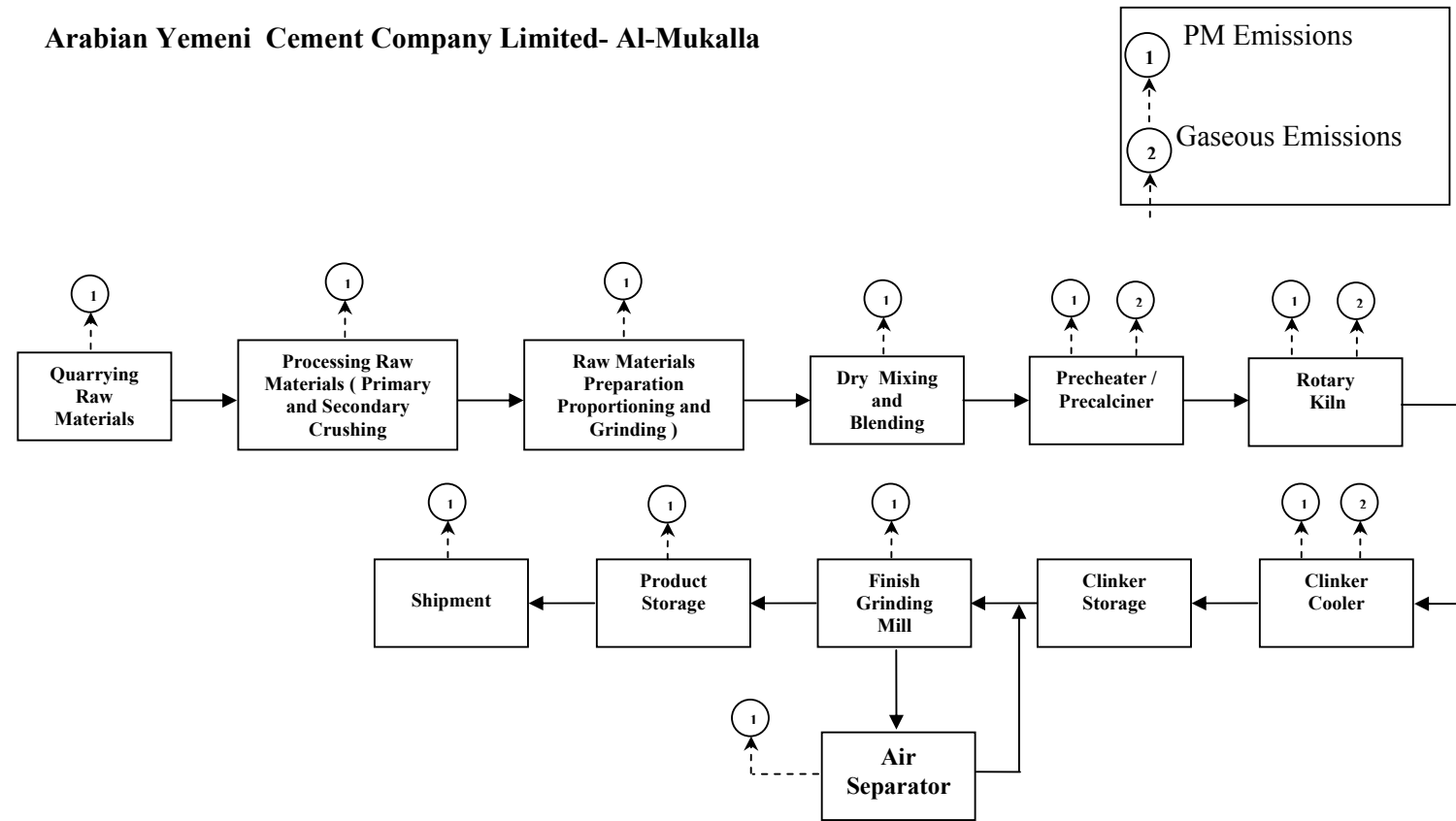


FIG. (4) PROCESS FLOW DIAGRAM FOR PROPOSED CEMENT MANUFACTURING FACILITY

3.2.1 Quarry, transport, and storage of raw materials

The cement manufacturing starts from the mining of limestone this being the major ingredient . the Run of Mine (ROM) is transported in Trucks to the Limestone Crusher of 800 TPH capacity to be crushed to a size of $> 75\text{mm}$ and conveyed by mean of long belt conveyors to a circular stockpile referred and the Pre Blending Storage . Similarly the corrective materials such as Clay, sandstone and Iron Ore are crushed to a size of $< 25\text{mm}$ in a crusher of 500 TPH capacity and stored in a linear stockpile. The limestone and the corrective materials are suitably proportioned consistent with the raw mix design to be fed into Vertical Roller mill.

3.2.2 Feed material preparation

The Vertical roller Mill with a capacity of 400 TPH grinds the proportioned raw material into a fine powder referred to as raw meal . The fineness is maintained at 10-12% on 90um sieve. The ground material is transported by means of Air Slides and Bucket Elevator for discharge into the homogenizing Silos which are two in number with a capacity of 12800T each . The stored raw mealis suitably blended by means of a sequential aeration to attain uniformity in the Raw Meal before feeding to the kiln system.

3.2.3 Clinker production

The heart of the cement manufacturing process is the pyro-processing system, which transforms the feed material into clinker - the basic input to cement production.

The clinker formation process can be divided into 4 stages:

- Drying and preheating,
- Calcination,
- Sintering or clinkering
- Cooling

The homogenous mix of raw meal is fed into the Pre Heater System consisting of a 6 stage Pre Heater and Pre Calciner. The raw meal undergoes a process change whereby the material

is calcined through a counter flow method of heat transfer with the hot gases from the kiln flowing up the pre heater system while the material flows downwards . The calcined material then flow in to the rotary kiln where the process of sintering takes place at a temperature of 1450 degrees C. The semi fused material is referred to as cement clinker. The clinker is then cooled in an inclined grate cooler where the bed of clinker is cooled by a gust of air blown from the bottom of the cooler . The temperature of the clinker is brought down from a bout 1000 degrees C at the discharge end of the kiln to 60 to 65 degrees C above ambient temperature at the discharge end of the cooler .The clinker is then transported by means of a pan conveyor to the clinker silo for storage. The capacity of the clinker silo will be 40000T.

3.2.4 Cement production

The clinker from the silo along with additive materials such as gypsum and limestone are suitably proportioned with a maximum percentage of 5% for gypsum are fed into the cement Mill for grinding into cement. There are two ball mills of 110TPH each for grinding cement . Two types of cement are envisaged at this stage namely the Ordinary Portland Cement (OPC) and Sulphate Resistant Cement (SRC). The ground cement is stored in silos of capacity 8000T each with Three silos for OPC and One silo for SRC.

3.2.5 Packing and loading

The dispatch of cement can be done through bulk loading or packed in paper bags of 50Kg weight . There are two bulk loading stations of 100T capacity each and Four packing machines with a capacity of 120TPH each for packing in bags . The facility envisaged will have automatic bag applicators and Automatic Truck loading arrangements for standard Trucks Numbering 6 and 2 Nos of manual truck loading arrangements For non standard trucks.

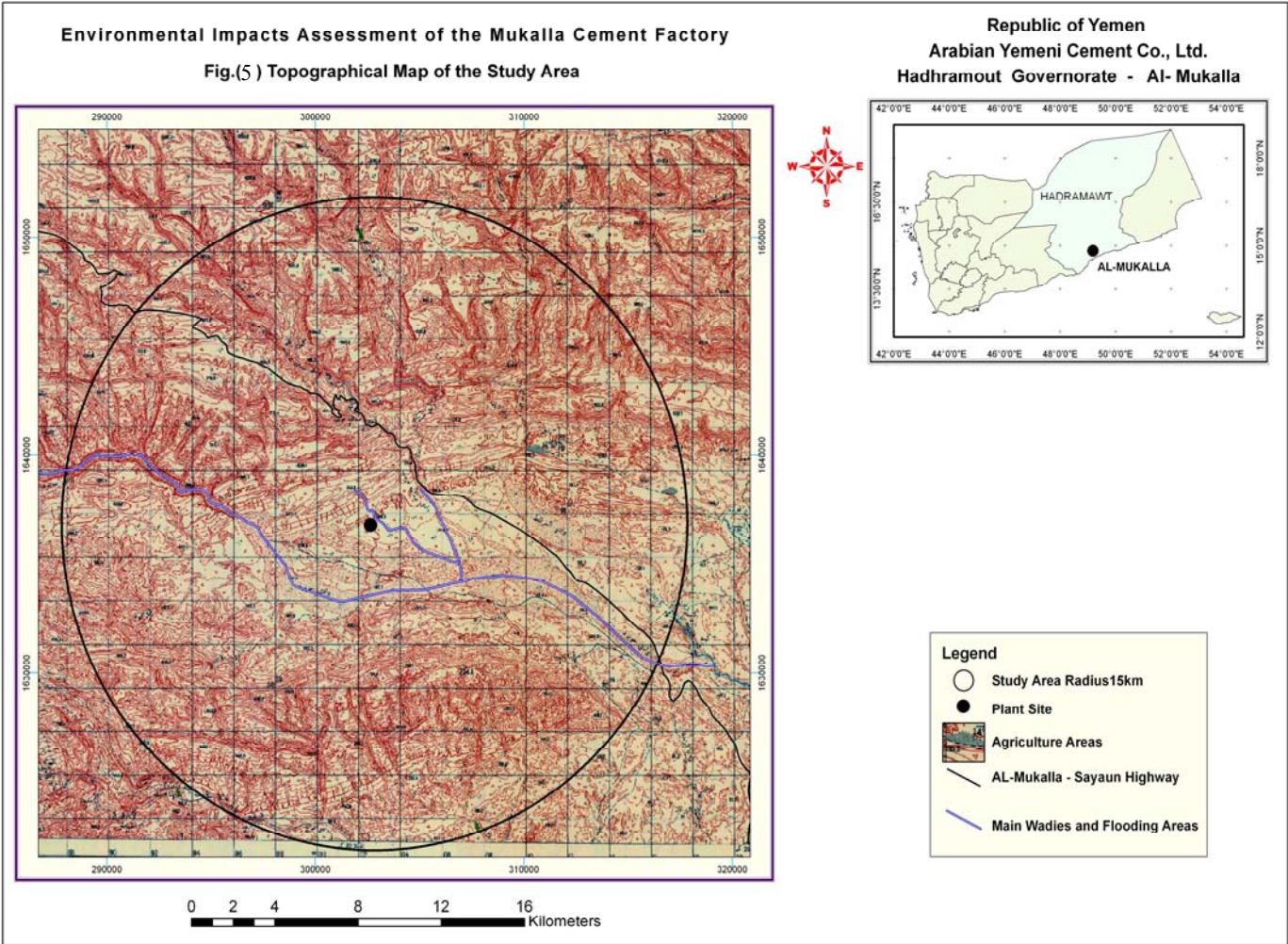
4. DESCRIPTION OF THE ENVIRONMENT

4.1 Physical environment

4.1.1 Topography

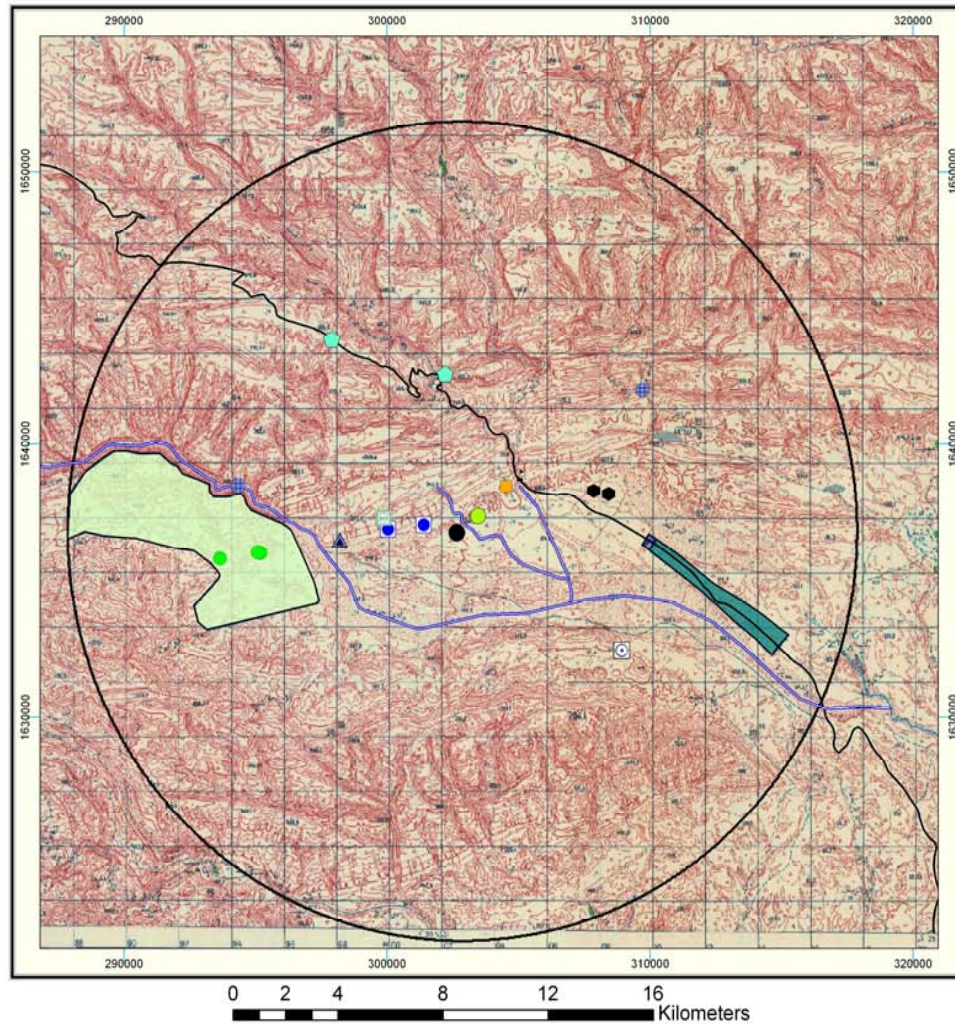
The CP/AYCCL is located within Low plain (124m above mean sea level) that is surrounded by mountainous terrain. Figure 5 presents a topographical map of the area surrounding CP/AYCCL.

The city of Ghieel Bawazeer is considered to be a major junction connecting Al- Ryain and Al- Mukalla . Ghieel Bawazeer has been experiencing rapid expansion in recent year . In 1994, the population of Ghieel Bawazeer was estimated around 36.612 inhabitants. Figure 6,7 show existing and proposed activities in the study area and out of the study area.



Environmental Impacts Assessment of the Mukalla Cement Factory

Fig.(٤) Tophographic Map Show Plant site, Existing and Proposed Activities in the Study Area



Republic of Yemen Arabian Yemeni Cement Co., Ltd. Hadramout Governorate - Al- Mukalla

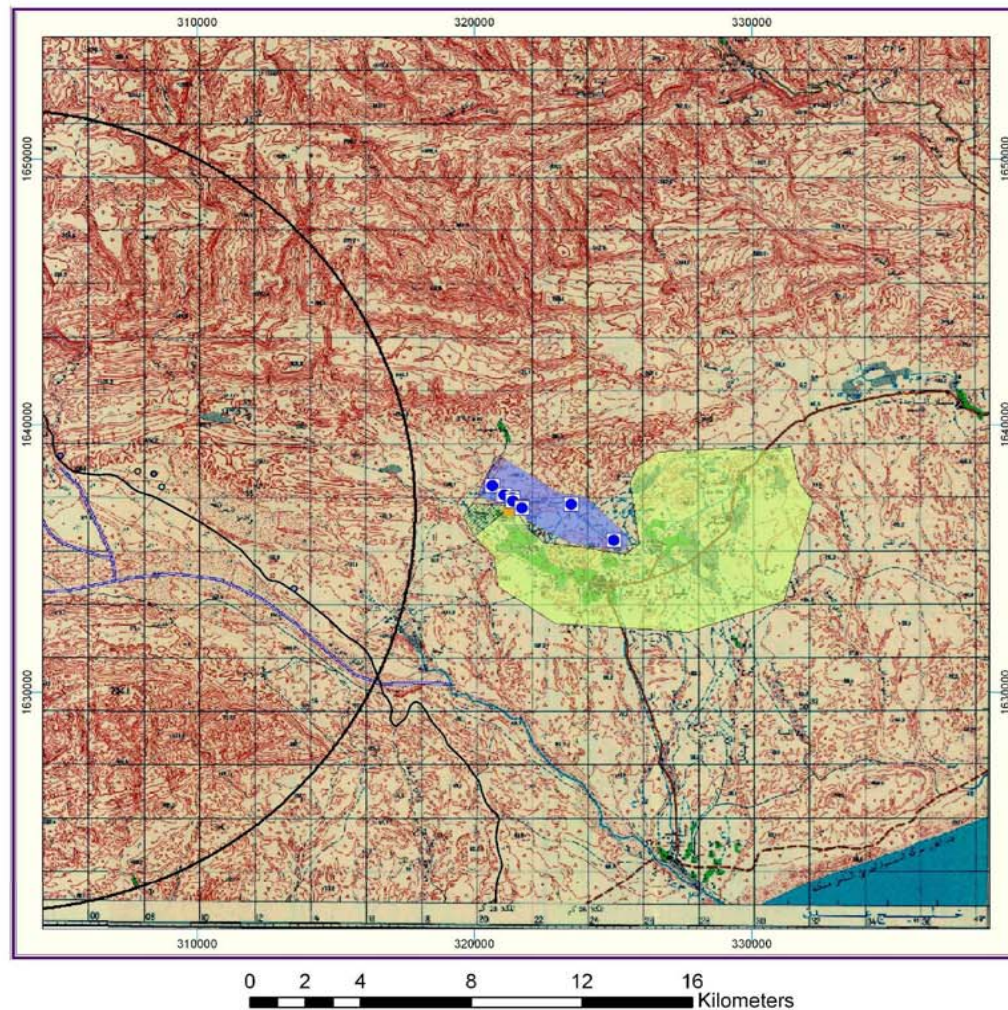


Legend

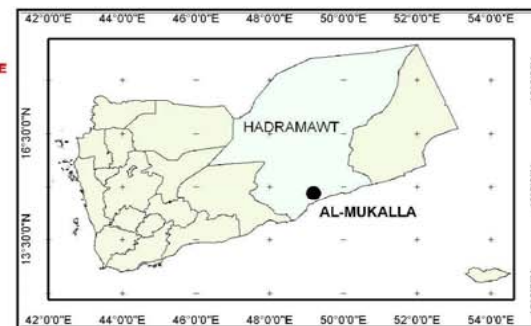
- Study Area Radius 15km
 - Plant Site
 - Factory Residence Complex
 - Site Entrance (Mukalla-Seiyun Highway)
 - Lime Kiln Plant
 - Factory Water Well
 - Open Water Cistern
 - ▲ Close Water Cistern
 - Proposed Dump
 - Village
 - Nomadic and Semi- Nomadic
 - Crusher
 - Spring
 - Open Grassing Areas
 - Existing and Expansion Populated and Development Areas 7km
 - AL-Mukalla - Sayaun Highway
 - Main Wadies and Flooding Areas
- | | Distance from Site |
|--|--------------------|
| Factory Residence Complex | 800m |
| Site Entrance (Mukalla-Seiyun Highway) | 3km |
| Lime Kiln Plant | 2km |
| Factory Water Well | 500m |
| Open Water Cistern | 2km-2.5km |
| Close Water Cistern | 2.5km |
| Proposed Dump | 4.3km |
| Village | 8.3km - 8.8km |
| Nomadic and Semi- Nomadic | 5.8km - 8.6km |
| Crusher | 7km - 9km |
| Spring | 5.4km - 6km |
| Open Grassing Areas | 7.5km |
| Existing and Expansion Populated and Development Areas 7km | 5.5km - 13 km |

Environmental Impacts Assessment of the Mukalla Cement Factory

Fig.(7) Topographical Map Show Main Important Activities out of the Study Area



Republic of Yemen
Arabian Yemeni Cement Co., Ltd.
Hadhramout Governorate - Al- Mukalla



Legend

- Study Area Radius 15km
- Existing Boundry of the Main Well Fields at the Al-Naqa'a and Al-Ghayl Bawazir (18 km from Plant Site)
- Existing Boundary of the Main Populated ,Agriculture, Industrial,Cultural Heritage,Historical and Tourism Areas (17.5km from Plant Site)
- Arabian Sea (31km from Plant Site)
- AL-Mukalla - Sayaun Highway
- Main Wadies and Flooding Areas

4.1.2 Geology and lithology

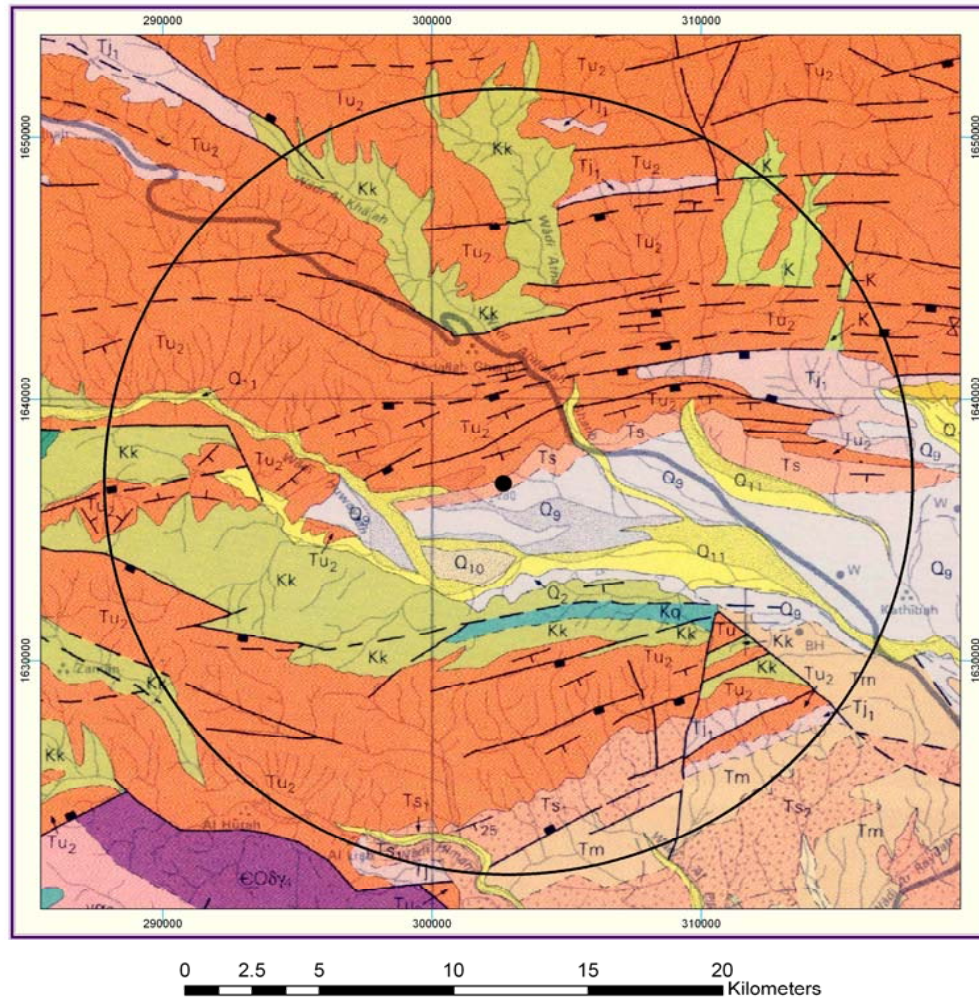
The outcropping rocks in the study area are predominantly from the Quaternary, Cretaceous, Paleocene, Lower Eocene, and Upper Miocene to Paleocene eras (Figures 8,9). The predominant formation in the area is Umm Er Radhuma formation. Table 10 presents an overview of the main geological features and lithological properties of the area surrounding.

Table 10. Major geological units and lithology in the Study area

Age	Group/Formation	Lithology
Quaternary	Quaternary Deposits	clays-gravels, loess
Middle Cretaceous	Al-Mahra Group /Harshiyat formation	sandston ,marl, dolomitic limestone,gypsum
Middle Cretaceous	Al-Mahra Group /Fartaq formation	grey limestone,marl ,marlilimestone, gypsum marli
Middle to Upper Cretaceous	Al-Mahra Group /Mukalla formation	Sandstone,medium-coarse-grained ,grey,brown,marl,yellow,limestone,dolomitic at the top.
Paleocene	Hadhramout group/Umm Er Radhuma formation	Shale,marly limestone ,brown,darkgrey ,dolomitic limestone ,with,grey.
Lower Eocene	Hadhramout Group/ Jiza' formation	Alteration of Shale, yellow , pink,marl,white limestone grey.
Lower Eocene	Hadhramout Group /Rus formation	Gypsum,shert,marl,dolomitic limestone at top and base
Upper Miocene to Paleocene	Shihr group /Irqah formation	Fluvial channel sediments and alluvial fans which consist of massive conglomerates.

Geological Map of Hadhramout

Environmental Impacts Assessment of the Mukalla Cement Factory
Fig.(8) Geological Map of the Study Area



Republic of Yemen
Arabian Yemeni Cement Co., Ltd.
Hadramout Governorate - Al- Mukalla

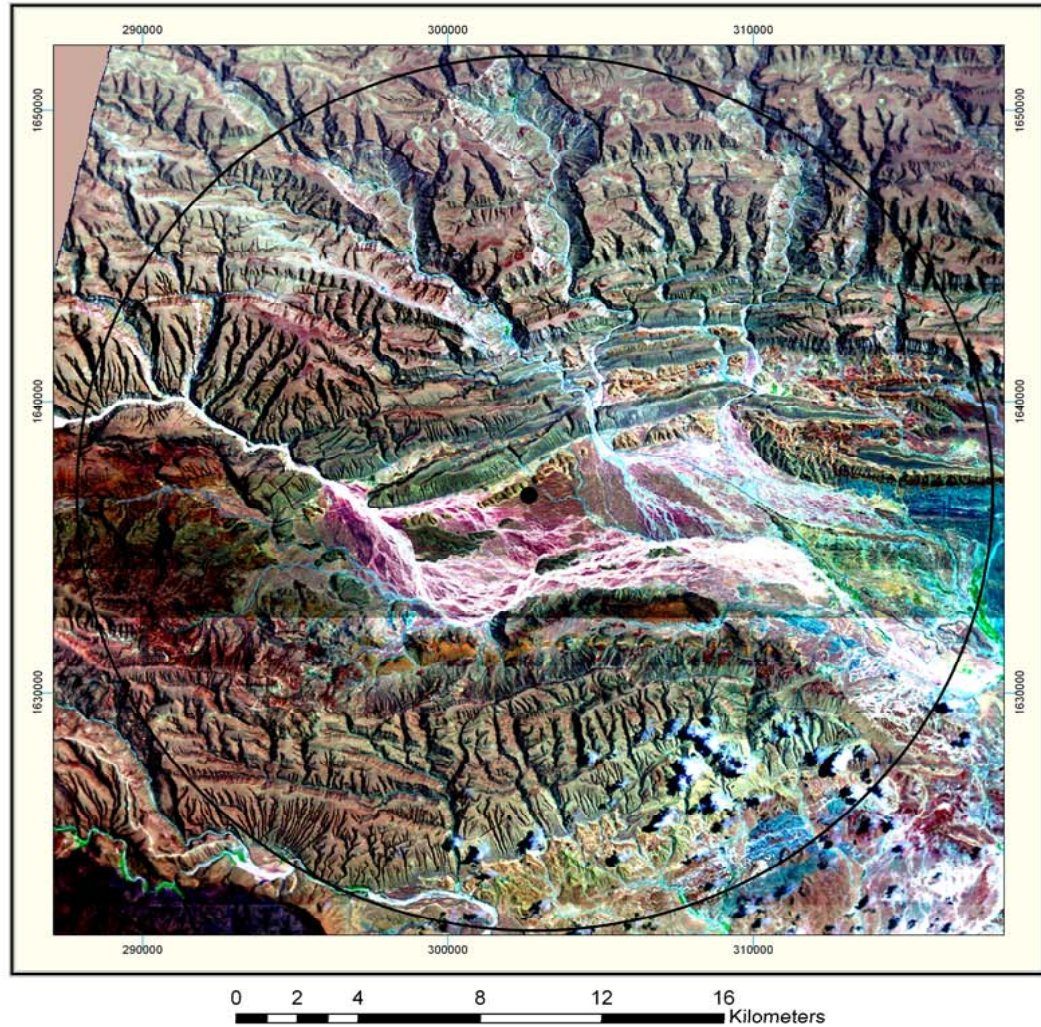


Legend

CENOZOIC	QUATERNARY	Q₁₁ Active alluvium: sands and gravels showing light tones on the imagery and occurring in the main water courses. Q₁₀ Older alluvium: conglomerate and coarse gravels, frequently cemented and formed during Late to post-Miocene, occurs in the lower reaches Q₉ Gravel, gravel sheets, gravel plains and alluvial fans generally in areas of low relief with a stony surface.
		Ts High Formation: consisting of conglomerates with sandstone intercalations.
TERTIARY	HADRAMAWT GROUP	K Mukalla - Hahab Formation: sandstones with minor calcareous horizons. K Tawilah Group: undifferentiated. Kh Harshiyat - Mithal Formation: sandstones with some calcareous horizons.
		T₁ Rus Formation: thin bedded dolomites, limestones, marls, gypsum and anhydrite. T₁₂ Jaza Formation Upper Member: nodular and flinty limestones with thin beds of brown and grey shales. T₁₁ Jaza Formation Lower Member: interbedded light grey shales and marly limestones. T₁ Jaza Formation: undifferentiated. T₂ Limen or Raduma Formation Upper Member: thickly bedded dolomitic limestones (Lower member).
CRETACEOUS	TAWILAH GROUP	

Environmental Impacts Assessment of the Mukalla Cement Factory

Fig.(q) Satallite Image Show Rock Unites of Study Area



Republic of Yemen
Arabian Yemeni Cement Co., Ltd.
Hadramout Governorate - Al- Mukalla



Legend

○ Study Area Radius 15km

● Plant Site



Recent Deposites



Irqah Formation



Rus Formation



Jiza Formation



Umm Er Radhuma Formation



Mukalla Formation



Fartaq Formation



Harshiyat Formation

Shihr Group
Upper Miocene
Paleocene
Hadramout Group
Eocene
Lower
Upper
paleocene
AL-Mahra Group
Cretaceous
Lower Middle Upper

4.1.3 Structural Geology

The contour map shows four regional transfer zones represented by low vertical displacement and indicate by low values of extension . The trend of the regional transfer zones observed on the contoured map of vertical displacement implies that the location of transfer zones are controlled by underneath structures which probably referred to tow possibilities , the first possibilities , are controlled by the offshore fracture (the fracture zones of the off-shore sheba ridge), or may be structure inherited from crystalline basement rocks. In addition small faults of N-S trend are observed particularly in the wadi Hawayrah area .

Wadi Hawayrah where the bedding in the hanging wall is rotated to about 40' . Release faults are recorded in the area where the transfer faults are formed in the hanging wall of individual faults like in the hanging wall of wadi Hawaryrah fault . The deformation of the hanging wall of wadi Hawayrah fault. The deformation of the hanging walls blocks are deformed with the synthetic faults , these structure are very characteristic feature with synthetic faults, in the area to form grabens of different sizes . Geological Map of the study area shows faults in a high frequency of the E- W and NE – SW strike trend with steep dips. In the switchbacks area the fault planes have a strong preferred orientation with a dominant ENE- WSW trend .

4.1.4 Earthquake events

Table(11) Number of registered domestic earthquake events At Al- Mukalla

Year	Event area Al-Mukalla
2001	41
2002	5
2003	7
2004	6
Total	59

Source : National Seismological observatory Center , Dahmar 2001-2004

4.1.5 Hydrogeology

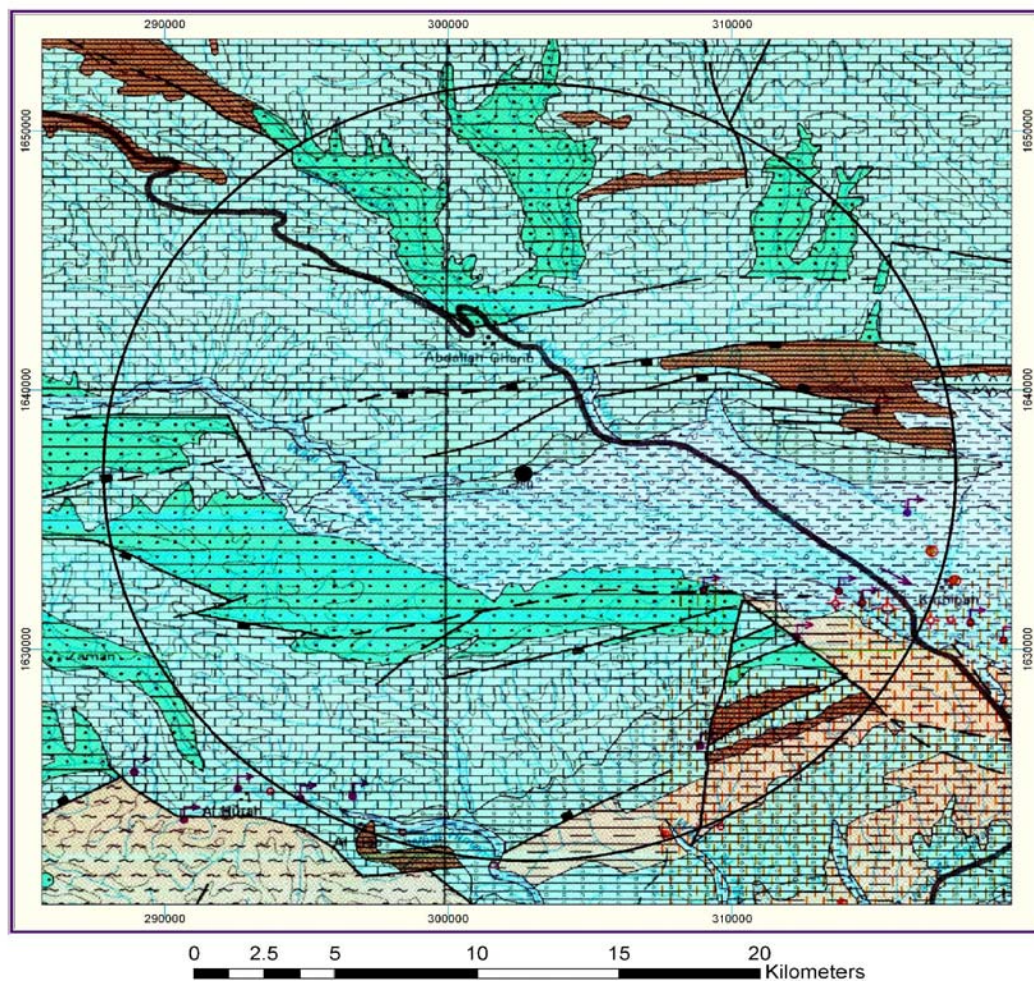
Few surface water bodies exist in Ghieel Bawazeer and as such the water supply systems in the region are based entirely on available groundwater resources. However, due to its unsustainable exploitation, the area has been experiencing a severe drop in the groundwater table (by more than a 6 m) every year. Table12 presents a summary of the major hydrogeological characteristics of Ghieel Bawazeer and figure 10 show hydrogeological map for study area.

Table12. Characterization of the water resources Ghieel Bawazeer

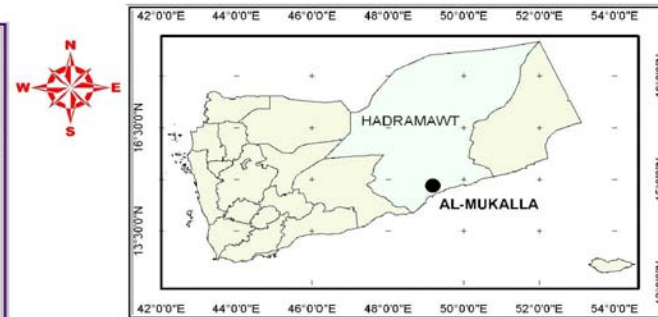
Age	Parameter	Characteristics
Quaternary	alluvial deposits	• Moderately or poorly productive aquifers
Oligocene Miocene	Shihr Group	• Moderately or poorly productive aquifers
Lower Eocene	Rus Formation	• Moderately or poorly productive aquifers
Paleocene	Umm er Radhuma Formation	• Moderately or poorly productive aquifers

Two bore wells have been installed at plant location to the West of the Limestone Deposit . The Two bore wells are 300m apart from each other almost in the same line to the west. The raw water analysis have been show in Appendix 3.

Environmental Impacts Assessment of the Mukalla Cement Factory
Fig.(10) Hydrogeological Map of the Study Area



Republic of Yemen
Arabian Yemeni Cement Co., Ltd.
Hadhramout Governorate - Al- Mukalla



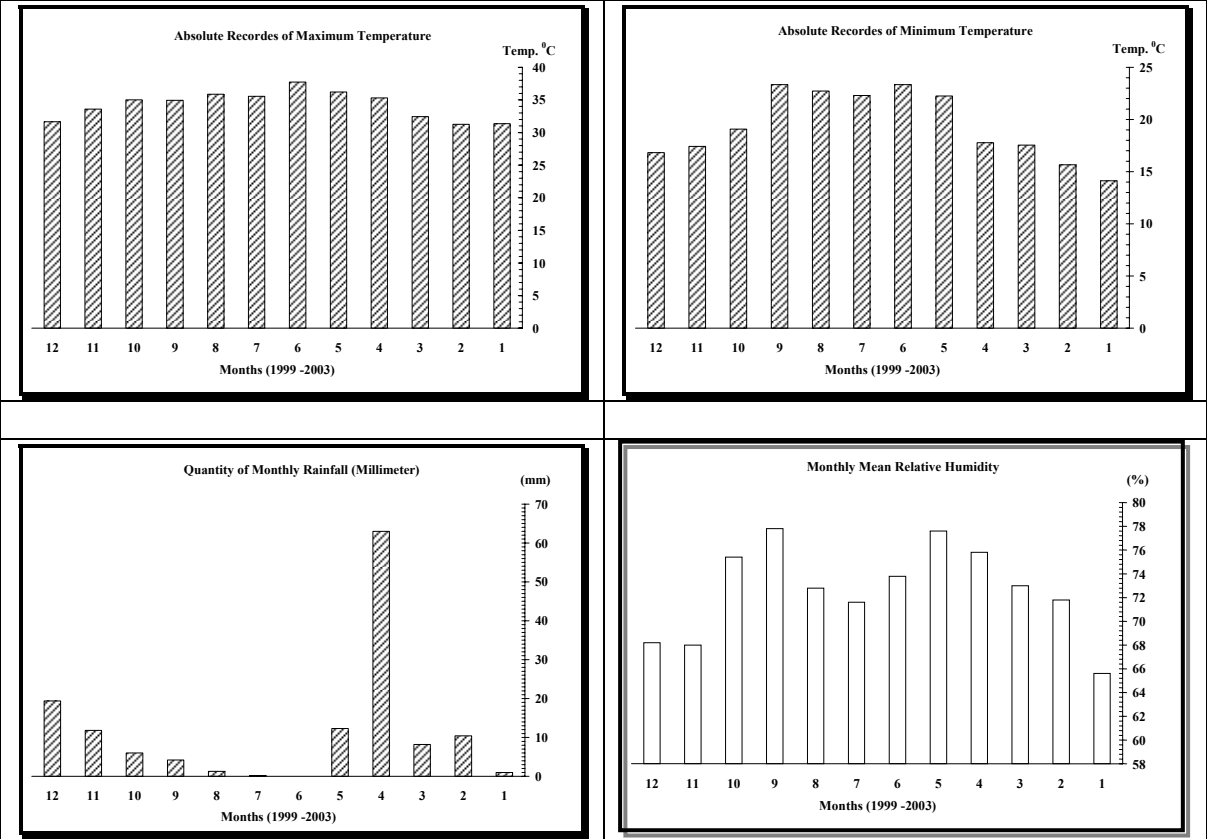
Legend



4.1.6 Climate and meteorology

The area surrounding CP/AYCCL is characterized by hot in summer in the costal area and moderate in plateaus .the seasonal wind affects the temperature in the costal areas. the temperature in mukalla comes down to 29.6 in July. In winter the climate is to some extent warm and the temperature is between 20-23 degree centigrade . The average rainfall in the area reaches 27.5 mm/year (based on data from 1999-2003). The area is also characterized by relative humidity 72.6%. moderate absolute of minimum temperature is 16.82 °c and moderate absolute of maximum temperature is 31.64°c in study area (figure 11).

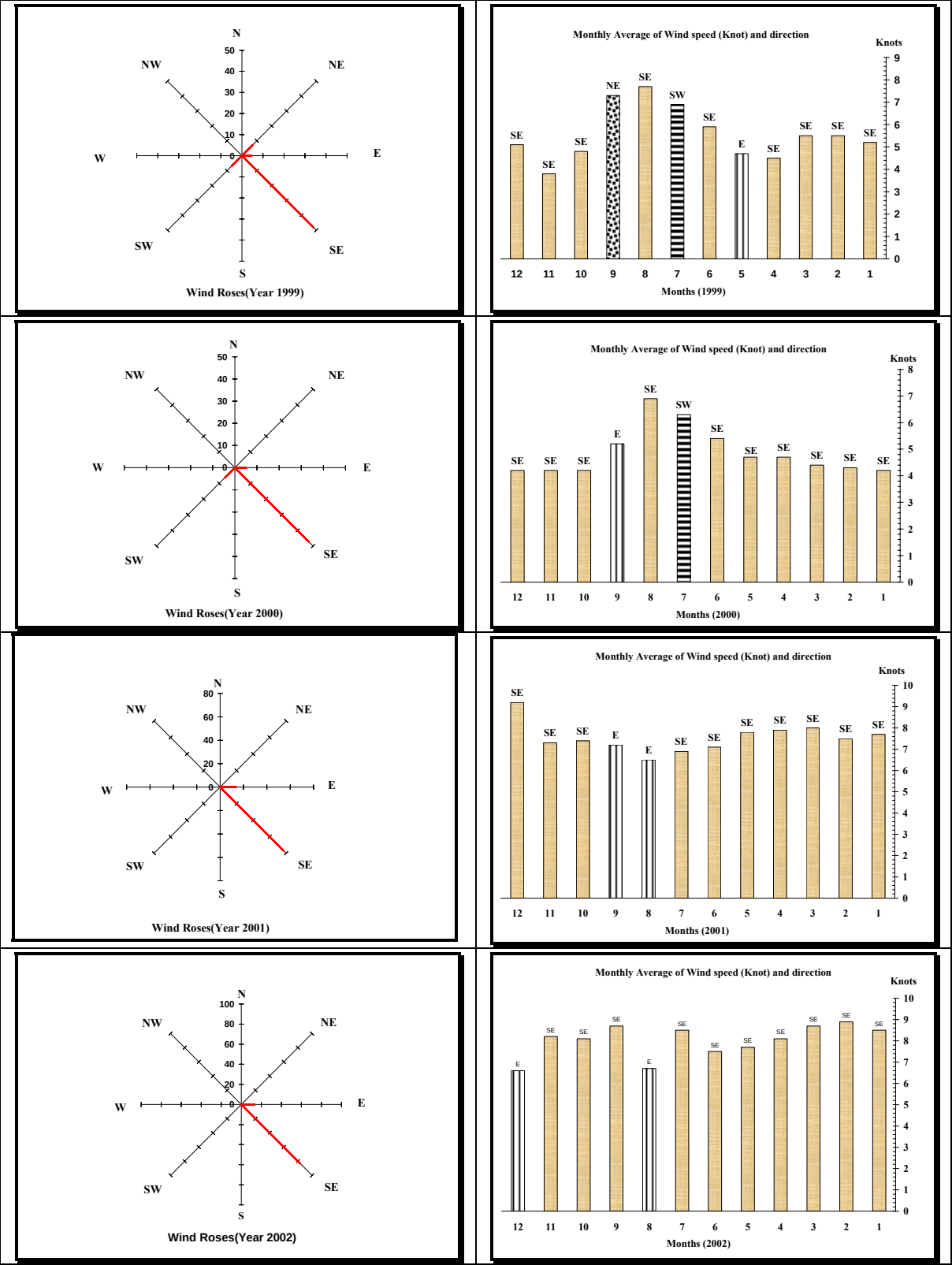
FIG. (11) SHOW TEMPERATURES, RELATIVE HUMIDITY AND RAINFALL PROFILES FOR AL-MUKALLA (1999-2003)

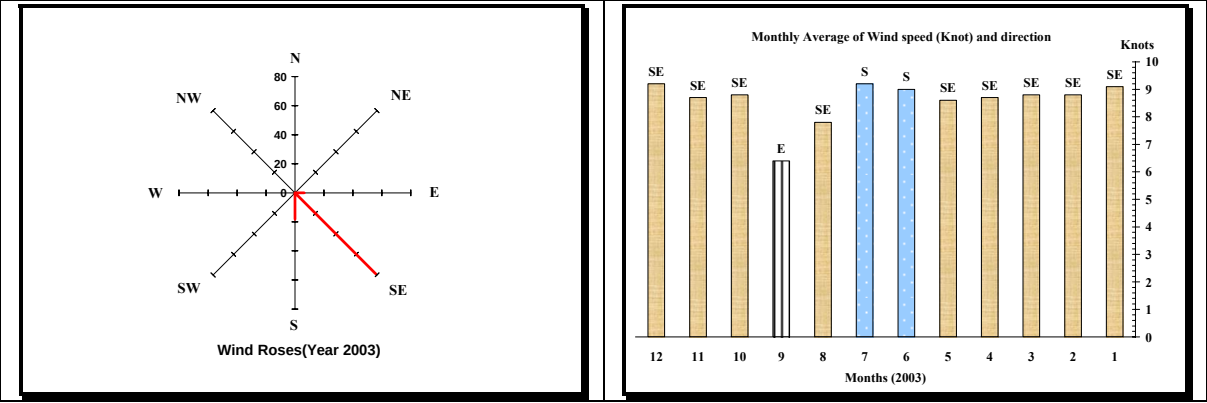


Winds in the Ryain area (including study area) blow predominantly from the South-East as illustrated in figure 12. wind roses and average of Wind speeds 8.5 knots are common, especially during the summer season. Note that the adopted meteorological data describes the conditions in Ryian for the years 1999-2003 . In the absence of data for study area proper, it

was assumed that both locations have similar meteorological characteristics particularly since study area is 30 Km North of Ryian .

FIG. (12) SHOW WIND SPEED DIRECTION AND WINDROSE





4.1.7 Ambient air quality on the Locality

Basically the diversion road to the site passing the Lime Kiln plant is a roughly laid out road consolidated and compacted out of pebbles and mud collected from the vicinity . The dry weather which normally pervades this locality adds to the dust whenever there is movement of vehicles which is not very common. The second aspect is the dust from the Lime Kiln Plant which could move in the North Western direction whenever there is a heavy blowing of wind. The third aspect is the movement of dust in the Easterly direction from the aggregate Crushing Plants which are located towards the South East of the site by the side of the Highway . The condition as existing at present does have an impact on the ambient air quality in the neighborhood . The ambient air quality as it is prevailing at present has not been assessed to substantiate the observation . Due to that the study area lacks, like most areas in Yemen, baseline data on ambient air quality and noise levels. Figure (13,14) show the Existing Activities in the vicinity of CP/AYCCL.



Fig (13) Show Existing Site Entrance of Mukalla-Sayaun Highway and Small Lime Kiln Plant in the Vicinity of CP/AYCCL



Fig(14) Show Existing Crasher in the Vicinity of CP/AYCCL

4.2 Biological environment

The site proper has a very sparse tree cover and is intensively not cultivated. Moreover, the lower slopes of the mountains surrounding the site to the north and south are generally arid due to the lack of appropriate soil cover and the prevalence of stony conditions that hinder to a large extent the survival of tree species (figure 15).

The study area is part of the Yemen lowlands that maintain a high level of biodiversity and provide an important stopover site for migrating birds. The lowlands support the majority of endemic or near-endemic species of plants and animals.

The area hosts the endemic Arabian gazelle, *Acacia orgena*, *Andropogon* , *Eragrostes pappos*, *Tetrapogon villosus* , *Cenchrus ciliaris* , *Cynodon dactylon* and *Arisdida adscensionis* .



Fig. (15) Terrestrial biodiversity in the vicinity of CP/AYCCL

4.3 Socio-economic environment

The CP/AYCCL cement factory will be the principal industry in the Government of Hadhramout and as such it will be a primary source of employment for the District of Ghieel Bawazeer. Other industrial establishments in the area include a range of small commercial/industrial establishments such as repair and small-scale fabrication workshops

and food processing plants. On the other hand, tourism and the services sector in the study area are promising sector and as such are considered to be one of source of employment or income generation.

Agriculture is the main economic activity in Ghieel Bawazeer as well as fishing activities(shehair town) . The main agricultural crops that are currently being cultivated in the area include a variety of cereals , dates , vegetables , fruit and tobacco that are generally grown under irrigation systems Vegetables are also important crops that are concentrated in areas with access to irrigation networks or groundwater wells. The cultivated crops are continuously changing depending on the needs of farmers, the market price of cash crops, as well as on the availability of irrigation water. Poultry and livestock are also important agricultural products in Distract of Ghieel Bawazeer. Figure 16 show agriculture activities and figure 17show Cultural Heritage.



Fig. (16) Agricultural activity in the Ghayl Bawazir



Fig. (17) Show Old Mosques and cemeteries of Cultural Heritage at Al-Naqa'a Town

4.4 Public health

The Governorate of Hadhramout has a relatively high incidence of illness occurrence amongst its inhabitants Table13. Malaria, G.S. Meritis, Blood Enteritis, N-Enteritis, T .B, Diphteria, Whooping cough, Measles, Hepatitis A and Hepatitis B disease

Table 13. Reported diseases in the Hadhramout governorate – Al-Mukalla for the year 2004

Illnesses	Cases
	Al- Mukalla
Malaria	864
G.S. Meritis	122
Blood Enteritis	131
N-Enteritis	5832
T .B	128
Diphteria	00
Whooping cough	30
Measles	584
Hepatitis A	514
Hepatitis B	41
AIDS	-

Source : Statistical Year- Book 2004

5. POTENTIAL ENVIRONMENTAL IMPACTS

The potential environmental impacts associated with the CP/AYCCL during the construction and operation phases. The parameters that may be affected in this context include air quality, waste and wastewater generation, traffic, noise, surface and groundwater quality, soil quality, terrestrial biodiversity, resource use, health and safety, landscape and visual intrusions, as well as the socio-economic well-being. While the impacts of some parameters can be assessed quantitatively using analytical and mathematical means, the impacts of other parameters can be described only by relying on a qualitative comparative approach and based on past experience. In this context, the assessment of impacts is directly related to the definition of sensitive receptors such as domestic premises, , hospitals, residences, schools, offices, factories, shops, mosques, sports stadiums, or recreational areas. In the case of the CP/AYCCL, the proposed site is located in a predominantly rural setting. The closest receptors to the site are the employees’ residence at CP/AYCCL , Abdulallh Ghareeb village, Al- Adwas village as well as the receptors in the surrounding areas (figure 18 and Table 14).

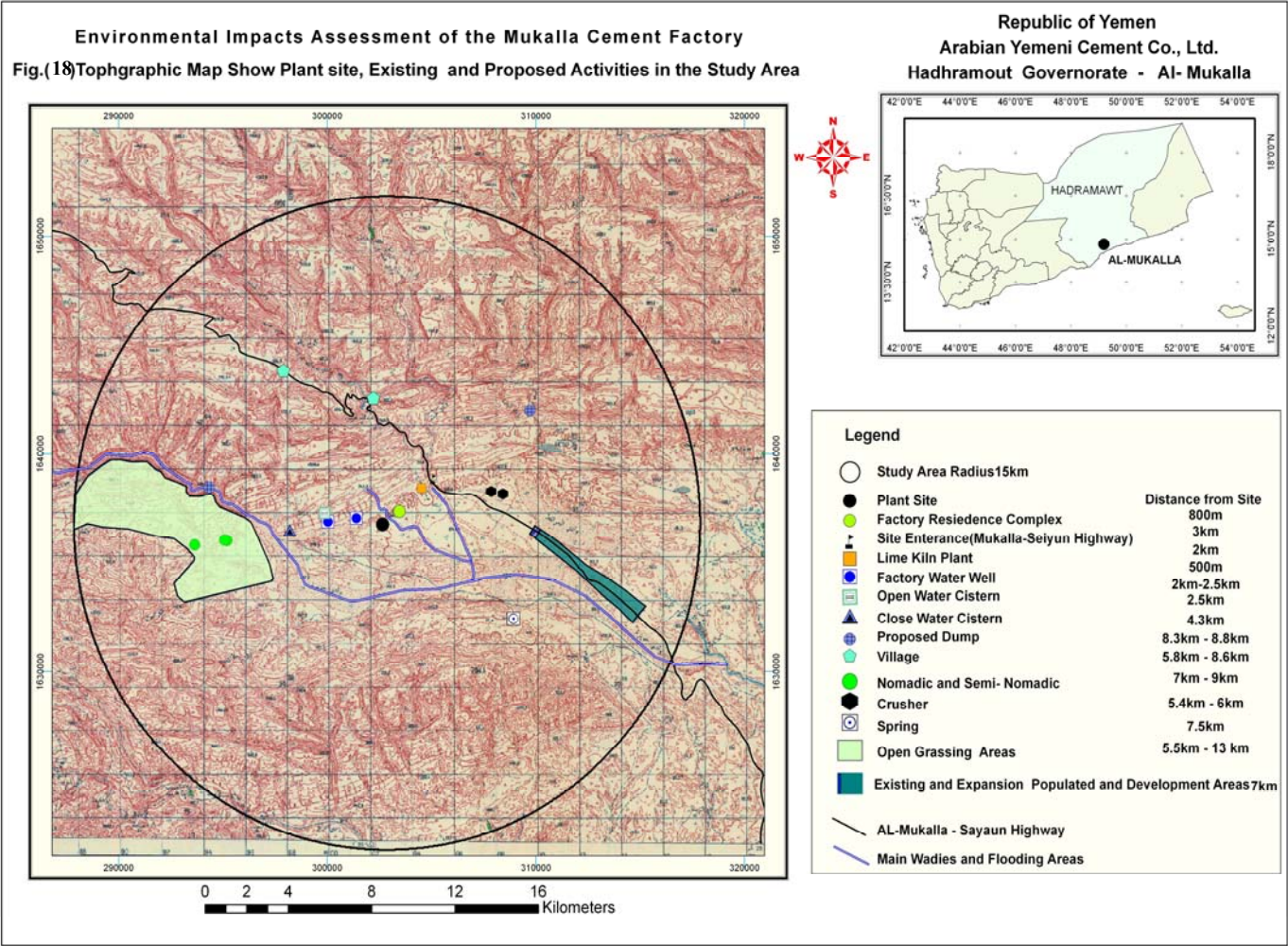


Table 14 Distance between site and nearest receptors

<i>Nearest receptor</i>		<i>Distance (Km)</i>
1	CP/AYCCLEmployees residence	0.8
2	Small lime klin plant	2.0
3	Abdullah Ghareeb Village	5.4
4	Al_Aduas Village	8.6
5	Proposed Madhar Dam	8.0
6	Nomadic and semi-Nomadic	7-9
7	Grassing activities Areas	6

5.1 Air quality

Cement manufacturing is commonly associated with the release of significant quantities of gaseous emissions which are mainly generated by the physical and chemical reactions that transform raw materials into clinker, the associated combustion of fuels, and the handling of materials both before and after clinker production. These emissions can be classified into two general categories namely dust or particulate matter (PM) along with a wide array of gaseous compounds such as the oxides of sulfur, nitrogen and carbon; hydrocarbons including volatile organic compounds; hydrogen fluoride; as well as ammonium nitrate and ammonia Table 15. Historically, the main objective of emission control in the cement industry has targeted PM and SO₂ emissions reduction and to a lesser extent the emission of nitrogen oxides (NO_x).

Table 15. Formation mechanisms of principal gaseous emissions from cement manufacturing

<i>Constituent</i>	<i>Formation mechanism</i>	<i>Influencing factors</i>
NOx	Oxidation of the molecular nitrogen present in the combustion air → thermal NOx formation Oxidation of the nitrogen compounds present in the fuel → fuel NOx formation Oxidation of organic and inorganic nitrogen in raw material minerals → raw materials NOx formation	Depends on the fuel used, combustion temperature, excess oxygen, and raw materials
SOx	Oxidation of sulfur compounds in the raw materials Oxidation of organically-bound sulfur in the fuel	Largely captured in the kiln products
CO ₂	Calcining the limestone in the feed material $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ Combustion of fossil fuels to generate process energy	Depends on the type of process and fuel used
CO	Incomplete combustion of fuel and organic carbon content of raw materials.	Contributions from raw materials can be very significant
HC and VOC	Volatilization of organic materials contained in the raw materials at the high kiln temperatures	Determined by the organic content of raw materials
Heavy metals	Release of heavy metals naturally present in raw materials and fuels	Depends on their volatility and cycles within the kiln system
Dioxins and furans	Reaction of chlorine with evaporated organics from the raw materials	Occurs at gas temperatures between 200 – 400 °C
NH ₃	Reaction of ammonia contained in raw materials with chlorides and sulfates to form ammonium salts	Limited to few cement sites throughout the world
Cl, F	Evaporation of small chloride and fluoride masses in raw materials and reaction with evaporated alkalis	Mostly circulated and bound in the clinker

(VDI, 1985; USEPA, 1994a, b; Hendriks *et al.*, 1998; CEMBUREAU, 1999; CIF, 2000b; EA, 2001)

Cement plants emit a considerable quantity of PM as a result of handling and processing raw materials often in fine-grained forms, which render dust emissions practically inevitable. The composition and grain-size distribution of the emitted dusts from cement plants vary widely depending on the characteristics of the raw material. Accordingly, a distinction is made between the types of dust, as outlined in Table 16. The most significant PM emission source within cement plants is the pyro-processing system that includes the kiln, the bypass system, and the clinker cooler exhaust stacks Table 17.

Table 16. Types of dust and their generation causes at cement plants

<i>Type</i>	<i>Generation mechanism</i>
Raw material dust	Quarrying, crushing and handling of raw material
Feed material dust	Feeding, milling, stacking, blending, reclaiming, conveying, and transferring of feed material
Cement kiln dust	Feeding and processing of materials involving countercurrent circulation of hot gases
Clinker dust	Cooling involving air circulation and open-storage of clinker
Cement dust	Feeding, milling, conveying, bagging and loading of cement materials

(VDI, 1985; USEPA, 1995a)

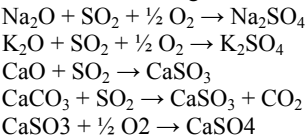
Table 17. PM emission sources from the cement industry

<i>PM emissions</i>	<i>(% of total emissions)</i>
Primary sources	91.4
• Rotary Kiln Stacks	
• Clinker Coolers	
• Cement Mill Stacks	
• By-Pass Stacks	
Secondary sources	8.6
• Silo	
• Raw Mill	
• Crushers	
• Packaging and Grinding	

(Canpolat *et al.*, 2001)

Nitrogen Oxides (NO_x) formation is an inevitable consequence of the combustion processes that are common to the cement industry. Essentially NO_x emissions associated with cement manufacturing are generated in cement kilns. Cement kilns emit NO_x by two primary mechanisms namely the oxidation of molecular nitrogen that is present in the combustion air (referred to as thermal NO_x and constituting the major source formation), as well as the formation of NO_x emissions from fuel combustion (referred to as fuel NO_x). On the other hand, sulfur compounds entering the kiln system either with the fuels or with the raw materials emit sulfur oxides (SO_x). The emissions are mainly in the form of sulfur dioxide (SO₂) (99 percent), although some sulfur trioxide is produced and, under reducing conditions, hydrogen sulfide (H₂S) could also be formed (EA, 2001). However, the alkaline nature of the cement provides for direct absorption of SO₂, which reacts primarily with the alkali oxides that evaporate from the kiln. As a consequence of these reactions, about 70 to 100 percent of the total sulfur entering the kiln is normally incorporated into the clinker structure mainly as alkali sulfates and gypsum¹. Thus, less than 12 percent of the sulfur involved is emitted as SO₂ in the kiln exhaust gases. Moreover, fuel sulfur as well as raw material sulfur in the form of sulfates does not contribute much to SO₂ emissions in the preheater/precalciner kilns because of the efficient scrubbing effects of the hot feed that passes through the preheater and the precalciner. The main source of SO₂ emission is the raw material sulfur that is present in

¹ SO₂ is absorbed through the following chemical reactions that occur in the kiln:



the form of sulfides (pyrite, marcasite) or organic sulfur. Note that high sulfur contents in the raw feed and fuel, can lead to operational problems like clogging in the cement kilns.

Other cement related emissions with less significant quantities include carbon dioxide (CO₂), carbon monoxide (CO), volatile organic compounds (VOCs), heavy metals, and dioxins. Table 18 Summarizes the major sources for the emission of CO₂, CO, VOCs, heavy metals, and dioxins in the cement industry. Note that additional emissions of CO₂, CO, NO₂, SO₂, and hydrocarbons are expected due to truck traffic to and from the quarry and the operation of heavy equipment and transport vehicles on-site.

Table 18. Summary of the minor gaseous compounds that are emitted from the cement industry

Constituent	Source
CO ₂	Cement-related CO ₂ emissions originate from fossil fuel combustion (about 45% of the industry’s emissions); transport activities (about 5%). The remaining CO ₂ (about 50%) originate from the manufacturing process that converts limestone (CaCO ₃) to calcium oxide (CaO), the primary precursor to cement. It is estimated that CO ₂ emission ranges between 0.507 and 1.35 tons of CO ₂ per ton of clinker produced.
CO	Carbon monoxide contributions from raw materials in cement production can be very significant compared with that from incomplete combustion of fuel. Approximately 85 to 95% of the organic matter in the raw materials is converted to CO ₂ in the presence of 3% excess oxygen in the kiln exhaust gas, and 5 to 15% is oxidized to CO .
VOCs	The main source of VOC emissions from cement kiln stacks is organic matter present in or attached to the raw material. A portion of this organic matter may be expelled in the kiln system even at moderate temperatures between 400 and 600° C. Some of the expelled organic compounds are oxidized but others leave the kiln as organic emissions. A small proportion (usually less than 1%) of the total organic carbon (TOC) content may be emitted as volatile organic compounds (VOC) such as hydrocarbons. The emission level of VOC in the stack gas of cement kilns is usually between 10 and 100 mg/Nm ³ , with a few excessive cases up to 500 mg/Nm ³ . In general, the occurrence of volatile organic compounds in the exhaust gas is often associated with incomplete combustion. In cement kilns, the emission is generally low under normal steady-state conditions, due to the large residence time of the gases in the kiln, the high temperature and the excess oxygen conditions. Concentrations however may increase during startup or upset conditions. These events can occur with varying frequency.
Heavy metals	Trace elements such as heavy metals are naturally present in low concentrations in the raw materials and fuels used for the manufacture of cement clinker. The behavior of these metals in the burning process depends largely on their volatility. Heavy metal emissions from cement plants depend on their content in fuels and raw materials, industrial technology (e.g. combustion temperature), and emission control measures. During the cement production process at high temperatures much of the heavy metals present in the fuel and the raw materials evaporate and then condense on the clinker and partly on fine particles in the flue gas. The latter portion of the metals finds its way to the atmosphere after passing through the emission control equipment.
Dioxines	Dioxins can be formed in the combustion system when chlorine and organic compounds are present. Under proper gas residence times, temperatures and oxygen contents within kiln systems dioxins/furans can be efficiently destroyed. Heterogeneous catalytic formation - “de novo” synthesis - is possible at temperatures between 200 and 450° C in the exhaust gas system provided precursors and other components are available.

5.1.1 Air Dispersion and Sources

The identification of the major emission sources in the study area including their geographic locations, operational characteristics, as well as the corresponding emission factors and rates. Emission factors and inventories have long been fundamental tools for air quality management. Emission estimates are important for developing emission control strategies, determining applicability of permitting and control programs, and ascertaining the effects of sources and appropriate mitigation strategies.

Emission sources at CP/AYCCL can be divided into two main categories namely point and area sources. Point sources include the main stacks Table 19. Area sources which are formed as a result of the handling, storage, and disturbance of dust include the operational portions of the quarries as well as the plant area itself.

.Table (19) Stack Parameters

			Stack			
process	Description	Control Device	Height	Diameter	Flow	Temperature
			(ft)	(ft)	(acfm)	(F)
Processing Raw Material						
Limestone Crusher	Reversible hammer/impact crusher	Bag filter	25	1	12.500	Ambient
Additives Crusher	Reversible hammer/impact crusher	Bag filter	50	2	12.500	Ambient
Raw Mill Plant	Vertical mill with high – efficiency separator	Bag filter	...	...	...	...
Raw Meal Homogenizing	Continuous blending silo	Pulse-jet bag filter	75	3	10.000	Ambient
Preprocessing						
Preheater/ Precalciner	Six-stage preheater and Precalciner	Bag filter	...	...	...	...
Rotary Kiln	Dry process rotary kiln	Bag filter	262	16	416.041	302
Clinker Cooler	Grate	ESP	75	5	55.000	350
Cement Production						
OPC Clinker Storage	Silo	Pulse-jet bag filter	24.4	3	3.000	Ambient
SRC Clinker Storage	Silo	Pulse-jet bag filter	43.4	3	3.000	Ambient
Cement Mill	Ball mill with high-efficiency separator and closed-circuit operation	ESP	30	1	7.500	Ambient
Cement Storage	Silo	Pulse-jet bag filter	75	3	3.000	Ambient
Packing and Loading	Two rotary packing machines	Pulse-jet bag filter	50	2	12.000	Ambient

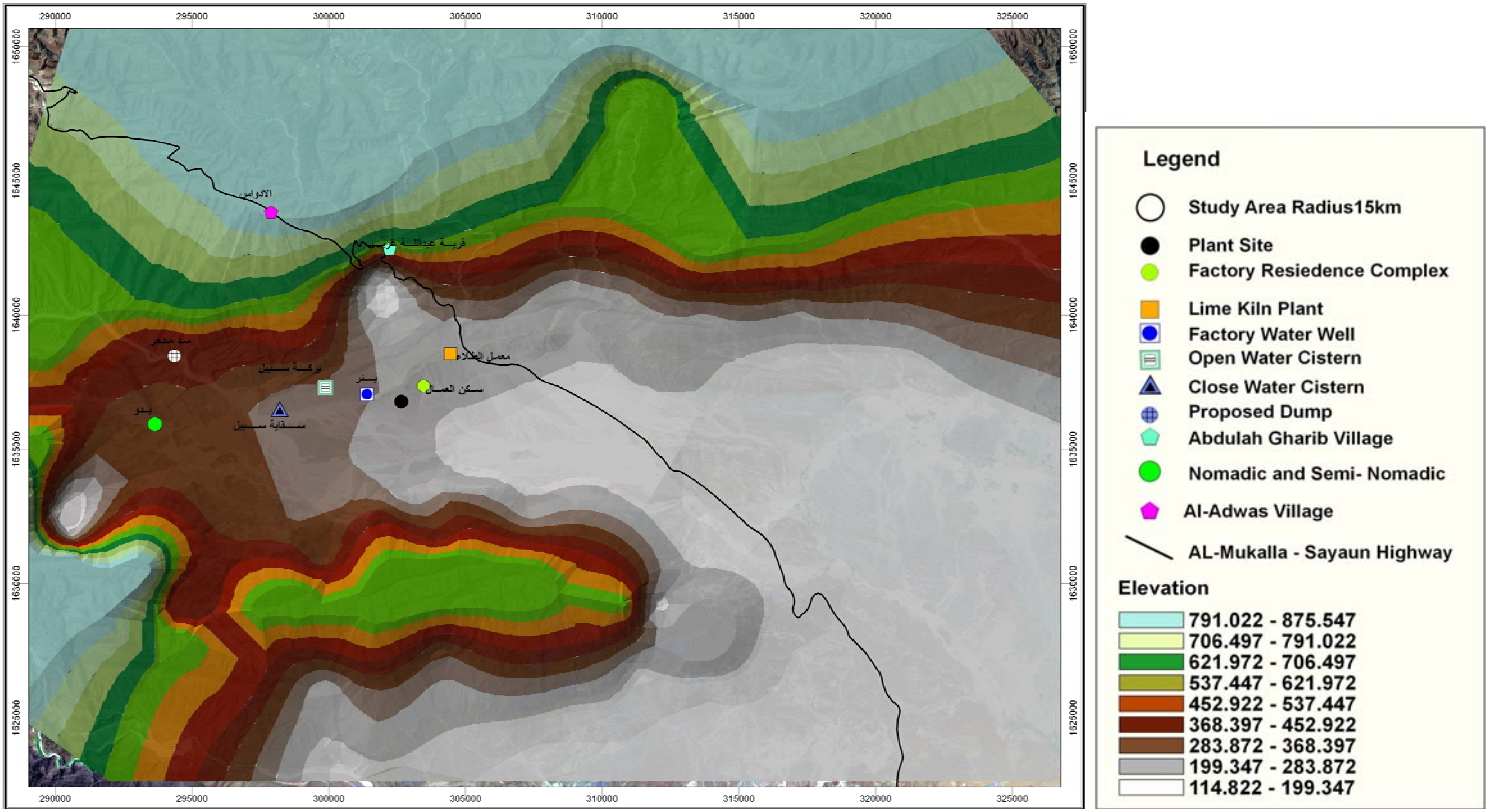
Note kiln exhaust and raw mill exhaust through main stack .

5.1.2 Meteorology and Topography

Meteorological data and terrain description are important input parameters that will affect the dispersion of emissions from stack and area sources. Variations in concentrations at potential receptors can occur with changes of meteorology and topography.

Complex terrain is defined as terrain at an elevation that exceeds the top of the stacks for the simulated sources. In complex terrain, the plume height can be lower than the nearby terrain. Intermediate terrain is terrain that exceeds the top of the stacks for the simulated sources but does not exceed the plume height. Simple terrain can be used when the terrain elevations in the immediate vicinity of the plant are less than 50 percent of the shortest non-fugitive stack height being simulated. The project area is characterized by its complex terrain with a high altitude that is surrounded by mountains towards north and hills from south, show Figure (19)

Environmental impacts Assessment of the Mukalla Cement Factory
Fig.(19) Locations of potential receptors for impact assessment



5.1.3 Environmental and health impacts of cement related air emissions

The constituents of cement-related emissions are associated with a wide array of environmental, health, as well as aesthetic impacts that have been summarized in Table 20

Table20. Environmental effects of major constituents emitted from cement manufacturing

Constituents	Physical impacts	Biological impacts	Health impacts
PM	Reduced visibility; damage to paints, fabrics, metals, and building materials	Reduction of photosynthesis, retardation of growth in plants and aquatic life	Aggravation of respiratory conditions, increased respiratory and cardiovascular diseases, lung damage, cancer, premature death
NOx	Precursor to ozone and acidic deposition, visibility reduction, water quality deterioration, fading of fabrics and textiles, and global warming	Discoloration and lesions on leaves, suppression of plant growth, damage to aquatic life	Irritation in respiratory tract, aggravation of lung and heart problems, oppressive odor, increased susceptibility to germs
SOx	Corrosion and deterioration of metals and building material, weakening and fading of fabrics and textiles	Necrosis and discoloration in leaves, suppression of growth and yield of trees	Irritation in respiratory tract and eyes, changes in lung functions, exacerbations of respiratory symptoms
CO ₂	Acidic deposition, materials damage, global warming,	Not applicable	Not applicable
CO	Not applicable	Not applicable	Blood toxicity, thinking impairment, headaches, fatigue, drowsiness, nausea, visual impairment, coma, irreversible brain damage, death
VOC	Precursor to ozone formation, contamination of soil and groundwater	Retardation of plant growth, chlorosis and necrosis in broad-leaved plants	Oppressive odor; irritations in respiratory tract and eyes; headaches; nausea; damage to liver, kidney, and central nervous system; potential carcinogens
Heavy metals	Contamination of soil, surface and ground water	Disruption of assimilation functions and cell membrane structure of plants, bioaccumulation in and poisoning of terrestrial and aquatic life	Irritation in the skin and mucous membranes, gastrointestinal effects, brain and nervous system damage, increased blood pressure, reproductive and developmental effects
Dioxins	Persistence in soil	Changes in hormone systems, reduced reproductive capacity, and immuno-suppression in animals	Skin rashes, liver damage, weight loss, reduction in immunity

(Elsom, 1992; Boubel *et al.*, 1994; Baumbach, 1996; Arya, 1999; Miller, 2002; USEPA, 2002a,b; WHO, 2002; Sharifi *et al.*, 1997; Farmer,1993)

5.2 Waste generation

The construction and operation works of the CP/AYCCL are a source of solid wastes generation that can be divided into four distinct categories based on their composition namely, construction wastes, Cement Kiln Dust (CKD), , operation and maintenance wastes, and general refuse. The impact of the generated wastes is dependent primarily on the management option that is adopted.

5.2.1 Construction wastes

Construction wastes at CP/AYCCL is generated from unused building materials includes wood from formwork and falsework, equipment and vehicle maintenance parts, materials and equipment wrappings, unusable/surplus concrete-grouting mixes-demolition waste, and damaged equipments.

Construction wastes pose adverse impacts in case of improper disposal. The haphazard disposal of construction wastes may cause visual intrusion, increase health and safety risks, result in degradation of the receiving environment, as well as decrease the value of surrounding property. As such, it is importance to allocate a proper disposal site.

5.2.2 Cement Kiln Dust

Particles that become entrained in the countercurrent gases or air are typically known as CKD. This material is comprised of unchanged raw materials, dehydrated clay, decarbonated (calcined) limestone, ash from fuel, and newly formed minerals produced by the chemical transformations of pyroprocessing. Often, CKD is collected and recycled into the kiln thereby producing clinker from the dust. However, if the alkali content of the raw materials is too high, some or all of the dust may discarded or leached (washed to reduce its alkalinity) before returning it to the kiln since the excess quantity of alkali compounds present in the raw material can adversely affects the quality of the cement, damage cement kiln linings, as well as increase dust emissions from the kiln stack. Most of this alkali dust is evaporated inside the kiln and bled off from the back end of the kiln (through a bypass system) or cement kiln dust should be stored in Bins and handled by pneumatic transportation.

The estimated amount of CKD generated per day is around 2 percent of the total amount of clinker generation. The open storage of CKD may lead to the spreading of the fine dust along large areas particularly during windy conditions, causing damage and nuisance to nearby residences and plantations, Note that the improper disposal of CKD is known to damage ground water, surface water, soil, and air quality as a result of leaching and wind dispersion .

5.2.3 Operation and maintenance wastes

The regular operation and maintenance works at CP/AYCCL will be another source of solid waste generation that include worn-out bricks that are used as refractory material inside the kilns and clinker coolers for heat insulation, scrap and used metals, faulty or worn-out equipment, fluorescent tubes, batteries, empty containers, used paint, engine oils, hydraulic fluids, as well as waste fuel. Failing to properly manage the waste stream will result in adverse environmental impacts including odor generation, visual impacts, as well as health impacts Note that chemical wastes and lubricants may pose serious environmental, health and safety hazards if not properly stored and managed. Furthermore, their improper handling can lead to toxic effects among exposed workers, adverse effects on air, water, and land as well as fire hazards. The seepage of chemical wastes into the sewerage network might also disrupt sewage treatment works due to potential damage to biological treatment systems.

5.2.4 General refuse

CP/AYCCLs workers, site offices, workers quarters, and canteens, all of which generate a variety of general refuse that requires proper management. General refuse consists mainly of food wastes, aluminum cans and waste paper, which can result in potential adverse environmental impacts if not properly managed. These include odor emissions, windblown litter, and visual impact especially if the waste stream is not collected frequently. The site may also attract pests, vermin, and other disease vectors if the waste storage areas are not well maintained and regularly cleaned. In addition, the disposal of wastes at sites other than approved landfills/dumps, can lead to similar adverse impacts at those sites.

5.3 Traffic

Transportation of raw materials (gypsum, sand and fuel) and cement to and from CP/AYCCL impacts traffic congestion on the roads leading to the plant including the main Mukalla -

Sayaun Highway. The proposed CP/AYCCL production capacity (1,2 MMt/Year) is expected to contributing to around 250 truck trips (two way trips) per day .

While these trucks are not expected to contribute significantly to the overall number of vehicles traveling on the Mukalla- Sayaun highway, they will add to traffic congestion particularly that they normally travel at lower speeds. Note that the existing condition of the highway, which is predominantly narrow and lacks shoulders, safety barriers, and appropriate lighting, limits overtaking potential that in turn increases congestion. Furthermore, the improper transportation of cement bags can lead to severe congestion particularly if some of the cement bags topple from the transportation trucks or if a cement bag is ruptured .

5.4 Noise and vibrations

Most activities in the process of cement manufacturing entail the use of heavy machineries that generate high levels of noise, much of which can be reduced by properly siting and insulating the operations area. Noise generation from the cement industry may either be permanent or intermittent. Intermittent noise is mainly due to blasting, the daily starting of engines, and the loading of rocks into dumpers. Permanent noise generating sources can be divided into three main groups namely:

- Machine generated noise: this regards mainly process machines (crushers, grinding mills), fan motors. Generally, the type and age of machines affect the level of noise generated, with older machines usually emitting higher levels of noise.
- Air-flow generated noise: this applies to stack, fan inlet/outlet or air intake and ventilation units. Generally, air flowing in a duct, pipe or stack generates noise whose sound power level depends on cross section, flow contours and speed. Flow speeds higher than 15-20 m/s generate noise.
- Other sources: such as noise escaping from buildings or caused by the transport of materials within the plant's boundaries.

Note that noise level propagation during plant operation based on noise value table 21.

Table 21. Typical energy-equivalent noise levels reported for the cement industry (ETPI, 1999)

Location	Noise levels(dBA)
	Typical noise levels*
Quarry **	87-106
Crusher	90-105
Raw mill	97-115
Kiln	94-115
Cement Mill	91-107

* : Measured at 7.5 m from source

** : Value measured during the loading and transport of raw materials

5.5 Surface and ground water quality

Cement production does not normally involve significant quantities of liquid effluents, which are usually limited to surface runoff, process, and cooling waters. As such the industry’s impact on water quality is limited and site-specific. Nevertheless, the transport, storage, and handling of fuels are potential sources of contamination for soil, surface water bodies, as well as groundwater sources in the area.

Furthermore, the handling and storage of fuels at CP/AYCCL may lead to fuel and oil spillage that can adversely impact groundwater and surface water resources in the area. Another important source of potential water pollution in the cement industry is the leaching of the highly alkali dust (CKD) that is generated as a waste stream-by product of the manufacturing process. Evidence of damage to groundwater and surface water from the on-site management of CKD has been documented in several cement plants.

Storm-water runoff is associated with the natural flow of water from adjacent lands surrounding the site as well as from the site proper that is expected to show a decrease in its ability to infiltrate water as a result of the increase of impermeable surfaces including buildings as well as concreted and asphalted areas. The improper design of drainage channels could lead to safety, socio-economic and environmental implications. It is during the wet season (especially during the sporadic floods that occur every ten years), that the CKD as well as spilled fuels and oils within the plant boundary can get entrained with on-site runoff water leading to the potential contamination of important surface and ground water sources as well as sea water down stream areas.

Other potential sources of aggression on surface and ground water sources at CP/AYCCL will include: 1) the untreated discharge of the effluent generated from the quality-assurance laboratory that may be contaminated by chemicals such as acids and/or alkalis; 2) cooling water effluents that contain dissolved solids (potassium and sodium hydroxide, chlorides, and sulfates) and suspended solids; 3) sewage effluent from toilets and discharges from on-site kitchen facilities*.

5.6 Soil quality

The disposal of the CKD will be a major source of soil degradation particularly if disposal conducted haphazardly and without taking into consideration the assimilation capacity of the disposal area. Soil property changes and decrees vegetation growth Table 22. Studies of CKD impacts on vegetation show decreased growth rates, reduced diversity, as well as a drop in production. CKD was also observed to result in a reduction of plant height, plant cover, number of leaves, leaf area, as well as the generation of photosynthetic pigments and phytomass.

*Estimated to range between 32 m³/day (50 L/capita/day water consumption rate excepted) and 52 m³/day (100 L/capita/day water consumption rate) and considering that CP/AYCCL will employs 520 employees.

Table22. Soil pH and associated impacts

<i>pH value</i>	<i>Soil classification</i>	<i>Impact interpretation</i>
≤ 5.5	Strongly acidic	• Possible Aluminum toxicity and excess availability of Cobalt, Cupper, Iron, Manganese, and Zinc • Deficient in Calcium, Potassium, Nitrogen, Magnesium, Phosphorous, and Sulfur • Boron deficiency below pH of 5 • Molybdenum becomes more available with decreasing pH • Bacterial and actinomycete activity is reduced along with a predominance of fungi • Mineralization of organic matter and nitrification are restricted • Below a pH of 3, functioning of cell membranes is impaired, resulting in leakage of elements
5.5 - 7.3	Moderately acidic, slightly acidic, and neutral soils	• Preferred pH range for most crops, lower end of range may be too acidic for some • pH between the range of 6.0 and 7.0 hampers phosphorous fixation • Neutral pH favors the fixation of molecular Nitrogen by free living soil microorganisms and by symbiotic microorganisms • Above a pH value of 7.0 the availability of Iron, Manganese, Zinc, Cobalt, and Cupper declines
7.3 - 8.5	Slightly alkaline and Moderately alkaline soils	• Above a pH of 7.0 there is an increase in the availability of Iron, Manganese, Zinc, Cobalt, and Copper • Increased risk of ammonia volatilization • First increasing availability of Phosphorus and Boron, but deficiencies may occur at higher pH values • Insoluble Calcium-Phosphates may be formed at higher pH • Electric conductivity is generally high at higher pH values
≥ 8.5	Strongly to very strongly alkaline	• Calcium and magnesium are liable to become unavailable to most crops • Often high sodium levels lead to toxicity and structural damage • Toxicity of bicarbonates and other anions • Possible Boron toxicity common in saline and or sodic soils • Availability of most micronutrients and of Iron, Manganese, Zinc, Copper, and Cobalt is reduced, except for Molybdenum • Decreased microbial activity

(Batjes, 1995, Landon, 1991, Mengel and Kirkby, 1982)

5.7 Terrestrial biodiversity

The potential terrestrial ecological impacts arising from cement manufacturing may include direct impacts as a result of habitat loss, loss of species, and habitat fragmentation as well as indirect impacts on the surrounding habitats and associated fauna due to increased human activities, dust accumulation, emission of noise and vibrations, accidental spillages and leakages, as well as trampling.

In the cement industry, quarrying is the main source of habitat loss and fragmentation due to the large quarries needed to supply the raw materials to the cement plant. Furthermore, dust accumulation on vegetation and soils will be reduce net photosynthesis, water-use efficiency, and respiration, resulting in lower primary production as well as to a change in plant chemistry, species competition and faunal community structure. The continuous generation of noise and vibrations on the other hand, can disrupt communication in fauna and lead to changes in behavior (e.g. food gathering, mating, warning signals and breed care can be disrupted) that may lead to a subsequent change in ecological communities.

At CP/AYCCL, the biodiversity at the site is expected to be enhanced with the adopted landscaping program that will include planting of green buffers that will improve the biological potential of the area by providing a green area within the arid surroundings.

5.8 Resource use

The cement industry is a heavy consumer of resources namely energy and raw materials. Energy consumption typically accounts for 30 to 40 percent of the production cost of cement, depending on the raw materials and the production process adopted. Energy consumption in cement production is in the form of electric and fuel energy. Fuel consumption is estimated to range between 2,900 and 5,100 MJ/ton of clinker produced. Therefore, it is beneficial to operate cement plants with low heat consumption and to achieve high levels of fuel utilization.

Concerning electricity consumption, cement production is known to consume anywhere between 90 and 130 kWhr per ton of cement produced. The main electricity consuming sections in a cement plant are the mills (finish grinding and raw grinding) and the exhaust fans (kiln/raw mill and cement mill) which together account for more than 80 percent of the total electrical energy usage.

Cement production is a high consumer of raw materials (limestone and gypsum), whereby the industry transforms raw materials into final product. The average feed-to-production ratio in the industry is around 1.72 ton for dry preheater process kilns. With the proposed production capacity of 1.2 MM tons per annum, the industry is required to consume 1.896 MM tons of raw materials. Quarry operations at CP/AYCCL will be responsible for change the natural drainage in the area (by altering the topography) as well as will impact the groundwater table

as a result of blasting activities that generate vibrations that can damage subterranean fissures and aquifers.

Water is primarily consumed for cooling of machineries such as the shafts of rotating kilns and cement mills. No direct contact or mixing, however, is usually involved between the oil and the water used and as such mechanical cooling waters can normally be recycled after use. Another source of water use is the operation of the electrostatic precipitator, whereby conditioning of the exhaust gases is often necessary and is commonly achieved by means of water jet-spraying into an evaporation cooler upstream of the separator (such water is normally evaporated and emitted at the stack as vapor. CP/AYCCL expected to consumes around 200 m³/day of fresh water (or around 0.05 m³/ton of cement produced).

5.9 Health and safety

The main health and safety concern in the cement industry has always been the exposure to the fine dust that is generated in significant amounts through-out the cement manufacturing process. Exposure to cement related dust has long been associated with the prevalence of respiratory diseases as well as varying degrees of lung and laryngeal cancer, gastrointestinal tumors, as well as dermatitis (Table23). Exposure to cement generated dust can occur through several pathways including inhalation, ingestion, as well as dermal exposure. Workers in the cement industry are the most susceptible group to the adverse health impacts of cement related dust with long periods of dermal, respiratory, as well as gastrointestinal exposure routes. If CP/AYCCL employees are not equipped with the required personal protection equipment and as such are exposed to elevated concentrations of cement dust which can result in high occurrence of sick leaves that in turn reduces plant productivity. The lack or improper training of the staff in charge of the operation and maintenance could equally expose them along with nearby residents to elevated concentrations of cement related dust.

Table23. Adverse health effects of CKD

Target	Effect	Reference
Cement plant workers	Decrease in lung volumes and expiratory flow rates	Weill <i>et al.</i> , 1975
	Lower lung function	Oleru, 1984
	Higher incidence of chronic respiratory symptoms and reduction of ventilatory capacity	Yang <i>et al.</i> , 1996
	Higher incidence of respiratory symptoms, chronic bronchitis, and impaired lung function	Noor <i>et al.</i> , 2000; Kalacic, 1973; Izycki <i>et al.</i> , 1979
	Higher incidence of chronic bronchitis and recurring incidence of chronic rhinitis, laryngitis, pharynx catarrh and asthma	Maciejewska and Bielichowska-Cybula, 1991
	Pulmonary alveolar proteinosis	McCunney and Godefroi, 1989
	Greater tooth surface loss	Tuominen and Tuominen, 1991
	Greater intensity of parodontal disease	Bozyk and Owczarek, 1990
	Pulmonary and hepatic granulomatous disorders	Cortex Pimentel and Peixoto-Menezes, 1978
	High incidence of retroflexion of the uterus, inflammation of the ovary, erosion of the vaginal part of the uterus, prolapse of the vaginal walls and incontinence among women workers	Dudkiewicz <i>et al.</i> , 1983
	Inflammatory changes and chemical burns in skin of workers exposed to long-term contact with cement	Maciejewska and Bielichowska-Cybula, 1991
	Significant increase in the incidence of chromosomal aberrations	Fatima <i>et al.</i> , 2001
	Lung and laryngeal cancer, gastrointestinal tumours and dermatitis	Noor <i>et al.</i> , 2000; Olsen and Sabroe, 1984
	Increased risk of stomach cancer	Mc Dowall, 1984
	Incidence of colorectal cancers	Jakobsson <i>et al.</i> , 1990
	Risk factor for right-sided colon cancer	Jakobsson <i>et al.</i> , 1993
	Higher general mortality and significant excess of lung-cancer deaths	Haider and Neuberger, 1980
General population	Polyneuritic symptoms, sleep disorders, headache and fatigue associated with increased thallium intake among population around a cement plant	Brockhaus <i>et al.</i> , 1981
	Prevalence of respiratory symptoms and varying degrees of airway obstruction among exposed population	Noor <i>et al.</i> , 2000
	Inflammatory infiltrations and atrophic and hypertrophic changes in the nose of exposed subjects	Janicka-Beuth, and Korenkiewicz, 1997
	Higher prevalence of most respiratory symptoms in exposed children	Goren <i>et al.</i> , 1999

On the other hand, exposure via indirect pathways or food-chain exposure may result in excess cancer cases over a period of 70-years. Several methods have been explored to estimate health-based socio-economic benefits for decreasing ambient PM levels (log-linear

and the linear relationship), however their use requires long-term continuous monitoring data coupled with good health statistics.

Other adverse impacts on health and safety include common occupational risks associated with the presence of heavy mechanical equipment, hot ovens, furnaces, crushers, explosives, fans, as well as fire and explosion risks. These risks are inherent to the cement industry and can only be minimized or mitigated through proper staff training and the adoption and implementation of clear health and safety operational procedures .

5.10 Landscape and visual intrusion

Landscape disturbance and visual intrusions are inevitable at the site proper owing to the fact that cement manufacturing is a heavy mineral-based industry that requires the exploitation of large plots of lands for plant setting and raw material extraction. The potential quarrying activities as well as the setting of the cement plant directly affect the existing landscape and land use patterns through:

- Displacing expected activities existing flora and fauna at the plant and the quarry site
- Degrading the land due to quarrying activities
- Creating potential conflict with adjacent land uses (Grassing areas) and industrial areas, thereby causing a visual disruption of the landscape.
- Loss of a Grassing areas to industrial/quarrying use
- Change in topography (due to surface mining) causing visual impacts
- Dust deposition on roads, buildings, vegetation and water bodies.

Impacts can be minimized by integrating the plant with the existing landscape and through the development and adoption of rolling restoration plans particularly prior to the operation phase.

5.11 Socio-economics

Cement manufacturing has evolved to become an integral contributor to modern economy, and the cement industry's principal socioeconomic development through the provision of concrete, a useful product which has a wide and expanding range of uses, including transportation, industry and commerce, housing, infrastructure, utilities, etc. As such, the proposed of CP/AYCCL is considered as an important driving force for the construction,

development, and rehabilitation efforts that the private is dedicated to achieving and promoting in Yemen. The local production of cement is a strategic necessity that will increase the independence of Yemen on other countries to achieve development (currently Yemen imports cement from Russia, Egypt, the United Arab Emirates, India, and Oman etc.). Furthermore, CP/AYCCL will contribute to the local economy of the area by providing employment opportunities that often extend beyond the boundaries of the area. CP/AYCCL will provides 350-520 direct employment opportunities. Indirect and induced employment opportunities are equally important sources for the generation of income at the community level. Indirect employment is usually achieved through the creation and promotion of new job opportunities at the businesses that supply goods and services to CP/AYCCL including contractors (e.g., maintenance, catering, and office services), transport providers, house purchase and rental, equipment and services procurement, construction companies, equipment manufacturers, caterers, etc. Induced employment on the other hand, is generated by the direct expenditure of CP/AYCCL workers in the local economy (and more specifically in the shops and stores located within the geographic boundaries of the town of project area and its surrounding villages). In addition, CP/AYCCL will provides healthcare, education, accommodation and pensions for its employees thus will be enhancing their socio-economic status. Furthermore, CP/AYCCL will contribute to the construction and/or implementation of local schools, mosques, and water projects in the project area.

On the other hand, CP/AYCCL will be responsible for several direct and indirect negative socio-economic impacts that include a drop in the land value in the area surrounding the plant, disruption of grassing practices, increased exposure to dust, and potential respiratory and dermal illness ,limiting the recreational potential of the area surrounding the site*, damaging the scenic qualities of the landscape, promoting a sense of a decreased level of resident satisfaction with the general character and amenity of the area, as well as leading to the development of a general perception of being exposed to adverse health risks.

5.12 Summary of impact analysis

Potential environmental impacts at CP/AYCCL are associated with air quality, solid waste, traffic, noise, surface and groundwater quality, soil quality, terrestrial biodiversity, resource use, health and safety, landscape and visual intrusion, as well as socio-economic impacts.

* Impacts are due to the coating and soiling of surfaces leading to annoyance and lowering the aesthetic value of the surroundings, corrosion of artifacts, as well as reduced visibility

Undoubtedly, CP/AYCCL will provides a positive socio-economic impact related to the potential increase in job opportunities for locals as well as providing a product that is much needed to meet the demand for the construction and development activities that are occurring on the National Local scales. On the other hand, several potential adverse aspects that are associated with the project can negatively affect the environment particularly as a result of the associated air emissions, effluent discharge, and the solid waste stream. As such, the adoption of proper environmental management plans is needed to ensure the sustainability of cement production and the expected benefits from CP/AYCCL. Based on the analysis presented in this Chapter, Table 24 provides a qualitative summary of the significance of potential environmental impacts that will associate with operations at CP/AYCCL.

Table 24 Summary of impact analysis

<i>Impact</i>	<i>Potential Magnitude</i>
Air quality	- - -
Solid waste generation	- - -
Traffic	- -
Noise	- -
Surface and groundwater quality	- - -
Soil quality	- -
Terrestrial biodiversity	- -/+
Resource use	- -
Health and safety	- - -
Landscape and visual intrusions	- - -/+
Socio-economics	+ + +/-
+++ High potential positive impact	- - - High potential negative impact
++ Moderate potential positive impact	- - Moderate potential negative impact
+ Low potential positive impact	- Low potential negative impact
0 Neutral impact	

6. ANALYSIS OF THE PROJECT ALTERNATIVES

6.1 Site Selection

potential sites for the proposed project were considered by study team. The locations were re-considered (Sites A and B) Figure 20 identifies the location of these sites .

The sites were evaluated according to the following guidelines:

- Located in an area not subject to air inversions or trapping of pollutants and where prevailing winds are towards relatively unpopulated areas.
- Distance to the main wells fields, Agricultural, population activities, and Cultural Heritage.
- Plot size sufficient to landfill or dispose on site
- Proximity to suitable disposal site .
- Convenient for public – private contractors and haul solid Wastes for final disposal.
- Land acquired .

The sites were evaluated with reference to a number of design criteria

6.1.1 Site A - Kuthibah

- Site located approximately 1km of populated area and 3km from the main wells fields, Agricultural, population activities , and Cultural Heritage areas.
- prevailing winds from South East direction towards populated areas (Al-Eyoun Town) .
- Plot size not sufficient to landfill or dispose on site
- Project land acquired difficult due to private owners

6.1.2 Site B – Abdullah Gareeb

- Site located approximately 18 km from the main wells fields, Agricultural, population activities , and Cultural Heritage areas.
- prevailing winds from south East are towards relatively unpopulated areas .
- Site size sufficient to landfill or dispose on site.
- Project Land acquired easily due to Public owners .

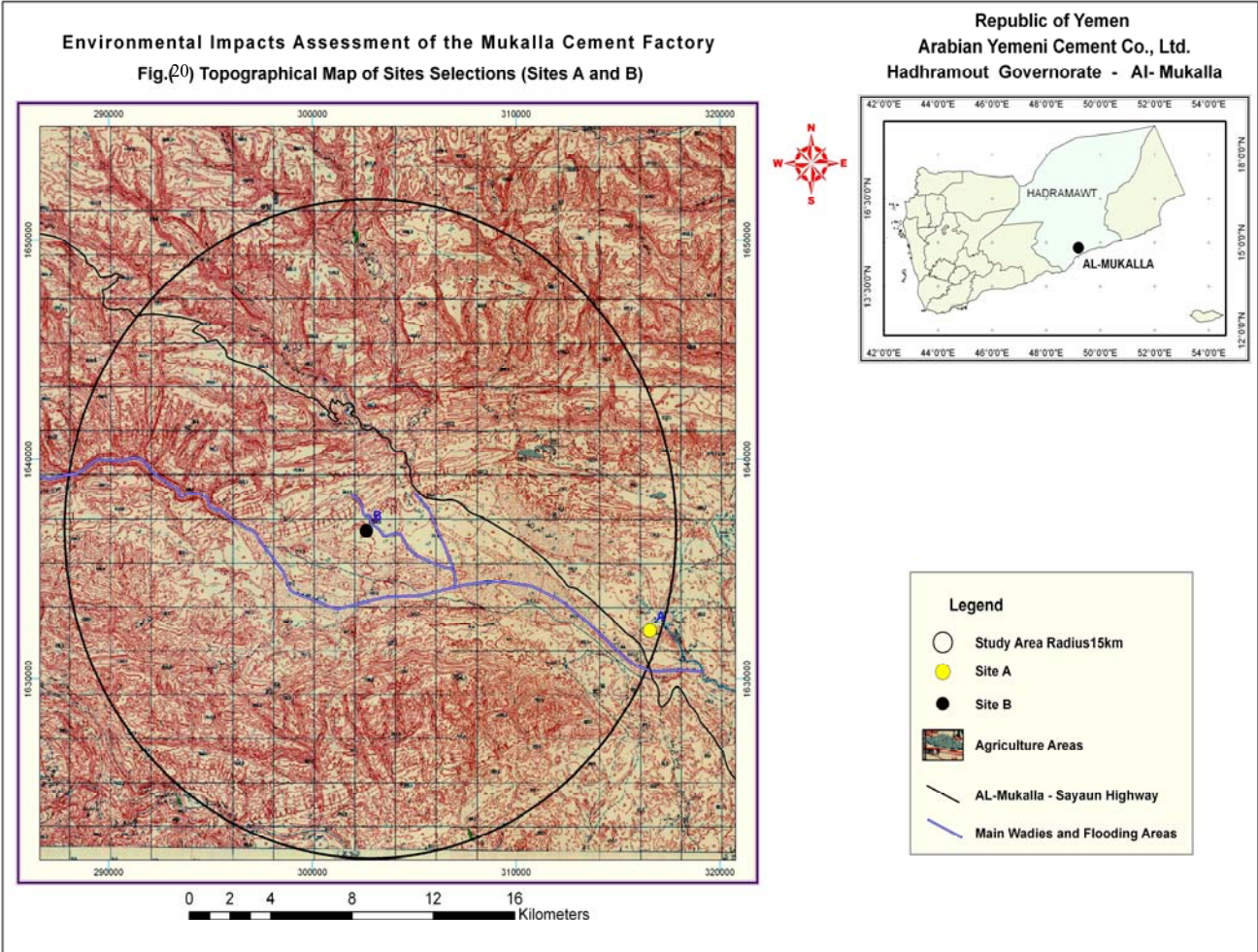
6.2 The Preferred Site

The comparison of the relative merits of each of the potential site concluded that Site B Abdullah Ghareeb , was the most advantageous . The reasons for this conclusion were summarized as follows:

- prevailing winds from south East are towards relatively unpopulated areas .
- Site size sufficient to landfill or dispose on site.
- Site located approximately 18 km from the main wells fields, Agricultural, population activities , and Cultural Heritage areas.
- Project Land have been acquired by Cement Plant of Arabian Yemen Cement Co. Ltd.

6.3 Implication of the 'Do Nothing ' Scenario

In the event that the proposed development did not proceed then , somewhat obviously , the requirement for sources of Limestone Deposit , Clay & Sandstone would be avoided . The environmental impacts would therefore be neutral in the context of this project



Emission control

Air quality management at the cement industry utilizes a number of control technologies to achieve the desired degree of emission reduction. Various factors play a role in the selection of these technologies, including emission standards, energy requirements, plant economics, availability of spare parts, as well as the technical know-how to operate and maintain the control systems. The choice of appropriate control processes and development of the flow scheme requires an understanding of the unit operations, operational capabilities, and environmental effects of various control components. The aim of this section is to assist CP/AYCCL decide on the Best Available Technology (BAT) for reducing dust emissions, while taking into consideration financial constraints. Finally, the “do nothing” scenario is compared with the installation of a BAT end-of-pipe emission control technology at CP/AYCCL.

6.4.1 Fabric Filters

Fabric filters (FFs) have been used in the cement industry well before ESPs were developed. FFs use filtering media to separate the dust particles from the exhaust gas, which typically constitutes woven fabrics and felts made of organic and inorganic fibers. With efficient maintenance, high dust removal efficiencies may be achieved with FFs, which mainly depends, however, on the filter charge as well as on the structure and the density of the filter medium.

FFs are favored by the cement industry because of their simplicity, reliability, high removal rates, and economic competitiveness. The main advantage of bagfilters is that the dedusting efficiency is always very high even if the process parameters are changed (e.g. during start up or shut down of the kiln, clinker cooler or cement mill, during switching from compound to direct operation (raw mill on or raw mill off). Furthermore, they can help in reducing SO₂ emissions by promoting absorption to the alkaline dust cakes that collect on the surface of the bags. In contrast, the main disadvantage of FFs is the high pressure drop causing comparatively high power consumption at the filter fan. In addition, their performance deteriorates for mechanical and process reasons, and fabrics usually have a limited life. It is important, therefore, to prevent hot particles from entering and to avoid severe temperature surge.

6.4.2 *Typical ESP*

ESPs utilize electrostatic forces to separate the dust from the gas. A favorable separation efficiency is achieved for particles with a specific dust resistivity between 10^9 and $10^{11} \Omega \text{ cm}$. Removal efficiency however, is highly dependent on the type of dust, the water-vapor content, and the temperature of the incoming gas. As such, conditioning of the gas is often necessary, by means of water-jet spraying for instance. The main advantages of ESPs are the low pressure loss, reduced power consumption, and the ability to achieve separation of coarse and fine particles for efficient evacuation of circulating elements. Nevertheless, the efficiency of ESPs is highly susceptible to changes in process parameters (e.g. during start up or shut down of the kiln, during switching from compound to direct operation and during occurrence of CO peaks). Although ESPs are easy to maintain, on-line maintenance is not possible. Other disadvantages include the risk of sparking off explosions of partially burned fuel or gas mixtures, resulting from incomplete combustion in the kiln. The risk is minimized by automatically tripping the ESP when the CO content of the kiln exhaust gas reaches a pre-set level, during which PM emissions will rise significantly. Table 25 compares the advantages and disadvantages of FF and ESPs in terms of reducing dust emissions.

Table 25 Comparison of the characteristics of FFs and ESPs used in the cement industry

<i>Parameter</i>	<i>ESP</i>	<i>FF</i>
Removal efficiency shows low sensitivity with operating temperature	Highly dependent on gas temperature	Up to 150°C and should be kept above gas dew point
Ability to control SO ₂ emissions	No	Yes
Does not lead to significant pressure drops	Yes	No
Removal efficiency is not affected by process parameters	No (low efficiency during startup and fluctuating operational parameters)	Yes
Online maintenance possible	No	Yes
Removal efficiency	Up to 30 mg/Nm ³	Up to 20 mg/Nm ³
Low solid waste generation rate	Yes	No (damaged bags)
Removal efficiency is not affected by dust particle size	No	Yes (very limited impact)
Conservation of water (low water use)	No	Yes
Capital cost	Cheaper	More expensive
Operational cost	Cheaper	More expensive
Available local operational and maintenance know-how	Low	Low to medium

6.4.3 *The “no control” scenario*

The proposed adoption of a BAT end-of-pipe technology for reducing PM emissions was compared to the “do nothing” or “no control” scenario. In this alternative, the dust emissions from CP/AYCCL will continue to emit into the environment with no control. This will increase air quality degradation and potential adverse health impacts caused by the exposure to elevated levels of PM. While the “no control” scenario means no capital and operational expenditure, it is likely to result in long-term deterioration of environmental, health and socio-economic conditions. Table 26 presents a simple qualitative comparative evaluation of adopting PM emission reduction BAT technology at CP/AYCCL versus the “no control” scenario. Evidently, the latter is non-sustainable.

Table 26. Comparative evaluation of PM BAT emission reduction versus the “do nothing” scenario

<i>Impact</i>	<i>Adopting PM BAT</i>	<i>“Do nothing” scenario</i>
Air quality	-	- - -
Water and soil quality	-/0	- -
Solid wastes generation (CKD)	- -	- -
Health and safety	+++	- - -
Short term expenditure (capital and operational costs)	-	0
Long term savings (in terms of reduced morbidity and mortality)	+ +	- -
ISO 14001	+ + +	- - -
Relationship with surrounding receptors	+ +	- - -

+++ High potential positive impact

++ Moderate potential positive impact

+ Low potential positive impact

0 Neutral impact

- - - High potential negative impact

- - Moderate potential negative impact

- Low potential negative impact

7. ENVIRONMENTAL MITIGATION PLAN

The mitigation plan proposes several potential impact-mitigation or control measures that will earn CP/AYCCL more acceptability, by eliminating or reducing to the extent possible many of the impacts that were outlined. Mitigation measures are intended to reduce the effect of potentially significant impacts on the environment. Thus, they are highly dependent on the significance of the predicted impact and the nature of the impact (permanent vs. temporary).

7.1 Mitigation of air quality impact

Several mitigation measures are available to eliminate or reduce the adverse environmental impacts that the cement industry has on ambient air quality. These measures are compound-specific and vary in their treatment efficiency as well as in their technical and financial requirements. As such, air quality mitigation measures will be presented separately for each constituent with mitigation measures ranging between BAT and low-cost treatments. The priority is clearly to mitigate PM dust emissions, particularly that exposure to other constituents such as NO_x, SO_x, VOCs, and trace metals appears to be of minimal concern

7.1.1 *Mitigation of PM emissions*

The largest PM emission source within cement plants is the pyro-processing system (point source emissions) that includes the kiln, the bypass system, and clinker cooler exhaust stacks. Other sources of PM emissions include fugitive and area source emissions that are generated from the handling, quarrying, and storage of raw and final products. Table 27 presents a summary of mitigation measures that could be adopted at CP/AYCCL A description of these mitigation measures follows.

Table27. Common control measures for particulate emissions from cement manufacture

Category	Source	Measure and description ¹	Emission reduction (%) ²
Point source	Crusher	Fabric filters: pulse jet, reverse air, or shaker bag house	99.6 – 99.9
	Raw mill	Fabric filters: pulse jet, reverse air, or shaker bag house	99.6 – 99.9
	Kiln system	- Electrostatic precipitators: requires gas temperature conditioning & CO leveling - Fabric filters: reverse air, requires gas temperature conditioning	99.5 – 99.8
	Clinker Cooler	- Electrostatic precipitators: physical preconditions must be considered - Fabric filters: Pulsed jet (newer plants), reverse air (older plants)	99.6 – 99.8
	Cement mill	Fabric filters: Pulsed jet (newer plants), reverse air or shaker (older plants)	99.6 – 99.9
Fugitive sources	Quarrying site	Water sprays with and without surfactants, foams, chemical dust suppressants, wind screens, equipment enclosures, and paving	Not available
	Storage areas	Closed silos with air-filtering separators, closed sheds (tents/umbrellas) with automatic handling system, wind breaks, pile covers	Not available
	Traffic areas	Paving, cleaning, wetting, speed limit, housekeeping	Not available
	Packing/loading /unloading points	Closed sheds with fabric filters, retractable housed chutes or telescopic tubes with suction hoods, reduction of drop height	Not available
	Conveyor system/Transfer points	Closed pneumatic conveyors, closed hoppers with fabric filters, drop height reduction	Not available

¹ EA 2001; CEMBUREAU 1999; INECE 1998; USEPA 1995a; AWMA 1992; VDI, 1985

²AWMA 1992.

7.1.1.1 Mitigation of point source PM emissions

The two most commonly used end-of-pipe de-dusting techniques in the cement industry are ESPs and FFs Both technologies are known to achieve good removal efficiencies whereby ESPs are capable of achieving a dust concentration ranging between 30 and 40 mg/Nm³ while FF can achieve concentrations ranging between 20 and 50 mg/Nm³.the selected FF should have:

- An air-to-cloth-ratio that ranges between 60 and 100 m³/m²/h (a typical value for the cement industry)
- Multi-compartments that allows increased flexibility particularly during maintenance
- Pulsed-air self-cleaning system
- High temperature resistant fabric material like Nomex to prevent the burning of bag fabric from hot clinker particles, which may result in small holes in the filters

Furthermore, the FF should be operated and maintained according to the following general guidelines:

- A proper and clear maintenance scheme should be developed in conjunction with the manufacturing and installing company
- Regular replacement of bag filters according to the specifications provided by the manufacturer
- Regular in-house dust emission measurement to gain more information about the effectiveness of the FFs
- Readily available spare parts (particularly FF bags and fans) to better respond to emergencies
- Regular monitoring of the temperature of incoming gases to maintain suitable gas temperatures and avoid damage to FF (by high temperatures that can lead to dew point)

The installation of the FF should allow for the automatic shutdown of the production line(s) whenever the FFs are placed off-line. This option will increase transparency and enhance the relationship between the plant and its surroundings. Furthermore, CP/AYCCL should implement a regular inspection and maintenance program for the FF compartments, cages, and filter bags whereby faulty equipment are replaced immediately (fabric filter bags have an average age ranging between 3 and 5 years).

7.1.1.2 Mitigation of fugitive PM emissions

Fugitive dust sources in the industry include quarrying and mining operations, vehicular traffic during limestone extraction and at the manufacturing site, raw materials storage piles, and clinker storage piles. The measures used to control emissions from these fugitive dust sources are comparable to those used throughout the mineral products industries.

Transportation and hauling

Paving is an important mitigation measure that can significantly reduce dust emissions resulting from traffic movement on-site and at the quarry. Since paving is a relatively expensive option, it is usually restricted to the main roads and yards. As such, CP/AYCCL can pave the main (permanent) road that connects the primary limestone crusher to the various parts of the quarry, the main road connecting the cement plant to the quarry, as well

as the parking yard. As such, paved roads should be regularly cleaned by a road sweeper. Temporary and low traffic volume unpaved roads on-site should be regularly sprayed with water to suppress dust emissions and prevent the carryout of fugitive CKD by the truck traffic. Effective wetting can be achieved by reducing the diameter of the water droplets and increasing their number through appropriate selection of pumps and nozzles used for the water spraying system. Speed limits should also be enforced as not to exceed 10 Km/hr except on paved roads. Finally, trucks carrying dusty cargo should be covered by tarps or screening material that should extend over the truck's bed in order to prevent air entrainment and spillage during hauling.

Material handling and storage

Control measures for PM emissions that are generated from material handling and storage encompass water sprays (with and without surfactants), chemical dust suppressants, pelletization, erection of wind screens, along with the adoption of several process modifications that include reducing material drop heights and enclosing storage operations. Table 28 presents typical dust reduction efficiencies of various control measures. Regular watering practices can enhance aggregation and cementation of fines to the surfaces of larger particles, thus achieving a reduction of more than 50 percent in the rate of fugitive dust emissions due to the formation of a crust that decreases the emission of dust (by increasing the threshold frictional velocity). The use of chemicals to treat exposed surfaces provides longer dust suppression. Continuous chemical treatment of material loaded into piles, coupled with watering or treatment of roadways, can achieve a reduction up to 90 percent in the total particulate emissions from aggregate storage operations. On the other hand, pelletization of CKD during storage can reduce PM emissions by up to 92 percent. Windbreaks and source enclosures are also good mitigation measures that can offer long term control techniques for limiting PM emissions. Enclosures include silos as well as warehouse-type structures that should have a roof, floor, as well as walls. On the other hand, temporary open storage piles should be covered by a layer of compact soil to reduce dust emissions. Open stockpiles should be properly treated and sealed with latex, vinyl, bitumen or other suitable surface stabilizer. Feasible mitigation measures that entail introducing process modifications include:

- Pelletization can be used at temporary storage points at CP/AYCCL particularly for the CKD generated by the by-pass system. Pelletized dusty materials are also likely to

help reduce emissions during transport and at temporary storage piles. Pelletization is achieved by passing the wet CKD through paired rollers that will produce small spherical pellets with recessed surfaces

- Installing a water sprinkler system with medium pressure nozzles on the hopper of the primary crusher
- Installing ventilation systems to be used in conjunction with hoods and enclosures covering transfer points and conveyors. Fabric filters fit this kind of application very well due to their flexibility in flow rate, dust burden, and geometrical arrangement.
- Minimizing drop distances of raw, waste, as well as final product by the use of adjustable conveyors.

Table 28. Emission reduction factors for materials storage

<i>Reduction method</i>	<i>Control Efficiency</i>
Wind break	30 %
Water sprays	50 %
Chemical suppression	80 %
Enclosure (2 or 3 walls)	90 %
Covered stockpiles	100 %

Source : (DEH, 2003)

CKD disposal

The CKD disposal practices first should be wetted and then compacted into layers by the use of either rollers or other heavy equipment. Wetting and compaction of CKD induce the formation of a fairly solid layer that is reported to be similar to a low-grade cement and will remain in a fairly solid form until mechanically disturbed. Although some flaking or scaling may occur that may produce fugitive dust from undisturbed compacted CKD, when subjected to mechanical action the dry material is easily crushed and once again prone to substantial fugitive emissions. For this reason, wet compaction must be part of an overall management practice that includes covering and protection from mechanical disturbance once it is dry. Furthermore, the compacted CKD should be covered by a layer of soil at the end of each operating day to prevent dust emission.

7.1.2 Mitigation of NOx emissions

Worldwide many cement plants were able to achieve significant reductions in NOx emissions by means of adopting several optimization measures such as process control, improved firing technique, optimized cooler connections, and appropriate fuel selection. The optimization of

the clinker burning process can reduce heat consumption, improve clinker quality, increase the lifetime of the equipment through the stabilization of process parameters, as well as reduce NOx emissions. The reduction is usually achieved by reducing flame and burning temperatures along with the heat of consumption. Kiln optimization can include many elements ranging from instruction-training of the kiln operators up to installation of new equipment such as dosing systems, homogenization silos, pre-blending beds, new clinker coolers, low NOx burners, after-burning in a reducing atmosphere, on-line NOx sensors, etc. Note that the operational costs for running an optimized kiln are usually less than those associated with operating an un-optimized kiln, whereby savings can be achieved from reduced fuel and refractory consumption, lower maintenance costs, as well as higher productivity.

7.1.3 Mitigation of SOx emissions

Currently the BAT for SOx emission from cement plants ranges between 200 and 400 mg SO₂/Nm³. As such, SOx emissions are best controlled by using low-sulfur fuels and raw materials coupled with continuous monitoring of the sulfide-sulfur content of the raw materials entering the kiln. In case of high sulfur content raw materials, slaked lime should be added to the exhaust gas of the kiln in order to absorb some of the SO₂. It has been found that the best method of introducing the slaked lime is to add it to the kiln feed directly.

7.1.4 Mitigation for the emission of trace gases

In addition to PM, SOx, and NOx emissions, the cement industry emits CO₂, CO, VOCs (volatile organic compounds), heavy metals, and dioxins. Table 29 presents a summary of the typical mitigation measures that can be used to reduce these emissions.

Table29. Common control measures for major gaseous emissions from cement manufacture

Constituent	Mitigation measure	Achievable emission reduction (%)
CO	Choice of raw material: with low content of organic matter	Not available
CO ₂	Choice of process: mainly shifting from wet to dry processes Energy efficiency improvement: fuel and equipment efficiency, electricity use	Up to 12
	Choice of fuels: shifting from high to low-carbon fuels	Not available
	Lower clinker/cement ratio: application of blended and alternative cements. Substituting natural pozzolanic materials for clinker substantially reduces process-related CO ₂ emissions. It represents one of the best, technically proven approaches for reducing process emissions.	Up to 29
	CO ₂ removal: mainly through combustion in a CO ₂ /O ₂ atmosphere	Up to 70
VOC	Choice of raw material: with low content of organic matter	Not available
	Increasing O ₂ concentration: at the kiln inlet of long wet or long dry kilns	Up to 40
	Introduction of highly organic raw material components directly to the hot zone of the kiln, where organic compounds are burned before escaping	Up to 95
	Activated coke: by passage of gas across packed beds of activated coke where VOCs are adsorbed, mainly organic compounds larger than C ₅	Not available
Heavy metals	Choice of raw material and fuel: with low content of volatile and semi-volatile heavy metals	Not available
	High efficiency dedusting: to reduce emissions of heavy metals attached to dust	Not available
	Activated coke: by passage of gas across packed beds of activated coke where heavy metals are adsorbed	Up to 99
Dioxins and Furans	Control of post kiln conditions: mainly gas residence times, temperatures and oxygen contents	Not available
	Choice of raw material: with limited chlorine input	Not available
	Efficient dedusting: incorporating special catalysts to reduce emissions of dioxins adhered to dust	Not available

Source: CEMBUREAU, 1999; EA, 2001; USEPA 1994a; Hendriks *et al.*, 1998; WBCSD, 2002)

Besides emission related to cement manufacturing, emissions with similar constituents are expected as a result of heavy machinery use such as truck traffic to and from the site as well as on-site traffic. Measures to reduce vehicle-induced emissions include proper maintenance and the adoption of a traffic management plan while avoiding congested routes. Concerning on-site heavy equipment, proper maintenance procedures and the quality of diesel fuel used are important to reduce emissions. In addition, equipment should be turned off when not in use, which would reduce power needs and emissions.

7.2 Mitigation of solid waste

Sources of solid wastes include general refuse, chemical wastes, as well as faulty equipment. The generated CKD can either be reused or disposed of. One approach to emission reduction is to minimize the production of cement kiln dust by reducing gas turbulence in the kiln and avoiding excessive flow velocities.

In case disposal is opted, the CKD can be wetted and then compacted into layers by the use of either rollers or other heavy equipment. Wetting and compaction of CKD induce the formation of a fairly solid layer that is reported to be similar to a low-grade cement and will remain in a fairly solid form until mechanically disturbed. The compacted CKD should also be covered by a layer of soil at the end of each operating day to prevent dust emission. Furthermore, run-off control should be provided to prevent off-site migration during storm events by collecting and treating storm water run-off. (Note that the CKD will be stored in closed Bins and transported pneumatically) .

On the other hand, reuse options include reuse in the cement manufacturing process, use as a soil amendment², or use as a stabilizing agent³. Direct return of dust to the kiln is a common recycling practice. The dust may be returned to the hot end, to the middle of the kiln, or to the feed material. However, cement kiln dust can only be reused if selected concentrations fall within specified limits, because the clinker quality can be affected by the presence of certain constituents. Alkali metals, such as lithium, sodium, and potassium, are of primary concern. The raw materials used to produce clinker as well as the adopted kiln fuel influence the chemical composition of the generated dust, and thus may affect recycling rates. Cement kiln dust that contains alkalis or possesses other undesirable characteristics may be treated so that it can be returned to the kiln system. Treatment techniques include pelletizing, leaching with water or a potassium chloride solution to remove alkali salts, alkali volatilization, recovery scrubbing (also known as flue gas desulfurization), and fluid bed dust recovery. Pelletization in particular provides CKD the strength to withstand firing upon re-entry into the kiln system without re-suspending large quantities of particulate matter or changing the chemical characteristics of the clinker. The leaching process on the other hand, generates wastewater that must be treated for high pH values and high concentrations of dissolved and suspended solids.

² CKD's alkali nature can be put into use to condition highly acidic soils.

³ CKD can be used to stabilize sewage sludge, waste oil sludge, contaminated soils, as well as to neutralize acid mine drainages.

Other sources of solid wastes include the containers that were used for the storage of chemical wastes and fuels on site, expired hazardous chemicals, faulty equipment and as well as regular refuse. Empty chemical and fuel tanks along with the hazardous wastes may generated at the CP/AYCCL laboratories then should be segregated and properly stored and disposed of at a permitted site. Storage should take place in a separate area that has an impermeable floor, adequate ventilation and a roof to prevent rainfall from entering. In addition, chemical wastes should be clearly labeled in English and Arabic, stored in corrosion resistant containers and arranged so that incompatible materials are adequately separated. Therefore CP/AYCCL should Implementing a purchasing and inventory control as well as the FIFO “First In First Out” system would avoid and reduce the amount of unused reagents that need to be disposed of as wastes.

Faulty equipment should be segregated whereby equipment that can be recycled could be sold to local recycling industries, while non-recyclable equipment especially used fabric filters should be transported to an approved landfill for disposal along with the general refuse therefore suitable site selection should be applied at the CP/AYCCL.

7.3 Mitigation of traffic impact

Primary measures adopted to mitigate traffic impacts include the proper dissemination of information regarding the transport schedule (of gypsum, and fuel, to CP/AYCCL and cement from CP/AYCCL). In this respect, proper planning and development of traffic plan that accounts for the reservations and inputs of nearby residents is essential to minimize potential inconvenience on commuters as well as to ensure the safety of motorists and pedestrians, particularly since the roads connecting CP/AYCCL to Mukalla –Seiyun High way which is not adequately equipped to handle heavy truck traffic. As such, truck movements should be limited to off-peak hours to the extent feasible. In addition, adequate warning and signing are needed at least 500 m down and up-gradient from the entrance of the CP/AYCCL to the Seiyun main road to warn people that heavy equipment and trucks are frequent along these intersections. Other traffic mitigation measures are presented in Table30 .

Table 30. Traffic control measures

Control measure	Typical examples
On-site	• Entrance and exit located so as to provide maximum turning space and sight lines • Vehicle movement in the direction of predominant traffic flow • Adequate off-loading and loading space to ensure vehicles can wait on-site • Adequate off-street parking for employees • One-way traffic within the site to prevent obstruction to vehicles entering and leaving • Speed restrictions on vehicles entering and leaving the site
Off-site	• Routing of traffic to and from CP/AYCCL to avoid residential areas • Scheduling of deliveries and departures to avoid over-night parking • Ensuring that vehicles and containers are appropriate for transport and that they are adequately maintained • Use of locally designated traffic routes

7.4 Mitigation of noise impact

CP/AYCCL should work with the consultants/contractors in charge of the construction works of the proposed project to introduce proper acoustic designs. Additional mitigation measures include good site practice, selecting quieter mechanical equipment, as well as adopting proper scheduling of construction activities. Scheduling noisy activities during the daytime periods (7:00 am to 6:00 pm) will ensure that the noise standard set for the evening will not be exceeded at several instances. In addition, CP/AYCCL should adopt good site practices and maintain proper on-site management to minimize noise emissions from the works during all times including:

- Ensuring that equipment that may be intermittent in use are shut down between work periods or throttled down to a minimum
- Adopting low noise equipment
- Installing rubber coating in dumpers and entry chutes
- Using personal protection gear such as earplugs, etc.
- Developing a greenbelt around the quarry area
- Controlling air-flow generated noise by adopting adequate sizing of inlet/outlet ducts
- Installing noise barriers around air blowers, pumps, and generators to reduce noise impacts at nearby receptors
- Devising and implementing a rigorous inspection and maintenance program applicable to equipment on-site

Concerning mitigation measures that could be adopted to reduce ground vibrations generated particularly from blasting activities at the quarry site, CP/AYCCL should adopt the following measures:

- Limit blasting to trained personnel
- Initiate periodic recording of blast vibrations,
- Limit blasting activities to fixed days and hours that are acceptable with nearby receptors
- Disseminate the blasting schedule to nearby receptors
- Use milli-second delay detonator, deck charging, or other techniques to reduce vibrations and noise
- use of surface mining that do not require blasting

7.5 Mitigation of surface and groundwater impact

The primary sources of potential impacts to water quality will be from site runoff, which may enter surface and groundwater waters directly. As such, open stockpiles of raw material and CKD should be covered with tarpaulin or similar fabric during rainstorm events to prevent the washing away, while earthworks at the quarry should be well compacted to prevent erosion especially during the wet season. Furthermore, CP/AYCCL should adopt an adequate disposal/reuse plan for the generated CKD to minimize to the extent possible the leaching of alkali dust. The installation of an appropriate drainage system coupled with a sedimentation tank is also imperative to reduce exposure time to potential discharge sources. Water from the settling tanks can be reused by CP/AYCCL as process water or for irrigation.

The uncontrolled disposal of residual fuel or waste oil near or surrounding areas of the CP/AYCCL or along the road ranks as a high priority. Proper mitigation should be implanted for this potential impact therefore will require close coordination between the CP/AYCCL, and the truck drivers association, including:

- Imposing heavy fines that can reach up to dismissing truck drivers who practice uncontrolled discharge of fuels along the road

Efforts should be made to clean any spillages in the wadis where dried fuel spills should be collected and transported to a landfill while fresh fuel pools should be pumped in containers and reused in small industrial kilns or ovens.

Other sources of potential water pollution include oil/fuel leaks and spills as well as the uncontrolled disposal of liquid effluents. The improper handling of fuels at the fuel receiving area constitutes a potential source of pollution at CP/AYCCL. As such, fuel tanks should be bunded to limit environmental damage resulting from accidental spillage. Bunds should be impermeable and resistant to the stored materials, avoid drains or taps that lead to a blind collection point, incorporate the distribution pipes within the bunded areas while avoiding the penetration of contained surfaces, have a design capacity in excess of 110 percent of the largest tank or greater than 25 percent of the total volume of the tanks, and be subject to regular visual inspection. In addition, oil and fuel residuals that will generated at vehicle and machine servicing areas, vehicle wash bays and lubrication bays should also be mitigated to avoid potential surface and ground water pollution. As such, oil-water separators and sand precipitators should be constructed while oil collection trays should be provided to the operators at the vehicle and machine servicing areas. Spent motor oils should be collected in sealed containers and stored within closed drums located within the workshops until they are reused or recycled. Oil contaminated cooling water should be treated in oil-water separators to remove oil. The treated water can be reused to cool the flue gases in the conditioning tower as well as the cement mill. Oil leakage or spillage should also be contained and cleaned up immediately. In addition, water released from the chemical laboratory should be treated at least in a neutralization tank to control the resultant pH (the effluent should have a pH that ranges between 6 and 9). In case the suspended solids in the effluent are high in relation to the receiving waters, treatment may be required to reduce levels in the effluent to a maximum of 50 mg/l, which is the effluent requirement for direct discharge to surface waters.

7.6 Mitigation of impacts on soils

The generated CKD should be properly managed by providing adequate storage appropriate disposal practices or by complying with soil application rates in case CKD reuse as a soil amendment is adopted. The use of CKD as an agricultural soil amendment to raise the pH of acid soils to a level appropriate for crops is well documented. Risk assessment data on the use of CKD in agriculture indicates that the improper or excessive use of CKD may present risk to human health and the environment and as such application procedures and frequency should be controlled as outlined in Table 31.

Table 31. Guidelines for CKD use in agriculture)

<i>Parameter</i>	<i>Unit</i>	<i>Average</i>	<i>Maximum</i>
Application rate	Tons/hectare/application	7.4	12.4
Application frequency	Year	1/3	1/2
Tilling depth	cm	15	10

Source : (adapted from USEPA, 1998a)

Accidental discharge of on-site chemicals can adversely affect the soil in the area. Therefore, proper storage of chemicals and fuels on-site and the installation of natural or synthetic liners beneath chemical and fuel storage tanks are essential. Chemicals used on-site should preferably be non-toxic and readily biodegradable. Other measures include containment of fuel spills and the development of procedures for emergency clean-up. The application of agrochemicals during on-site landscaping activities should also be avoided to prevent potential soil and ground water pollution.

7.7 Mitigation for terrestrial biodiversity

Efforts should be made to preserve existing vegetation in surrounding area when feasible, avoid fires, prohibit hunting activities and the disposal of wastes, hazardous and chemical material in non- allocated areas, initiate a landscaping program on-site, as well as endorse a well planned restoration and reforestation plan for the quarry and the buffer area that extends 2000 m around the CP/AYCCL. The reforestation plans should be closely coordinated with the agricultural and irrigation Ministry office Branch at Al- Mukalla and should use indigenous flora in re-vegetation schemes on-site since the use of exotic species hampers the recolonization of the area by the local fauna. Following closure of the quarry, several steps should be undertaken to ensure the reintegration of the site with its surroundings including:

- Removal of buildings, equipment, wreckage and wastes.
- Reshaping of quarry walls to prevent unloading cracks and potentially dangerous collapse.
- Reshaping of walls and loosening of compacted floors to facilitate re-vegetation and ensure the aesthetic quality of the restored landscape.
- Retaining natural drainage on-site
- Re-vegetation using indigenous stocks of local vegetation

7.8 Mitigation of resource use

Efforts should be made to minimize water, energy, and raw material consumption at CP/AYCCL. Water use could be reduced through reusing the treated wastewater effluent at the CP/AYCCL for landscaping purposes, thus limiting the pressure on the limited available water resources. In addition, using the water that is collected after the oil/water separation tanks is highly advisable for cooling purposes. Other water conservation measures include using closed loop water recovery systems as well as providing provisions for the collection and use of rainwater (harvesting).

Power accounts for over 33 percent of the total operational costs of cement plants, as such reducing energy consumption is both economically and environmental sensible. The optimization of the clinker burning process can lead to a significant reduction in heat consumption, improve clinker quality, increase the lifetime of the equipment through the stabilization of process parameters, and decrease NO_x emissions. Kiln optimization can be achieved by providing appropriate instruction/training of the kiln operators as well as through the installation equipment such as dosing systems, homogenization silos, pre-blending beds, new clinker coolers, etc.. Other power-saving measures include the use of energy-efficient equipment that should be properly operated, maintained, and turned off whenever not in use.

Raw material use can be highly optimized through the adoption of computer aided deposit evaluation and preparation techniques that can be used to plan for optimal quarrying schemes. Usage of such techniques leads to resource conservation with minimal exploitation costs. A commonly practiced resource use technique is block modeling of quarries according to type, size, location, and quality of the raw material.

7.9 Mitigation of health and safety impacts

The occupational health risks in a cement plant are associated with exposure to the dust, noise and vibration, as well as working with various heavy equipment. Besides these risks, the people working in the quarry are exposed to the risks of explosives and fire irruption. Mitigation measures that can reduce potential health and safety impacts can be divided into seven main categories that include: 1) site security, 2) site safety, 3) enhancing safety at site facilities, 4) establishing environmental controls, 5) regulating transportation, 6) developing emergency/contingency plans, as well as 7) ensuring personnel protection.

7.9.1 Site security

The site security plan restricting access to unauthorized personnel shall be checked to ensure:

- Restricting access to the plant by proper fencing
- Maintaining a buffer area around the plant and the quarry with a radius of 2000 m
- Installing warning signs in Arabic and English at the entrance of the plant to warn people about the risks associated with the cement industry
- Displaying emergency telephone numbers for Police, Ambulance, and Fire services in Arabic and English
- Locking gates outside working hours
- Erecting a fence along the perimeter of the site, consisting of non-combustible wire screens, 3 m high, and with a mesh of 50 mm or less to prevent unauthorized access
- Erecting site identification board of durable material and finish at the entrance of the site giving the name of the site, and the name, address and telephone number of the site operator
- Providing at least two 24 hour guard for the plant
- Keeping a daily record of persons and vehicles entering/leaving the site

7.9.2 Site safety

The site specific safety plan to limit occupational accident risks on site shall be checked to ensure that:

- Visitors report to the site office where they should sign-in and be issued a pass. Visitors should also sign out on departure and surrender their pass. No visitors should be permitted to access the operational areas unless they have received the express permission and have attended a site safety briefing or are accompanied by an employee familiar and knowledgeable in site safety procedures
- Staff and employees working on-site attend a safety and operational course before commencing work
- Personnel and visitors to the operational areas of the site wear personal protective clothing inclusive of high visibility clothing, protective footwear, and safety helmets

7.9.3 Enhancing safety at site facilities

Facilities on-site should have adequate safety precautions to limit potential occupational accidents. Several key safety procedures presented below should be checked:

- Explosives are stored in a remote site within the boundaries of CP/AYCCL that is far from residential buildings, fuel tanks, and office spaces
- The explosive storage facility is fenced with barbwire, locked, guarded, and has access to a well-compacted road and fire fighting equipment
- A drinking water supply is provided at the site
- Tanks are clearly labeled with details of contents, potential hazards (e.g. explosive, flammable, toxic etc.), and emergency services telephone numbers
- Closed working spaces are properly ventilated (at least 5 Air Changes per Hour)
- Electrical grounding is ensured while handrails and guard railing should be regularly inspected and maintained
- Compacted service roads are provided and maintained from the site entrances to the active quarry areas

7.9.4 Establishing environmental controls

Key environmental controls that shall be adopted at the site include but are not limited to include:

- Maintaining a record of the types and quantities of wastes generated
- Maintaining a record on the disposal/reuse practices being adopted
- Ensuring that raw material and CKD transportation vehicles traveling to or from the site are fully sheeted (i.e. flat bed) or well-contained from point of departure to arrival
- Cleaning vehicles leaving the site of debris from chassis and under-parts
- Ensuring that no waste materials are burned within site boundaries. A fire should be regarded as an emergency and immediate action should be taken to extinguish it
- Preventing stagnation of water volumes to hamper insect and vector breeding

7.9.5 Regulating transportation

Key safety measures that should be checked for the transportation of the raw material, final product, as well as wastes include:

- Vehicles should be cleaned at the end of daily operations
- Vehicles should be fitted with automatic backing lights and warning sound device
- Vehicles should be licensed and have appropriate third party insurance
- Drivers must be in the possession of a current relevant truck driving license

7.9.6 Developing emergency/contingency plans

The proposed emergency/contingency plan includes several measures including:

- A safety specialist should be responsible for the preparation, implementation and maintenance of a safety program, which should be periodically evaluated. The responsibility of the safety specialist includes performing safety training and conducting safety inspections, sessions and practice. He should also be responsible for the investigation of accidents. A safety committee should be formed and regular safety meetings should be organized.
- Contingency plans should be established to maintain occupational health and safety procedures for various aspects of operations, identify likely accidents, outline emergency scenarios, establish command hierarchy, organize communication lines, determine response actions, delegate responsibilities, designate evacuation signal, identify rendez-vous points mark on appropriate maps for each work area, and coordinate with local fire service, police and ambulance services.
- All safety equipment and tools should be regularly maintained. In addition, environmental friendly fire-fighting equipment such as dry powder extinguishers should be provided within the premises of the plant. Annual fire fighting training drills for the operating staff should be conducted. The safety specialist should prepare, implement and maintain a comprehensive fire protection and prevention program. The safety specialist should also be responsible for the inspection and maintenance of the fixed and portable fire protection equipment and for the investigation of fire incidents
- All emergency exits at CP/AYCCL should be clearly marked (emergency lights and/or fluorescence), and free from debris to ensure quick and free passage in case of emergency

7.9.7 Ensuring personnel protection

The mitigation measures that can be adopted to assure the safety of the personnel include the following

- Individuals working on the cement manufacturing line should be provided with overalls, PVC type overalls for wet weather working, respiratory masks, eye protection plugs and defenders, ear protection plugs and defenders; and high visibility waistcoats
- Uniforms and Personal Protection Equipment (PPE) should be kept hygienic and in good

condition. Workers should also be trained on the appropriate use of PPE and be convinced with the importance of using PPE for their own safety and welfare.

- Personal ID cards should be provided for all employees
- A trained first aider should be present on-site at all times during operational hours. First aid kits should be kept at several locations and be regularly inspected to replenish any deficiencies
- The periodic health monitoring program for on-site workers should be enhanced to allow record keeping of all illnesses and accidents occurring on-site. Regular medical checkups should be provided for staff on a semi-annual basis

7.10 Mitigation of landscape and visual impacts

The visual intrusion and landscape alteration can be minimized by adopting several mitigation steps that include:

- Preserving existing floral cover when feasible
- Avoiding on-site storage of wastes and equipment
- Prohibiting heavy equipment and transport vehicles from parking outside the fenced boundary of the plant
- Selecting appropriate paint colors for the exterior of the buildings to help blend with the surrounding
- Complying with the building codes of the area and reducing the construction of elevated structures
- Maintaining buildings within the plant to preserve their architectural and visual appeal
- Planning and implementing an appropriate landscaping program for the site that takes into account restoration or creation of native floral cover with local fauna and flora
- Planning and optimization quarry operations to minimize actively working areas
- Shielding the quarrying face of the hill by erecting visual barriers
- Quarrying from hill faces away from public view
- Adopting a rolling restoration program (to the extent technically feasible) rather than waiting until quarrying is finished. Annual budgets should have specific allocations for quarry rehabilitation, its monitoring and appraisal. Native flora is important to re-establishing and enhancing local fauna. When introducing plant species, native plants should be used to maintain ecosystem integrity and to facilitate re-colonization of the area

by the surrounding native fauna.

- Establishing stable landforms and adequate drainage systems prior to the initiation of re-vegetation work. Loose surfaces of overburden areas at the quarry site should be reworked and compacted into several benches with acceptable slopes. Drain structures should also be created to control the erosion of the slopes.
- Provisioning a greenbelt to minimize unsightly intrusion on the surrounding
- Planting one row of tree seedlings with at least 1 m of height, one per 3m, along the fence line of the site
- Dedicating an area corresponding to at least 10 percent of the total site area for landscaping and greenbelt

7.11 Mitigation of socio-economic impacts

Dissemination of the positive socio-economic impacts of the plant is an important measure that should be considered. Historically, the cement industry often has had an “undesirable” image. This perception has been based primarily on visible emissions and quarrying operations, which generate noise, traffic, and dust. Nevertheless, the cement industry worldwide has been actively involved in “greening” the industry and improving its environmental compliance, by obtaining the ISO 14001 certification. Other important steps that can be undertaken by CP/AYCCL to improve the relationship with the nearby community and build confidence in the management of operations include:

- Providing the local community residing in the vicinity of CP/AYCCL priority in terms of job opportunities, especially to individuals or families that may be negatively affected
- Adopting policies to recruit locally and to hire local contractors when possible
- Adopting a monitoring plan to assess adverse impacts on nearby receptors
- Instigating a formal system to respond in a timely fashion to complaints about nuisances (emissions, noise, etc.)
- Making emergency response teams available to local municipalities
- Making company clinics available to the surrounding community
- Committing to the publishing of data and reports on environmental performance
- Providing in-kind contributions to the local community
- Restricting the movement and transportation of heavy machinery outside the sites to off-peak traffic hours and night time (if noise levels do not exceed the standards)

7.12 Summary of mitigation measures

The implementing responsibilities for implementing mitigation measures falls within the jurisdictions of CP/AYCCL. Table 32 presents a summary of the proposed elements of the mitigation plan that should be considered at CP/AYCCL.

Table 32. Proposed mitigation measures

<i>Issues</i>	<i>Mitigation measures</i>	<i>Priority *</i>	<i>Attributes/location of intervention</i>
Air quality	- Implementing baseline data on ambient air quality at the CP/AYCCL before operation phase - Installing fabric filters (or electrostatic precipitators) to achieve a PM emission factor of 30 mg/Nm3 from all stacks - Using water sprays to suppress dust emissions from primary crushers - Using water sprays (with and without surfactants) on all open piles and storage yards - Using Covered facilities - Paving/asphalting the roads and yards that experience a high traffic rate and spraying regularly with small nozzle water spraying systems	1	In the vicinity of CP/AYCCL (klin plant and crasher)
		1	Exhaust gases from raw mills, kilns, and clinker coolers
		1	Feeding hood of primary crushers
		1	Open and temporary storage piles at CP/AYCCL
		1	Open and temporary storage piles at CP/AYCCL
		1	Roads within CP/AYCCL, the road connecting the primary crusher with the various parts of the quarry, the road connecting CP/AYCCL to the quarry, and the main yard facing the primary crusher
		1	Raw material storage yard
		1	Raw material storage yard
		2	CP/AYCCL workshops
		1	Speed limit of 10 Km/hr on unpaved roads and 20 Km/hr on paved roads within CP/AYCCL
	- Enclosing the raw material storage yard, maintaining it under negative pressure and equipping it with fabric filters - Installing adjustable conveyors to reduce dropping height - Ensuring proper maintenance of equipment on-site - Enforcing speed limits	1	Throughout CP/AYCCL
		2	Use endemic species
		3	On the exit from CP/AYCCL towards the small Klin plant
		2	All trucks
		3	Preheater/precalcinator kiln
	- Adopting good housekeeping measures at CP/AYCCL to reduce dust build-up - Planting a green-buffer around CP/AYCCL and the quarry - Setting up of an automatic truck wheel-wash facility - Covering trucks carrying dusty cargo with tarps or screening material, when practical - Adopting combustion control approaches to reduce NOx emissions - Installing post-combustion control equipment to reduce NOx emissions - Using low-sulfur fuels and raw materials - Adopting a continuous monitoring program of the sulfide sulfur content of the raw materials entering the kiln - Increasing the use of natural pozzolanic materials	3	Preheater/precalcinator kiln stacks
		2	Fuel tanks and purchasing department
		2	CP/AYCCL laboratory
		2	Control room and CP/AYCCL laboratory

<i>Issues</i>	<i>Mitigatio measures</i>	<i>Priority *</i>	<i>Attributes/location of intervention</i>
Solid waste	- Implementing site selections study for the solid and Hazardous waste disposal at the CP/AYCCL before operation phase. - Reducing gas turbulence in the kiln and avoiding excessive flow velocities - Reusing the generated CKD in the cement manufacturing process - Reusing the CKD as a soil amendment - Reusing the CKD as a stabilizing agent when possible - Segregating, properly storing, as well as disposing of empty chemical and fuel tanks along with the hazardous wastes generated at the CP/AYCCL laboratories - Labeling the chemical wastes in English and Arabic, as well as storing them in corrosion resistant containers - Implementing a purchasing and inventory control as well as the “First In First Out” system - Selling recyclable faulty equipment to metal recycling industries - Transporting non-recyclable equipment especially old fabric filters to a government approved sanitary landfill	1	In the vicinity of CP/AYCCL.
		1	Preheater/precalcinator kiln
		1	Control room and CP/AYCCL laboratory
		1	At agricultural plots with acidic soils
		1	At the CP/AYCCL
		1	Temporary solid waste storage areas at CP/AYCCL
		1	
		2	Temporary solid waste storage areas at CP/AYCCL
		2	Purchasing department at CP/AYCCL
		2	Temporary solid waste storage areas at CP/AYCCL
		2	Temporary solid waste storage areas at CP/AYCCL
Traffic	- Disseminating information regarding the transportation schedule at CP/AYCCL - Limiting truck movements to off-peak hours - Installing adequate warning and signing at least 500 m down and up-gradient from the entrance of the CP/AYCCL as well as on the exit that links CP/AYCCL to the Syun main road - Adopting on-site traffic control measures	1	Coordinate with Local Council at project area
		1	Coordinate with Local Council at project area
		1	Stop signs, heavy machinery signs, and speed bumps
		2	One way traffic within CP/AYCCL; speed limit of 10 Km/hr on unpaved roads and 20 Km/hr on paved roads within CP/AYCCL; adequate off-street parking spaces for heavy equipment and trucks
Health and Safety	- Defining procedures on explosive handing and other precautions during blasting . - Enforcing site security - Ensuring site safety - Enhancing safety at site facilities - Establishing environmental controls - Regulating transportation on – site - Developing emergency/ contingency plans - Ensuring personnel protection	1	Define explosive charge, depth, and appropriate mill-second detonator
		3	at CP/AYCCL
		2	at CP/AYCCL
		2	at CP/AYCCL
		1	at CP/AYCCL
		3	at CP/AYCCL
		2	at CP/AYCCL
		2	at CP/AYCCL

<i>Issues</i>	<i>Mitigation measures</i>	<i>Priority *</i>	<i>Attributes/location of intervention</i>
Noise	- Introducing good acoustic design for the CP/AYCCL - Adopting proper scheduling of construction activities - Scheduling noisy activities during the daytime periods - Operating well-maintained mechanical equipment on-site - Ensuring that equipment that may be intermittent in use are shut down between work periods or are throttled down to a minimum - Installing rubber coating in dumpers and entry chutes - Using personal protection gear such as earplugs, muffs, etc. - Developing a greenbelt around the quarry area - Controlling air-flow generated noise by adopting adequate sizing of inlet/outlet ducts - Installing noise barriers around air blowers, pumps, and generators to reduce noise impacts at nearby receptors - Devising and implementing a rigorous inspection and maintenance program applicable to equipment on-site - Limiting blasting to trained personnel - Initiating periodic recording of blast vibrations - Limiting blasting activities to fixed days and hours that are acceptable with nearby receptors - Disseminating the blasting schedule to nearby communities - Using of milli-second delay detonator, deck charging, or other techniques to reduce vibrations and noise	1 3 1 2 2 2 2 2 2 1 1 1 3 1 1 1	Coordination with implementing contractors Coordination with implementing contractors Concern Management at CP/AYCCL . Concern Management at CP/AYCCL. Concern Management at CP/AYCCL Primary crusher hopper, entry chutes of homogenization silos Concern Management at CP/AYCCL. Avoid exotic species and opt for endemic fast growing species Near motors, generators, and fans primary crusher, raw mill, clinker cooler, cement mill, homogenization silos. CP/AYCCL workshops Purchasing vibration meters Blasting activities should be limited to weekdays and should avoid early morning hours and evening hours CP/AYCCL quarry CP/AYCCL quarry

Issues	Mitigatio measures	Priority *	Attributes/location of intervention
Surface and groundwater	- Using baseline data on ambient water quality after operation phase - Compacting earthworks at the quarry to prevent erosion especially during the wet season - Adopting an adequate disposal/reuse plan for the generated CKD in order to minimize to the extent possible the leaching of alkali dust - Installing an appropriate drainage system coupled with a sedimentation tank and grease/oil traps in order to reduce exposure time to potential discharge sources - Imposing heavy fines that can reach up to dismissing any truck driver that practices uncontrolled discharge of fuels near the site or along the road - Clean any spillages in the wadis whereby dried fuel spills should be collected and transported to a landfill while fresh fuel pools should be pumped in containers and reused in small industrial kilns or ovens - All fuel tanks at CP/AYCCL should be banded	1	Bore wells at CP/AYCCL.
		2	CP/AYCCL quarry site
		1	Adopt wetting, compacting, and soil covering of CKD at the disposal site
		1	Near fuel tanks, workshops, CKD storage piles/yards
		1	Coordinate with local council
		1	Hiring a qualified contractor with previous experience in cleaning oil leaks
		1	Bunds should be impermeable and resistant to the stored materials, avoid drains or taps that lead to a blind collection point, incorporate the distribution pipes within the banded areas while avoiding the penetration of contained surfaces, have a design capacity in excess of 110 percent of the largest tank or greater than 25 percent of the total volume of the tanks, and be subject to regular visual inspection
- Constructing oil-water separators and sand precipitators near workshops and fuel tanks - Neutralizing the water released from the chemical laboratory	3	Collected grease and oil should be skimmed before discharge	
	3	Build a stabilization pond with pH meter to collect effluent from CP/AYCCL laboratory	
Soil quality	- Implementing baseline data on ambient soil quality in the vicinity of CP/AYCCL before operation phase - Providing for adequate storage, appropriate disposal practices, or complying with soil application rates in case CKD reuse as a soil amendment. - Properly storing chemicals and fuels on site - Installing natural or synthetic liners beneath chemical and fuel storage tanks - Developing procedures for emergency clean-up of spilled fuel	2	In the vicinity of CP/AYCCL
		1	Disseminate reuse safe practices and monitor application rates and soil pH in affected lands
		1	Concern management at CP/AYCCL.
		2	Concern management at CP/AYCCL
		2	Implement yearly drills for emergency clean-up crew
		3	Concern management at CP/AYCCL
Terrestrial biodiversity	- Preserving existing vegetation when feasible, avoiding fires, prohibiting the disposal of wastes, hazardous and chemical material in non- allocated areas - Initiating a landscaping program on-site, as well as endorsing a well planned restoration and reforestation plan for the quarry and the buffer area - Removing all buildings, equipment, wreckage and wastes following closure of quarry - Reshaping quarry walls to prevent unloading cracks and potentially dangerous collapse - Reshaping of walls and loosening of compacted floors to facilitate revegetation and to ensure the aesthetic quality of the restored landscape. - Retaining natural drainage on-site - Adopting a re-vegetation program that uses indigenous stocks of local vegetation	3	Concern management at CP/AYCCL
		2	Concern management at CP/AYCCL
		3	Concern management at CP/AYCCL
		3	Concern management at CP/AYCCL
		2	Concern management at CP/AYCCL
		2	Construct water drains at the quarry site to allow the descent of the water along natural drainage contours
		2	Avoid exotic species and opt for endemic dust resistant fast growing species

<i>Issues</i>	<i>Mitigation measures</i>	<i>Priority *</i>	<i>Attributes/location of intervention</i>
Resource use	Implementing wastewater treatment unite through reusing the treated wastewater effluent at the CP/AYCCL for landscaping purposes	1	Concern management at CP/AYCCL
	Using closed loop water recovery systems as well as providing provisions for the collection and use of rainwater	1	Installing closed-circuit cooling water systems with softening and separation for the mills and clinker cooling sections
	Implement a power consumption audit	1	Measure consumption at each production section
	Optimizing the clinker burning process by providing appropriate instruction/training of the kiln operators as well as through the installation of new equipment such as dosing systems, homogenization silos, pre-blending beds, new clinker coolers, etc.	3	Concern management at CP/AYCCL
	Using energy-efficient equipment that should be properly operated, maintained, and turned off whenever not in use	2	Concern management at CP/AYCCL
	Adopting computer aided deposit evaluation and preparation techniques that can be used to plan for optimal quarrying schemes	3	Purchase/develop a software system that geographically outlines the characteristics of underlying bed-rock
	Exploring the potential use of phospho-gypsum, an industrial byproduct available from fertilizer plant as replacement to natural gypsum	3	Check with nearby fertilizer plants on the availability of phospho-gypsum
Health and safety	Defining procedures on explosive handling and other precautions during blasting	1	Define explosive charge, column depth, and appropriate mill-second detonator
	Enforcing site security	3	At CP/AYCCL
	Ensuring site safety	2	At CP/AYCCL
	Enhancing safety at site facilities	2	At CP/AYCCL
	Establishing environmental controls	1	At CP/AYCCL
	Regulating transportation on-site	3	At CP/AYCCL
	Developing emergency/contingency plans	2	At CP/AYCCL
	Ensuring personnel protection	2	At CP/AYCCL

<i>Issues</i>	<i>Mitigatio measures</i>	<i>Priority *</i>	<i>Attributes/location of intervention</i>
Landscape and visual intrusions	- Preserving existing floral cover when feasible - Avoiding on-site storage of wastes and equipment - Prohibiting heavy equipment and transport vehicles from parking outside the fenced boundary of the plant - Selecting appropriate paint colors for the exterior of the buildings to help them blend with the surrounding - Complying with the building codes of the area and reducing the construction of elevated structures - Maintaining buildings within the plant to preserve their architectural and visual appeal - Planning and implementing an appropriate landscaping program for the site that takes into account restoration or creation of native floral cover with local fauna and flora - Planning and optimization quarry operations in order to minimize actively working areas - Shielding the quarrying face of the hill from public view by erecting visual barriers - Quarrying from hill faces away from public view - Adopt a rolling restoration programs (to the extent technically feasible) rather than waiting until quarrying is finished - Provisioning a greenbelt to bar any unsightly intrusion the project may have on the milieu	3	In vicinity of the CP/AYCCL
		2	Concern management at CP/AYCCL
		2	Provide off-street parking spaces for heavy equipment and transport trucks
		2	Concern management at CP/AYCCL
		2	Concern management at CP/AYCCL
		2	Concern management at CP/AYCCL
		1	Concern management at CP/AYCCL
		2	Concern management at CP/AYCCL
		1	Concern management at CP/AYCCL
		1	Concern management at CP/AYCCL
Socio-economic	- Providing the Nomadic and semi-Nomadic at the grassing areas in the vicinity of (CP/AYCCL) through numbers of close and open water cisterns instead of existing ones which became close to the cement plant. - Reducing potential exposure to emissions, especially dust - Restricting the movement and transportation of heavy machinery outside the sites to off-peak traffic hours and night time (if noise levels do not exceed the standards) - Providing the local community residing in the vicinity of CP/AYCCL priority in terms of providing job opportunities, especially to individuals or families that may be negatively affected - Adopting policies to recruit locally and to hire local contractors when possible - Adopting a monitoring plan to assess potential adverse impacts on nearby receptors - Instigating a formal system which responds in a timely fashion to complaints about nuisances (air pollution, noise, etc.) - Permitting local schools and teams to use the sport courts at CP/AYCCL's residential complex - Making emergency response teams available to local municipalities - Making company clinics available to the surrounding community - Committing to the publishing of data and reports on environmental performance - Providing in-kind contributions to the local community either through cement or other building products	2	Planting one row of tree seedlings with at least 1 m of height, one per 3m, along the fence line of the site. Dedicate an area corresponding to at least 10 percent of the total site area for landscaping and greenbelt
		2	Construct water drains at the quarry site to allow the descent of the water along natural drainage contours
		1	At the grassing areas in the vicinity of CP/AYCCL
		1	Concern management at CP/AYCCL
		2	Concern management at CP/AYCCL
		1	Concern management at CP/AYCCL
		2	Concern management at CP/AYCCL
		1	Regular monitoring reports should be made available
		1	Provide a hotline number with an operator that can dispatch an investigating team within 24 hr
		3	Coordinate with local schools and teams
		3	Coordinate with local fire fighting squadron
		3	Concern management at CP/AYCCL
		1	Concern management at CP/AYCCL
		2	Concern management at CP/AYCCL

*Priority level: 1= High priority measure; 2= Medium priority measure; 3= Low priority measure

8. ENVIRONMENTAL MONITORING PLAN

The main objectives of the monitoring plan include:

- Identifying the extent of environmental impacts predicted in the EA
- Determining project compliance with regulatory requirements
- Assessing the performance and effectiveness of monitoring activities by comparing monitoring results with the baseline data and / or environmental standards
- Adopting remedial action and further mitigation measures if found to be necessary

Monitoring of air quality, noise levels, surface and ground water quality, soil quality, solid waste generation, terrestrial biodiversity, resource use, traffic, health and safety, landscape and visual intrusion, socio-economics as well as operations will be essential at CP/AYCCL. For certain parameters, sampling and chemical analysis are necessary while for others, only visual inspection and photographic documentation by experienced personnel are adequate. In the case of non compliance, efforts should be made to:

- Review the effectiveness of the environmental management plan and propose alternative actions as appropriate
- Identify the most probable source
- Check on the proper implementation of the specified mitigation measures
- Increase the monitoring frequency to assess the effectiveness of remedial measures

Quarterly monitoring progress reports should be prepared, while yearly comprehensive reports should be generated to present results of the monitoring activities and assess the adequacy of environmental control measures. All monitoring records should be kept in an acceptable format (in word processing format such as MS Word or spreadsheet such as MS Excel) and reported regularly to the responsible authorities and concerned stakeholders.

8.1 Air quality

The potential of the main source of emissions at CP/AYCCL will be the pyro-processing system that includes the kiln, the bypass system, and clinker cooler exhaust stacks. As such, stack flue gases and ambient air quality should be monitored for selected indicators including at least dust (PM, PM₁₀), NO_x, and SO_x. If resources are available, other indicators could be added to the monitoring program such as CO and VOCs.

8.1.1 Criteria

Yemeni standards and international standards can be adopted (Table 4) in evaluating ambient air quality indicators. Similarly emission limit values can be adopted in evaluating on-site emissions from point sources (Table 8).

8.1.2 Methodology

8.1.2.1 Point sources

During operation, in addition to continuous monitoring of flue gas temperature and oxygen level, the opacity and the concentrations of PM/PM₁₀ shall be monitored on all pyro-processing related stacks Table 20 through the installation of opacity and dust monitors See Appendix 4a. It is advisable to install opacity/dust monitors that have an automatic in-situ zero and span checking capabilities because equipment calibration can be a difficult process in Yemen. Furthermore, a combustion gas analyzer fitted with a probe can be used to measure flue gas composition particularly NO_x and SO_x See Appendix 4b . Parameters such as weather conditions, date and time of sampling shall be recorded in detail. Meteorological data, which are essential for air quality monitoring during operation, should be collected by a continuous meteorological monitoring station that can be installed on site See Appendix 4a. This monitoring station should record at least wind speed and direction, ambient temperature, rainfall, and incoming solar radiation. Data recorded by the station may be collected through a central computer located within the plant.

A periodic maintenance program should be implemented on fabric filters whereby compartments, cages, and filter bags are checked for damage on a monthly basis or when a PM emission surge is recorded by the continuous flue gas monitoring station.

8.1.2.2 Ambient air

The 1-hr and 24-hr PM/PM₁₀ levels should be monitored to indicate the impact of the emitted dust on ambient air quality on selected receptor see Figure (18). Measurements shall be conducted by drawing air through a high volume sampler See Appendix 5a : fitted with a conditioned pre-weighed filtered paper, at a controlled rate. After sampling for 1 hour (or 24 hours), the filter paper with retained particles shall be collected and returned to a laboratory for drying in an oven at 110°C followed by accurate weighing. The average PM/PM₁₀ level

shall be calculated from the ratio of mass of the particulates retained on the filter paper to the total volume of air sampled. When positioning the sampler, the following points shall be noted:

- A horizontal platform with appropriate support should be provided to secure the samples against gusty winds; airflow around the sampler shall be unrestricted (a portable high-volume sampler can also be used)
- Any wire fence or gate to protect the sampler shall not obstruct airflow
- The distance between the sampler and an obstacle (i.e. building) shall be at least twice the height that the obstacle protrudes above the sampler
- No furnace or generator shall be nearby
- A secured supply of electricity shall be provided to operate the sampler

An alternative means of measuring 1-hr averaged PM/PM₁₀ concentrations is through a hand-held particle counter (capable of sampling in the range 0.1-100 mg/m³) See Appendix 5 : This method does not require laboratory analysis and gives instant PM/PM₁₀ readings. Air samples are drawn for a period of one hour and the device provides the time-averaged PM/PM₁₀ level. Calibration of the monitoring equipment should be conducted prior to implementation of the monitoring program and as specified by the manufacturer.

Wind speed and direction shall also be recorded. Wind sensors shall be installed on masts at an elevation of 2 and 10 meters above ground so that they are clear of obstruction or turbulence. The wind monitoring equipment shall be calibrated once every six months. In the case of unavailability of elevated wind sensors, it might be possible to use calibrated hand-held anemometers on the condition that no obstructions are present.

Relevant data including temperature, pressure, weather conditions, elapsed-time meter reading for the start and stop of the sampler, identification and weight of the filter paper, and date and time of sampling shall be recorded in detail. Finally, monitoring ambient concentrations of NO_x and SO_x concentrations should be conducted through the use of stationary or portable gas analyzers see Appendix 5 .

8.1.3 Monitoring locations

Point source emission should be conducted on all stacks Table 19 . Stack dispersion modeling revealed that a large area may be exposed to high PM or gaseous levels. As such, permanent gas analyzers shall be installed at selected receptors Table 14 or a portable gas analyzer that is rotated between the site locations. With the consent of residents, the gas analyzers should be mounted on building-tops). The monitoring data shall be regularly collected, downloaded, and processed at a central PC within CP/AYCCL. A copy of the monitoring data shall be sent on a quarterly basis to the EPA.

8.1.4 Frequency

While continuous monitoring at all locations is highly desirable, it may not be affordable at this time. Therefore, the maintenance frequency for various indicators are outlined below depending on the importance of the indicator. Continuous dust/opacity monitoring should be adopted for all pyro-processing point sources at CP/AYCCL while NO_x and SO_x flue gas monitoring can be adopted on a monthly basis if continuous monitoring instruments are not available. Similarly, monthly sampling frequency shall be observed at ambient monitoring stations for ambient 8 -hour PM/PM₁₀, NO_x, and SO_x concentrations. In case of complaints or whenever the highest impacts are likely to occur, 1-hr monitoring shall be conducted on a weekly basis. Bi-weekly measurements should be observed at all stacks and ambient air quality sampling locations in order to assess the fabric filters performance and build a baseline. Combustion sources (power generators) at CP/AYCCL should be monitored on a semi-annual basis for temperature, oxygen level, combustion efficiency, PM/PM-10, and SO_x.

8.2 Noise

8.2.1 Criteria

The standards or criteria against which noise (measured as A-weighted equivalent sound pressure level, L_{eq} , in dB) monitoring can be assessed include the Yemeni noise guidelines in different zones Table 7. In addition, occupational noise exposure should be assessed with respect to the standards promulgated by the OSHA Tables 5, 6 .

8.2.2 Methodology

Sound level meters shall be used to measure noise levels in terms of L_{eq} , in dBA. Calibration of the meters shall be conducted on a quarterly basis, using a portable calibrator. Both meters

and calibrators shall be verified by the manufacturer every two years to ensure accuracy of measurements. Calibrated hand-held anemometers shall be used for the measurement of wind speed during noise monitoring periods. Noise monitoring shall be carried out for at least one hour in order to determine the average noise level.

Noise measurements shall not be made in the presence of fog, rain, wind with a steady speed exceeding 5 m/s or wind gusts exceeding 10 m/s. The monitoring locations shall be at a point located 1m from the exterior of the receiver building façade and at a height of approximately 1.5 m above ground or at a height that has the least obstructed view of CP/AYCCL in relation to the receiver. Relevant data including temperature, pressure, weather conditions, elapsed-time meter reading for the start and stop of the sampler, date and time of sampling, and work progress of the concerned area should be recorded concurrently with noise measurements.

8.2.3 Monitoring locations

Noise monitoring locations include the quarry, the primary crusher, the raw mill, kiln, the cement mill as well as five sites selected around the perimeter of the plant at varying distances to examine noise propagation and attenuation at the receptors identified in Table 14. In addition, noise measurements should be readily conducted at locations where a complaint is filed.

8.2.4 Frequency

A quarterly sampling frequency should be observed at all monitoring locations for 1-hour noise monitoring. In case of complaints or whenever the highest impacts are likely to occur, 1-hr noise monitoring should be conducted.

8.3 Surface water and groundwater

8.3.1 Sampling location and analysis criteria

The improper handling, storage, transport, and disposal of fuels/oils and the generated CKD are the major sources of aggression on surface and ground water quality. As such, groundwater samples should be collected from tapped wells in the areas surrounding CP/AYCCL particularly in the vicinity of the CKD disposal site (at least from three wells). Water samples should be collected from the grease traps, oil/water separators, as well as sedimentation tanks prior to discharge. In addition, water samples should be collected and analyzed from potentially affected water sources whenever a spill occurs on-site or along the

roads used for fuel transportation. Monitoring indicators include at least pH, temperature, oil content, suspended solids, and COD. The standards or criteria against which surface and groundwater quality will be assessed are presented in Table 9.

8.3.2 Methodology

Surface and ground water samples should be collected and placed in pre-cleaned (1 liter) plastic/glass bottles depending on the target analysis. After collection, the bottles should be properly sealed and placed in a cooler at a temperature below 4°C and transported to the laboratory facility for analysis, preferably within 6 hours after the sampling time. A Global Positioning System (GPS) should be used to approximate the geographic coordinates of sampling locations. In addition, groundwater samples should clearly indicate the location of the well and its corresponding depth. Relevant data including monitoring location/position, depth, time, weather conditions (wind speed and direction, ambient temperature, precipitation) should be recorded concurrently. In-situ monitoring instruments should be checked and calibrated prior to usage and as per manufacturer specifications. Responses of sensors and electrodes should be checked with standard solutions before each use.

8.3.3 Frequency

Surface and ground water should be monitored on a quarterly basis. In case of spillage or whenever the highest impacts are likely to occur, water monitoring should be conducted every two weeks.

8.4 Soil

Soil quality should be monitored at the CKD disposal site as well as in the agricultural plots that are treated with CKD for pH adjustment. An annual sampling frequency should be observed. Samples should be collected in pre-cleaned (5 to 10 liters) plastic/glass recipients depending on the target analysis. After collection, the recipients should be properly sealed and placed in a cooler at a temperature below 4°C and transported to the laboratory facility for analysis preferably within 6 hours after the sampling time. Soil quality should be monitored for moisture content, pH, salinity, and nutrients (nitrogen, phosphate, potassium, chloride, sodium). Heavy metal content (mercury, lead, chromium, copper, nickel, zinc and cadmium) in affected soils should be monitored every three years.

8.5 Solid waste

The objectives of the audit should be to ensure that the wastes are handled in an environmentally sound manner; mitigation measures are implemented properly, and encourage the reuse and recycling of materials. Quantities, photographic documentation, and interviews are essential elements of the audits. The generation volumes of the CKD should be monitored daily. Furthermore, CKD samples should be taken weekly in order to allow for pH analysis.

8.6 Terrestrial biodiversity

Semi-annual field surveys with photographic documentation should be conducted for biodiversity indicators (percent of area recolonized, species present, dominant species, survival rate of introduced flora by species) within the site and its immediate surroundings. The presence or absence of common species should be documented when feasible.

8.7 Resource use

Energy and water consumption should be presented in terms of KWh/ton of clinker produced; tons of heavy fuel oil used/ ton of clinker produced; and tons of diesel used/ton of clinker produced

and water Should be reported in terms of m³/ton of clinker produced both consumption shall be monitored continuously to limit over-exploitation. Continuous metering of energy and water shall also be adopted at the different stages of the production line with special emphasis on high-energy consuming phases (kiln, raw mill, cement mill, fabric filters, cement mill, primary crusher, preheater-precalcinator section, packaging section). Resource-use audits should be conducted as part of the overall performance assessment of the plant and to help identify system losses.

8.8 Health and safety

Continuous monitoring shall be conducted in order to determine the application of mitigation measures and health and safety guidelines at CP/AYCCL. The proper use of PPE shall be checked daily by the head engineers, while monthly checks shall be implemented in order to assess the condition of the installed safety signs, first aid kits, fire fighting devices, etc. Record keeping of injuries/illnesses and major occupational accidents shall be followed at the plant and reported according to injury/illness type (cuts, respiratory illnesses, dermal diseases, gastro-intestinal infections, eye infections, burns, mortality, accidents leading to handicaps).

8.9 Landscape and visual intrusions

Visual inspection and photographic documentation are necessary to ensure the effective implementation of mitigation measures and the protection of landscape and visual resources. As such, field surveys shall be conducted on a quarterly basis to assess the impact on the nearby landscape. These surveys should be used for planning exploitation locations and quantities at the quarry sites as well as to monitor the adopted re-vegetation scheme particularly the survival rates of the planted endemic flora.

8.10 Socioeconomics

Monitoring of socio-economic indicators such as employment generation shall be conducted on a regular basis through employment records. Monitoring of social indicators such as population perception, shall be conducted annually through field questionnaires, interviews, and public meetings. It is essential to maintain constant open channels with the nearby receptors and the NGOs, LC, at the project area.

8.11 Operations monitoring

The shift supervisors in charge of operations should maintain daily reports. Records of the production rate, gas flow rates, counter readings, pressure values, temperatures, etc. for all facilities and equipment should be reported. Characteristic operation data of major equipment at the plant and remarks and comments of the shift supervisors concerning abnormal readings, overloads, stoppage, outages and other operation events should also be recorded on a daily basis.

8.12 Summary of monitoring plan

A summary of the monitoring indicators with corresponding location and frequency is presented in Table 33. While CP/AYCCL can assist in the implementation of the monitoring plan, it is recommended that an independent third party consultant be responsible for the overall implementation of the monitoring in close coordination with CP/AYCCL, the EPA, and the GIA. depicts a potential framework for implementing environmental management plans at CP/AYCCL, Figure21.

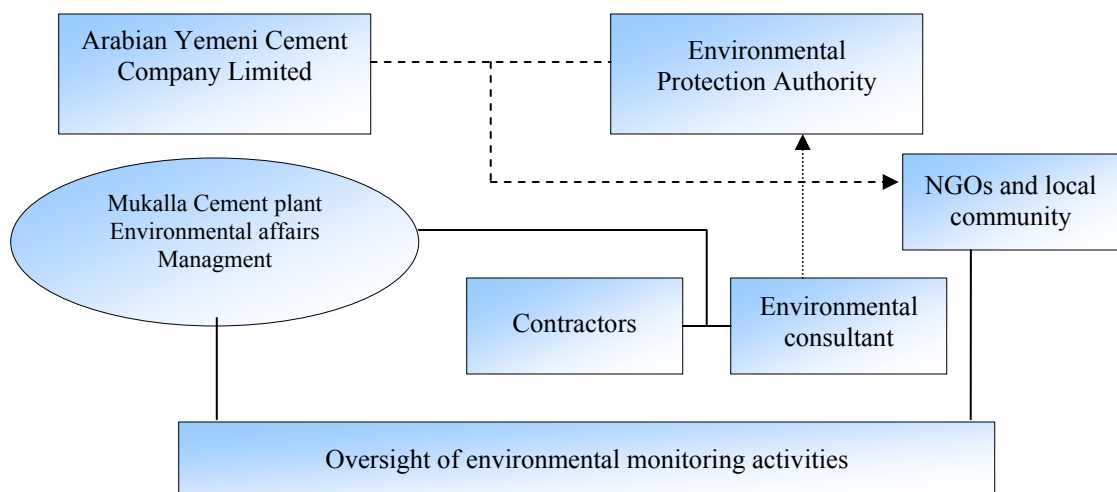


Fig. (21) Framework for implementing the environmental management plan

Table 33. Summary of the proposed monitoring plan

<i>Impact</i>	<i>Monitoring means</i>	<i>Parameters</i>	<i>Location</i>	<i>Frequency</i>
Air quality	Measurment/sampling (using the following analysis techniques: extractive, paramagnetic, electrochemical, non dispersive infrared, non dispersive ultraviolet, chemiluminescence, cross-duct opacity)	PM/PM ₁₀ , Temperature	Pyro-processing stacks at CP/AYCCL	Continuous
		NOx, and SOx	Pyro-processing stacks at CP/AYCCL	Continuous/Monthly
		PM/PM ₁₀ , Temperature	Cement grinding stack, clinker cooler stack, By-pass stack	Continuous
		PM/PM ₁₀ , SOx, Temperature, oxygen level, combustion efficiency	Combustion sources	Semiannually
		PM/PM ₁₀ , NOx, and SOx	Selected receptors Table 14	Quarterly
		PM/PM ₁₀ , NOx, and SOx	Selected receptors Table 14	Upon complaint /Weekly
	Audit	Fabric filter components	All fabric filters	Monthly
Noise	Measurement	L _{eq} (dBA)	Quarry, primary crushers, raw mill, cement mill 4 sites selected around the perimeter of the plant (CP/AYCCL residence complex. Abdullah Ghreeb.	Bi-annually Bi-annually and upon complaints
Surface and groundwater	Sampling	Temperature, pH, oil content, suspended solids, COD	Tapped wells located in the areas surrounding the CKD disposal site (at least 3 wells)	Quarterly
			Groundwater wells, installed grease traps, oil/water separators, as well as sedimentation tanks	Quarterly
			Spillage site(s)	Every two weeks

<i>Impact</i>	<i>Monitoring means</i>	<i>Parameters</i>	<i>Location</i>	<i>Frequency</i>
Soil	Sampling	Moisture content, pH, salinity, and nutrients (nitrogen, phosphate, potassium, chloride, sodium) Heavy metal content (mercury, lead, chromium, copper, nickel, zinc and cadmium)	CKD disposal site as well as in the agricultural plots that are treated with CKD	Annual Every three years
Solid waste	Audits, photographic documentation, and interviews Sampling	Generation, storage, recycling, transport, and disposal CKD generation rate pH	CP/AYCCL and CKD disposal site CP/AYCCL CKD disposal site	Quarterly Daily Weekly
Terrestrial biodiversity	Visual inspection and photographic documentation	General condition of the floral cover	CP/AYCCL, quarry sites, and landscaped areas	Annual
Resource use	Metering Audit	Water and energy consumption Raw material consumption	CP/AYCCL and associated quarries CP/AYCCL and associated quarries	Continuously Continuously
Health and safety	Health and safety surveys	Proper use of PPE, presence of safety signs, first aid kit, and fire fighting devices Injury/illness records	CP/AYCCL roads linking CP/AYCCL with the main road network	Continuously
Landscape and visual intrusions	Visual inspection and photographic documentation	Adopted re-vegetation scheme Quarry exploitation pattern and resulting visual intrusion	CP/AYCCL, quarry sites, landscaped area, surrounding receptors	Quarterly
Socio-economic	Field questionnaires Interviews	Population perception Employment records	CP/AYCCL and region of influence CP/AYCCL	Annually Continuously
Operations monitoring	Visual inspection and documentation	Production rate, gas flow rates, counter readings, pressure values, temperatures, abnormal readings, overloads, stoppage, outages	All facilities and major equipment at the plant and quarry site	Daily

8.13 Data management

The monitoring data will be important for future environmental management .It will formulate the background to determine the accuracy of environmental quality predictions and provide the scientific basis for establishing or modifying environmental measures in the future. Therefore, it is proposed to develop a database of the monitoring data collected. Periodic environmental monitoring reports should be prepared to analyze the data, assess monitoring activities and provide recommendations to ensure the effectiveness of the environmental monitoring plan during the project life. Appendix 6 presents draft monitoring forms that can be refined during the operation phase.

A database, preferably computerized, should be developed and maintained for the various monitoring activities. This will facilitate the statistical analysis of trends in concentrations over time, as well as provide a record that can be independently audited by the EPA for compliance with the environmental regulations. In addition to recorded levels of various indicators, the database should report the time of sampling, the instantaneous meteorological conditions, production capacity, method of sampling, location of sampling, as well as the appropriate standards.

Sample analysis can be conducted either on-site if hand-held instantaneous equipment are available or at a commercial laboratory. Competent laboratories that can assist in the required analysis may be limited in Yemen. Universities can play a significant role in providing the technical know-how and necessary equipment at a reasonable cost.

8.14 Reporting

Monitoring reports should be submitted to the EPA for feedback on the overall monitoring program. These reports should summarize monitoring data (air quality, noise levels, surface and groundwater quality, soil quality, terrestrial biodiversity, resource use, solid waste, health and safety, landscape, socio-economics) with full interpretation illustrating the acceptability or otherwise of environmental impacts and identification or assessment of the implementation status of mitigation measures. The monitoring reports should include at least the following sections/information:

- (a) Executive summary
- (b) Basic project information
 - Project organization including key personnel and contact addresses
- (c) Location of sensitive receivers and of monitoring stations
- (d) Production capacity
- (e) Environmental parameters
 - Implementation status of environmental mitigation measures recommended in the EA
 - Monitoring results
 - Monitoring methodology
 - Parameters monitored
 - Monitoring locations
 - Monitoring date, time frequency, and duration
 - Weather conditions during the period
 - Monitoring results tabulated with maximum and minimum values
 - Diagrams showing the performance of the works
- (f) Other parameters
 - Daily consumption figures of electricity, water and raw materials
 - Service hours of main machinery and equipment
 - Information on major equipment repair, overhaul and other maintenance works
 - Spare parts used and mobile equipment
 - Times, duration, reason and remedying of emergency operation and outages
 - Statistics of staff members and labor utilization
 - Report of non compliance or exceedance of the environmental standards
 - Record of complaints received including location, nature, actions and follow-up procedures
 - Records of health and safety accidents on-site

9. CAPACITY BUILDING AND INSTITUTIONAL STRENGTHENING

Capacity building in environmental management falls within several sectors ranging from the management of air quality, water quality, traffic, solid waste to resource conservation, as well as health and safety. Proper environmental management dictates that construction and operation procedures be implemented in accordance to the current state of the art and knowledge regarding environmental protection. This can be accomplished by hiring competent personnel with the appropriate educational and professional background and instituting periodic training programs and site-specific plans that are adequate for protecting the general public and the environment as well as contributing to the mitigation of potential environmental impacts. For this purpose, CP/AYCCL employees as well as the employees of contractors and consultants involved in the various activities of the plant should be required to attend environmental training-awareness seminars-workshops. In an effort to strengthen institutional capacity and environmental awareness, such seminars-workshops should be opened for individuals from concerned ministries and agencies such as the EPA, GIA, NWRA, MoAI, MoIT, MoPH, LC, NGOs, etc. The objective of the seminars-workshops is to ensure environmental awareness, knowledge and skills for the implementation of environmental management plans. Seminars-workshops shall be conducted at least twice per year for a period of one to two days. A maximum of 20 participants should participate in a particular seminar-workshop, which should address various topics including:

- Air quality management
- Risks associated with the cement industry
- The fundamentals of occupational health and safety procedures
- BAT in the cement industry
- Emergency response plans at CP/AYCCL
- Procedures for dealing with spillage, fires and other accidents
- Pollution health impacts
- Prevention and control measures
- Sampling techniques and environmental monitoring guidelines (air, noise, water, solid waste, soil)
- Environmental laws, regulations, and standards

- Solid waste management
- Water and wastewater management
- Traffic and pedestrians safety measures
- Instructions on the use of protective clothing
- Operating procedures at the plant

It is also recommended that the permanent staff at CP/AYCCL who is in charge of coordinating the implementation of the environmental management plans be given the opportunity to attend relevant international workshops coupled with study tours at well controlled cement factories. The environmental affairs management at CP/AYCCL role should focus on assessing environmental practices, developing an internal audit system, reviewing environmental monitoring reports, identifying required control measures, initiating public relations campaigns to report and advertise CP/AYCCL's environmental commitment (advertise steps being taken to comply with international standards, international accreditation such as ISO 14001), maintaining a clear environmental policy, and establishing a transparent communication with governmental and non-governmental agencies concerned in environmental management. Note that launching a well planned public relations campaign (i.e. television, billboards, newspapers, seminars at local schools and universities, plant visits) highlighting CP/AYCCLs commitment to environmental protection can significantly improve its image and gain the trust of the public particularly in the Project area.

10. COORDINATION AND CONSULTATION OF LOCAL AGENCIES AND NGOs

During coordination and consultation of local agencies and NGO's in assessing the potential (both positive and negative) environmental Impacts of the CP/AYCCL . The Team of Consultants had visited every nomadic , semi-nomadic, village, town and city and met the local opinion leaders and members their views and comments as following :

10.1 Local council and NGO's of Modiriah Ghie Bawazeer (project area)

- The local council strongly supporting the establishment of the proposed project in ghie Bawazeer.
- CP/AYCCL should contribute to the local economy of the area by providing job opportunities,healthcare such as expansion the existing health unit at Al-Eyoun yoon Town into health center.
- Wild Life affairs. And representative of Al-Eyoun Town at local council their views that efforts should be made to preserve existing Flora, fauna and grassing activities of nomadic and semi-nomadic in surrounding area when feasible.



Fig. (22) Show, the meeting between study team, leaders of local council , members of Environment and Development Supporter Society and representatives of Wild Life affairs of Al-Eyoun Town at Ghie Bawazeer, representatives, EPA and CP/AYCCL at Al-Mukalla



Fig. (23) Show, Building of local council at Modiriah Ghie Bawazeer

Environment and Development Supporter Society Gheil Bawazeer

- The membership of Society strongly supporting the establishment of the proposed project in ghieel Bawazeer.
- CP/AYCCL should taking into account the measures to reduce the potential environmental impacts on the surrounding areas due to Air and Gas emissions , explosive activities and solid waste ...etc.
- The Society needs for technical support (furnishing, training etc.).
- *Civic Organizations Network and Social Development Society- Ghieel Bawazeer*
- The Chairman of Society strongly supporting the establishment of the proposed project at ghieel Bawazeer.
- CP/AYCCL should taking into account the measures to reduce the potential environmental impacts on the surrounding areas due to Air ,Gas emissions , ,solid waste and the proposed dams at the surrounding areas (Madher and binyameen dams). ...etc.



Fig.(24) Show, the meeting between study team ,Chairman of Civic Organizations Network and Social Development Society at ghieel Bawazeer , representatives, EPA and CP/AYCCL at Al-Mukalla

Environment Friends Society- Shehear Town

- The members of Society strongly supporting the establishment of the proposed project.
- CP/AYCCL should taking into account the framework for the environmental management at the cement plant for coordination with local NGO's.
- Real needs for assistance of establishment solid waste management system to improve environmental health at the town.
- The Society needs for technical support (training, computers ...etc.)



Fig. (25) Show, the meeting between study team, members of Environment Friends Society- Shehear Town, representatives, EPA and CP/AYCCL at Al-Mukalla



Fig. (26) Show, Building of Environment Friends Society- Shehear Town

Environment and Social protection Society-Al-Naqa'a

- The members of Society strongly supporting the establishment of the proposed project.
- Real needs for assistance of establishment solid waste management system to improvement of environmental health of population at the town.
- The Society needs for technical support (training, computer...etc.)



Figure (27) Show the meeting between study team , chairman of Environment and Social protection Society- Al-Naqa'a,representatives,EPA and C P/AYCCL at Al-Mukalla



Figure (28) Show Building of Environment and Social protection Society-Al-Naqa'a

10.2 Governmental Agencies at Al-mukalla- Hadhramout Governorate

- The leadership of Hadhramout Governorate strongly supporting the establishment of the proposed project.
- CP/AYCCL should taking into account the measures to avoid and reduce the potential environmental impacts on the surrounding areas due to Air and Gas emissions ...etc.
- CP/AYCCL should taking into account the proposed dam at the Wadi Hawirah
- Disposal of hazardous waste in Environmental safety way.
- CP/AYCCL should committed towards environmental protection and compliance with health standards.
- CP/AYCCL should taking into account the framework for the environmental management at the cement plant.
- CP/AYCCL should protect the existing vegetations at the surrounding area.

Occupation Safety and Health Administration Branch

- CP/AYCCL should taking into account the following :
- Enhancing safety at site facilities
- Developing emergency/contingency plans
- Ensuring personnel protection
- Enforcing site security

- Defining procedures on explosive handling and other precautions during blasting
- Establishing environmental controls
- Ensuring site safety
- Regulating transportation on-site

Ministry of Agriculture and Irrigation Branch

- Efforts should be made to expanding agriculture activities through pilot project for rural development of livestock and vegetations at the surrounding area.
- Efforts should be made to preserve existing vegetation in surrounding area when feasible, Appendix 7 Records of local Agencies and NGOs communications

10.3 CONCLUSION AND RECOMMENDATION

- CP/AYCCL provides a significant positive socio-economic impact related to the potential in job opportunities for locals as well as providing a product that is much needed to meet the demand for the construction and development activities that are occurring on the national scale. In contrast, several potential adverse impacts can negatively affect the environment particularly those associated with emissions, effluent discharge, and waste generation.*
- This document presents a variety of standards from different organizations; however, the World Bank recommends that countries do not exceed the World Health Organization (WHO) guidelines. Results indicate that the off-site ambient air impacts of the proposed cement facility should not exceed the WHO and Yemen guidelines.*
- The priority in the cement industry is to minimize the increases in ambient particulate levels by reducing the mass load emitted from the stacks, from fugitive emissions, and from other sources, Collection and recycling of dust in kiln gases is required to improve the efficiency of the operation and to reduce atmospheric emissions. Units that are well designed, well operated, and well maintained can normally achieve the emission requirements acceptable to the World Bank.*

- d) *Implementing baseline data on ambient air and soil quality at the (CP/AYCCL) prior operation phase. Air Quality Issues and cost for appropriate pollution control equipment and air quality monitoring should be included in the project overall planning and design.*
- e) *Implementing site selection study for solid waste disposal at (CP/AYCCL) prior operation phase due to sensitive areas in the Vicinity of the CP/AYCCL such as Floods, Wadies, Huge Catchments areas as well as at downstream Arabian Sea.*
- f) *Implementing wastewater treatment unit at the (CP/AYCCL) during operation phase. Using available baseline data on ambient water quality at the (CP/AYCCL) during operation phase.*
- g) *Taking into account the proposed dam at the Wadi Hawirah as well as bore wells at the (CP/AYCCL) during operation phase due to existing faults in the vicinity of the (CP/AYCCL). Taking into account the local leaders views and their comments in the project area.*
- h) *Providing the Nomadic and semi-Nomadic in the grassing areas through numbers of open and closed water cisterns instead existing ones at the (CP/AYCCL).*
- i) *The Environmental Management plan (EMP) must be integrated into the overall project plan, design, budget and development /implementation. This must include the mitigation issues mentioned in this report and monitoring requirements to show the effectiveness of the mitigation, additionally, the project must include an assignment of institutional responsibilities for the implementation of mitigation issues. See chapter 7.8.9.*

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APPENDIXES

- APPENDIX - 1 - EIA CORRESPONDENCE**
- APPENDIX - 2 - EXPERTS INVOLVED IN STUDY**
- APPENDIX - 3 - TABLE SHOW THE RAW WATER ANALYSIS (BORE WELL NO.1)**
- APPENDIX - 4 - CONTINUOUS AIR EMIMISSON MONITORING EQUIPMENT AND METEOROLOGICAL PARAMETERS**
- APPENDIX - 5 - AMBIENT AIR QUALITY MONITRING EQUIPMENT**
- APPENDIX - 6 - PRESENT DRAFT MONITORING FORMS**
- APPENDIX - 7 - RECORDS OF INTER AGENCY /NGO's COMMUNICATIONS**

APPENDIX-1 EIA CORRESPONDENCE



Republic of Yemen
GENERAL INVESTMENT AUTHORITY

الجمهورية اليمنية
الهيئة العامة للاستثمار

الرغم : ٣٣٠
التاريخ : ٢٠٠٤/٨/٢٠

الرقم : ٣٣٠
التاريخ : ٢٠٠٤/٨/٢٠

الاحترام

الاخ / رئيس الهيئة العامة لحماية البيئة

بعد التفتيش:-

يسر الهيئة العامة للاستثمار أن تذكركم أطيب تحياتها ونود الاحاطة بأن الاخ/عبدالله احمد نقشان تقدم للهيئة بطلب الاستثمار لاقامة المشروع التاليه بياناته:-

- ١٠- اسم المشروع: مصنع انتاج الاسمنت
- ١١- موقع المشروع: منطقة العيون - عبدالله غريب - غيل باوزير - م/حضر موت .
- ١٢- منتجات المشروع وطاقة الانتاجية السنوية:-

م	المنتجات	الوحده	الطاقة الانتاجيه القصوى
١-	اسمنت بروتلاندي عادي ومقاوم للملوحة	طن	٧٠٠.٠٠٠

- ١٣- التكلفة الاستثمارية للمشروع: (٢١٠.٠٠٠.٠٠٠.٠٠٠ ريال .
- ١٤- قيمة الموجودات الثابتة للمشروع: (١٨.٢٢٠.٠٠٠.٠٠٠ ريال .
- ١٥- تقدر احتياجات المشروع السنوية من المياه: (١٧٢.٠٠٠ م^٣ المصدر خاص)
- ١٦- تقدر احتياجات المشروع من الطاقة الكهربائية (٩.٨٨٠.٥٠٠) ك.وات المصدر خاص /عام)
- ١٧- البرنامج الزمني لتنفيذ المشروع:

تاريخ بدء التنفيذ	تاريخ اتمام التنفيذ	تاريخ بدء الانتاج
٢٠٠٤/١/٦ م	٢٠٠٦/١٠/١ م	٢٠٠٦/١٢/١ م

- ١٨- حجم العمالة اللازمة للمشروع: (٤٤٥) عامل .

وخلية يرجى التكرم بالاطلاع وابداء رأيكم البيئي بشأن اقامة المشروع المذكور اعلاه خلال مده اقصاها (٧) ايام من تاريخه مالم سيعبر عدم الرد موافقة .

شاكرين تعاونكم سلفاً . . .

هذا وتقبلوا تحياتنا

رئيس الهيئة العامة للاستثمار

الاخ / م.ع. الرصد البيئي

للاطلاع ومتابعة المشروع بالتنسيق مع هيئة الاستثمار والافادة

٢٦ شارع القا - ص.ب : ١٩٠٢٢ - صنعاء - الجمهورية اليمنية - ب.فون : ٢٦٢٩٦٦ / ٢٦٢٩٦٣ - فاكس : ٢٦٢٩٦٤
26 Al-Kahe St. Southern Al-Sa'na P.O.Box : 19022 - Sana'a - Republic of Yemen - Tel : 262966/262963 Fax : 262964

REPUBLIC OF YEMEN
Ministry of
Tourism and Environment
Environment Protection Authority

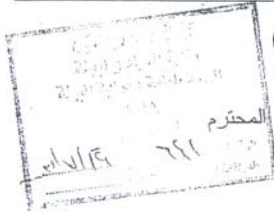


الجمهورية اليمنية
وزارة السياحة والبيئة
الهيئة العامة لحماية البيئة

المرفقات:

التاريخ:

الرقم:



الأخ / رئيس الهيئة العامة للاستثمار

تحية طيبة وبعد،،،

الموضوع / مصنع إنتاج الأسمنت بالمكلا - محافظة حضرموت

تهديكم الهيئة العامة لحماية البيئة أطيب التحيات، وبالإشارة إلى الموضوع أعلاه نود الإحاطة بأن المشروع أعلاه بحاجة إلى دراسة تقييم أثر بيئي كامل كون المشروع من المشاريع التنموية والتي لها أثر بيئي. وعليه نقترح عمل دراسة كاملة لتقييم الأثر البيئي للمشروع مع أهمية إشراك المجتمع المحلي في الدراسة المذكورة أعلاه قبل بدء التنفيذ ليتم مراجعتها من قبل الهيئة العامة لحماية البيئة.

وتقبلوا خالص التحية،،،

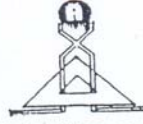
رئيس الهيئة العامة لحماية البيئة

د. محمد سعيد المشجري



بسم الله الرحمن الرحيم

AL-DAR FOR CONSULTATION
Economic , Industrial , Engineering
and Management Consultants
Tel. 275893 - P.O.Box. 12261



الدار للاستشارات

اقتصادية - هندسية
صناعية - إدارية
تلفون ٢٧٥٨٩٣ - ص.ب ١٢٢٦١

٢٧ / ٨ / ٢٠٠٣ م

المحترم

الأخ / رئيس الهيئة العامة لحماية البيئة

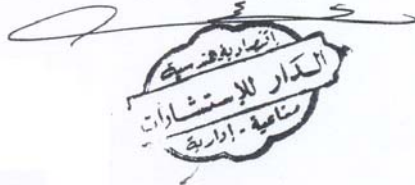
بعد التحية ،،،

نود الإحاطة إلى أننا بصدد إعداد دراسة تقييم الأثر البيئي لمشروع إنتاج الأسمت والتموقع تنفيذه في منطقة العيون على بعد ٥٦ كيلومتر تقريبا من مدينة المكلا - محافظة حضرموت ، وقد كلفنا بذلك من قبل أصحاب المشروع .
المرجو منكم تحديد طبيعة المهام المطلوبة لإعداد الدراسة .

شاكرين تعاونكم معنا سلفا

مع خالص التحية وجزيل التقدير ،،،

مهندس / يحيى محسن إسحاق



تحية طيبة
لجنة من
الدار
للمهندسين
والإستشاريين

الخ / سید عالم
لدار الإستشارات
المهندسين

متطلبات دراسة تقييم التأثيرات البيئية لمصنع الاسمنت

← ملخص تنفيذي

عرض المشروع والتأثيرات البيئية المحتملة ووسائل تخفيف الآثار البيئية السلبية المقترحة والخطة البيئية وأهم نتائج الدراسة

← وصف المشروع المقترح

وصف المشروع وأهدافه وموقع المشروع والغرض منه والأنشطة المرتبطة بالمشروع
مواقع استخراج المواد الخام
المخطط العام للموقع المذكور

← ملخص عام عن المشروع

- المالك والجهة المانحة للترخيص
- خصائص المشروع والهدف منه
- العائد البيئي والعائد العام من المشروع
- (الرسومات الإيضاحية) خريطة الموقع العام

← الأهداف والغرض من المشروع

- برنامج الأعمال المقترح للتنمية
- وصف عام لمكونات المشروع المقترح
- برنامج زمني للتنفيذ والعمر الزمني للمشروع
- تفاصيل سند ملكية وموقع الارض

ملخص نتائج الدراسات الابتدائية والاقتصادية للمشروع

← الموقع

- اشتراطات تنمية القطاع أو المركز الذي تقع الأرض في نطاقه وقربه من المناطق المحمية والاماكن الحساسة واحواض المياه والمشاريع المجاورة
- وصف الموقع متضمنا خرائط ورسم تخطيطي أو صور فوتوغرافية لتحديد موقع التنمية المقترحة
- توافق المشروع مع :
 - استخدامات كل من الأرض والمياه بالموقع أو أي أرض مجاورة
 - أي مواقع تاريخية أو مناطق محمية بيئية الاحواض المائية
- (رسومات إيضاحية) خرائط مساحية بمقياس رسم مناسب موضحا عليها المناطق المحيطة بالمنشآت والطرق والمنافع القريبة من المشروع واستخدامات المناطق المجاورة ومسافة حرم بين المشروع والتجمعات السكانية ومشاريع التنمية الأخرى والمجاورة والحدود الادارية .

← وصف وتخطيط المشروع وعناصره

- أقصى مساحة أرضية متأثرة بالمشروع
- رسم وتخطيط الموقع وصور فوتوغرافية
- وصف مساحات وارتفاعات ونوع مباني المشروع
- تحديد ووصف لمناطق التوسع المستقبلي
- متطلبات إمداد الطاقة والمياه ومصادرهما
- متطلبات المشروع من المواد الأولية والمواد الكيميائية والمضافات.....
- تحديد أماكن التخلص من المياه العادمة المعالجة
- الاتزان المائي للمشروع
- أنواع وكميات المخلفات الصلبة والغازية والسائلة المولدة (زيت، كيماويات، مخلفات خطرة) وطرق التخلص منها
- العمالة أثناء الإنشاء والتشغيل عددها ومصدرها وأماكن إقامتها وعدد ساعات العمل وخلافه
- وصف عمليات الإنتاج
- استعمال لمواد الخام والمواد المساعدة بما في ذلك استخدام المياه
- تخزين المواد الخام والمنتج النهائي
- الطاقة الإنتاجية السنوية بالطن

□ ملخص للدراسات التخطيطية والبنية الأساسية

⊗ اعداد الموقع وطرق الانشاء

- توقيت ومرحلة وساعات العمل أثناء الإنشاء
- الاعمال الإنشائية المقترحة شاملة الأعمال المؤقتة والمعدات المستخدمة وطرق نقل المعدات للموقع ..
- وصف لكميات أعمال التسوية بالموقع .
- نطاق المشروع ، وتأثير تشغيلها على البيئة وفاعلية الوسائل التي اتخذت للحد من الآثار السلبية

❖ إطار العمل التشريعي والخطوات الاستشارية

- القوانين والمعايير التي تحكم نوعية البيئة والصناعة والمياه السطحية والجوفية والصرف الصناعي والاسكان واستخدام الاراضي المعمول بها أثناء تخطيط المشروع وإنشاءه وتشغيله وتحديد المواد ذات العلاقة بالمشروع
- القرارات ذات العلاقة بالمشروع
- قائمة بكل الاعتمادات والتراخيص
- تسجيل محصلة الاستشارات والاجتماعات مع حفظها

❖ وصف البيئة المحيطة

- وصف البيئة المحيطة وتحديد أولويات المشاكل والقضايا البيئية
- المشاكل البيئية التي تم التعرف عليها
- الجيولوجيا، الطبقات الجيولوجية، خلفية عن الأنشطة الزلزالية ، الطبوغرافيا، السطح ، التربة الطقس و
- سرد المشاكل الأساسية والبيئية والاجتماعية التي تحتاج لتحليل كامل في دراسة تقييم التأثير البيئي
- ملخص الأبحاث والدراسات المنشورة عن البيئة المحيطة

⊗ بيانات أساسية وتقييم التأثير

- عوامل الأرصاد الجوية والبحرية
- الحياة البرية والحيوانية والنباتية في منطقة المشروع
- عوامل تضاريس الأرض وخصائص و جيولوجية التربة والتضاريس وخطوط

الكونتور الأرضية

- عوامل هيدرولوجية ونوعية المياه الجوفية . ومصادر المياه الجوفية وهيدرولوجية المياه السطحية

- وجود أماكن تراث أو ذات أهمية تاريخية محتمل أن تتأثر بالمشروع

- (رسومات إيضاحية) أشكال إيضاحية مثل (وردة الرياح أشكال بيانية توضح معدلات سقوط الأمطار . الخ)

• مشكلة طيوغرافية الأرض

- خصائص سطح الأرض الحالية
- الخلل أو التغير المباشر أو الغير مباشر المحتمل
- المواد الثقيلة أو المتغيرة أو المستخدمة في عمل مساحات خضراء

- (رسوم إيضاحية) خريطة كونتورية للموقع

• مشاكل هيدرولوجية ونوعية المياه

- نظام الصرف الحالي (وهذا يشمل موقع الأودية وتعيين المناطق المعرضة للسيول
- التأثيرات الممكنة على المنشآت
- دراسات نوعية المياه

• مشاكل إدارة المخلفات السائلة والمواد الصلبة والغازية

- الوضع الحالي للمساحات المائية أو المياه الجوفية
- مصادر التغير لنوعية المياه الممكنة (أثناء التشييد أو التشغيل)
- إعادة استخدام المخلفات الصلبة في عمليات التصنيع

• التأثير على نوعية الهواء

- الوضع الحالي لنوعية الهواء في المنطقة
- مصادر تلوث الهواء أثناء التشييد والتشغيل
- تأثير المشروع المحتمل على جودة الهواء في المنطقة

- دراسة خاصة بنوعية الهواء

- تأثيرات الضوضاء
 - ضوضاء التشييد والتشغيل ومصادرها
- التأثيرات السلبية على المنظر العام
 - وصف المنظر العام للمشروع والتنسيق الجمالي له وتكامله مع المشاريع المجاورة
 - الأخذ في الاعتبار لشرائط البيئة أثناء البناء والتشغيل
- (رسومات إيضاحية) رسومات إيضاحية وقطاعات أو صور ثلاثية الأبعاد لتوضيح المنظر العام للمشروع
- مشاكل الحياة البرية النباتية والحيوانية
 - تعيين المناطق التي قد تتأثر بصورة مباشرة أو غير مباشرة
 - تحديد أنواع الحياة البرية
 - تحديد للتأثيرات الممكنة على النباتات والكلائنات البرية
- (رسومات إيضاحية) خرائط الحساسية البيئية
- مشاكل النقل الأرضي أو البحري
 - تقييم تأثير الحركة المرورية المتولدة من التشييد والتشغيل على شبكة الطرق المحلية
 - تقدير متوسطات الانتظار المتوسطة والقصى
- (رسومات إيضاحية) لعناصر شبكة الطرق
- (دراسة مكملية) ملخص دراسة المرور في المنطقة
- الأماكن التاريخية
 - تعيين الأماكن ذات الأهمية التاريخية أو ذات تراث حضاري
 - التأثيرات المحتملة على هذه الأماكن أثناء الإنشاء والتشغيل
- (رسومات إيضاحية) خرائط توضح مواقع الأماكن التاريخية أو ذات التراث الحضاري في المنطقة

- تقييم الكوارث

- المواد المخزنة التي تصنف كمصدر خطر
- تحديد الكوارث المحتملة والأحداث الطبيعية
- وسائل تأمين التلوث البيئي

- البيئة الاجتماعية والثقافية والاقتصادية

- الوضع الحالي والمستقبلي للتجمعات السكانية القريبة من منطقة المشروع
- استخدام الأراضي
- أنشطة التنمية الحالية وهاكل المجتمع
- عدد سكان العمالة وسوق العمل وتوزيع الدخل
- السلع والخدمات ووسائل الترفيه ووسائل الصحة والسلامة العامة.
- اليد العاملة المطلوبة في الموقع أو المجتمع ومصدرهم
- التأثيرات الاقتصادية المحتملة
- التنسيق مع السلطة المحلية والاهالي والمنظمات الغير حكومية المتأثرة بالمشروع بصورة مباشرة

□ (رسومات إيضاحية) خرائط توضح أماكن تجمع السكان بالنسبة للمشروع وأماكن إقامة العاملين بالمشروع أثناء الإشتاء والتشغيل .

□ (دراسة مكملة) ملخص دراسة اجتماعية

- ❖ التأثيرات البيئية الهامة

- يرفع به أهم التأثيرات البيئية لكل مشكلة بيئية تم عرضها مع الإيضاح
- التأثيرات الإيجابية والسلبية
- التدمير العكسي والغير عكسي أثناء التشغيل والتشييد

- ❖ البدائل ووسائل تخفيف الآثار السلبية

- تخفيف الآثار السلبية لبيان كيفية تنفيذ وإدارة المشروع

- ⊗ اعتبار البدائل

- التنمية والتخطيط البديل
- الممارسات الإدارية المختلفة
- خيارات تخفيف الآثار السلبية والإصلاح

☐ صلاحية البديل الأفضل

- نوع وجودة ومقياس الخدمات
- عوامل بيئية
- نتائج الدراسات المفصلة
- استدامة المشروع
- دراسة بدائل مقترحة عدم إقامة المشروع

• خطة إدارة البيئة

❖ وتشمل إجراءات تخفيف الآثار البيئية السلبية وتقليل التأثيرات التي لحدود المقبولة وتشمل:

- ❖ وسائل موجهة الطوارئ الناتجة من الحوادث مثل الانفجارات والتصدعات وعربات النقل والحرائق
- ❖ تقدير تكلفة هذه الآثار والمتطلبات المؤسسية والتدريبية الخ
- ❖ تقدير آثار وتكاليف الوسائل
- ❖ برامج للتدريب والتوعية لطاقم الإدارة
- ❖ وضع مؤشرات التماسق البيئي مع الترخيص ومتطلباته

• وسائل تخفيف الآثار السلبية الخاصة

- مشاكل طبوغرافية الأرض
- مشاكل نوعية المياه والمشاكل الهيدرولوجية ومشاكل مياه الصرف والمخلفات الصلبة والمواد الخطرة والوسائل
- المشاكل التاريخية والوسائل المقترحة للحفاظ عليها

❖ خطة المراقبة والرصد

أعداد خطة تفصيلية للرصد والمراقبة لتطبيق وسائل التخفيف وقياس الآثار الناجمة خلال مرحلتى الإنشاء والتشغيل على أن تتضمن الخطة

- وصف تفاصيل برنامج المراقبة
- المؤشرات التي يتم مراقبتها
- المعايير والأسباب الداعية للمراقبة

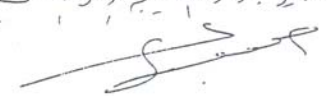
- أماكن المراقبة وتباعد الفترات الزمنية ومدة المراقبة
- التكاليف المراقبة والرصد
- الخطوات الواجب اتباعها في حالة ما إذا أوضحت المراقبة عدم تناسق المؤشرات البيئية مع المعايير المطلوبة
- خطوات التقارير الدورية الداخلية والجهات المعنية

❖ المراجع والسيرة الذاتية

المراجع

والسيرة الذاتية للمطاقم الاستشاري الذي قام بالدراسة
كشف بالجهات التي تمت مقابلتها

مدير إدارة المصممين


مدير إدارة تقييم التربة


REPUBLIC OF YEMEN
Ministry of Water and Environment
Environment Protection Authority



الجمهورية اليمنية
وزارة المياه والبيئة
الهيئة العامة لحماية البيئة

التاريخ : / / ٢٠٠٠ م

المرفقات :



الأخ / المهندس عبدالله أحمد بقشان
تحية طيبة ،

الموضوع : / دراسة تقييم الأثر البيئي لمشروع إسمنت المكلا - حضرموت.

إشارة إلى مذكرتكم رقم ٠٠٢٢/س ف / ٠١٠٤ بتاريخ ٢٩ يناير ٢٠٠٤ بخصوص الموضوع أعلاه وبعد المراجعة الأولية للدراسة تبين الآتي :-

- منهجية الدراسة لم تلتزم بمرجعية المهام التي وضعت من قبل الهيئة العامة لحماية البيئة للإلتزام بها عند إعداد الدراسة من قبل الإستشاريين.
- هناك كثير من القصور في البيانات والمعلومات الواردة في الدراسة .
- الدراسة أعتمدت على الجانب الوصفي وليس الكمي.
- الجانب الإجتماعي لم يتم التطرق إليه بشكل واضح .
- انواع المخلفات لم تحدد كمياتها السنوية ولم تحدد كيفية التخلص منها وكيفية السيطرة عليها بشكل واضح.
- لم تتطرق الدراسة الى المشاريع المستقبلية في المنطقة مثل السدود وآبار المياه.
- الأنشطة البشرية في المنطقة لم تتطرق لها الدراسة بشكل واضح.
- التركيب الطبوغرافي للمنطقة لم يذكر بشكل واضح .
- الدراسة نصفها باللغة العربية والنصف الآخر باللغة الإنجليزية .
- عدم وجود ملاحق للدراسة وخاصة بالآتي :
 - أسماء معدي الدراسة وتخصصاتهم .
 - مراجع الدراسة.
 - كشوفات الذين تم مقابلتهم من الجهات الرسمية والشعبية .
 - المخططات الخاصة بالمشروع غير واضحة .

REPUBLIC OF YEMEN
Ministry of Water and Environment
Environment Protection Authority

المرفقات :

شريعة العدل



الجمهورية اليمنية
وزارة المياه والبيئة
الهيئة العامة لحماية البيئة

التاريخ : / / ٢٠٠٠ م

وبناء على ما تقدم نود التأكيد بأنه من الأهمية التأكيد بمهام المرجعية التي سلمت لكم .
وعليه يرجى تكليف الفريق الذي أعد الدراسة بمراجعة هذه المهام والتأكد بها حتى تتمكن
من التثبت في الدراسة وإستكمال الإجراءات اللازمة وفقاً لقانون حماية البيئة رقم ٢٩ لعام
١٩٩٥ م.

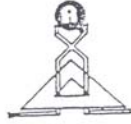
الهيئة العامة لحماية البيئة
م. محمود محمد شديوه



نسخة مع التحية للأخ/رئيس الهيئة العامة للاستثمار

بسم الله الرحمن الرحيم

AL-DAR FOR CONSULTATION
Economic , Industrial , Engineering
and Management Consultants
Tel. 275893 - P.O.Box. 12261



الدار للاستشارات

اقتصادية - هندسية
صناعية - إدارية
تلفون ٢٧٥٨٩٣ - ص ب ١٢٢٦١

٢٠٠٦/٥/٢٤

المحترمون

الأخوة / الشركة العربية اليمنية للأسمنت

بعد التحية ،،،،

الموضوع : " دراسة تقييم الأثر البيئي لمشروع

مصنع الأسمنت التابع للشركة - المكلا "

بالإشارة إلى الموضوع أعلاه وإلى الاتفاق معكم باستكمال وتغطية النواقص المدونة في مذكرة
الهيئة العامة لحماية البيئة رقم (177) والمؤرخة في 16 / 3 / 2004م فإننا نرفق لكم طي هذا
النسخة النهائية من دراسة تقييم الأثر البيئي اخذين في الاعتبار كل ما ورد في مذكرة الهيئة .

مع جزيل الشكر والتقدير ،،

المدير عام

مهندس / عبدالكريم محمد الزبيري



APPENDIX-2
NAME AND POSITION OF EXPERTS

NAME	POSITION
Abdulkareem Al-Zubairi,B.E.	Team Leader
C.Rajendran, B.E	(Mech),DBM,MIE,FIV,FIE
Yousuf Ridha Al-Anbarie, BSc	Civil Engineering
K.Ravi Kumar, B.E	Electronics & Communication
K.P.Bhaskaran, Diploma	Mechanical Engineering
Abdallah Hussen Al-Bidani,BSc.	Project Co-ordinator
M.M.AL-Khlani,MSc	Environmental Assessment Expert
Riyadh M. Al-Aghbari ,B.SC	Hydrologist
Abdassalam Adukhane,BSc	Geologist
Ali M. Al-Sabri B.Sc	Geologist

APPENDIX - 3 - TABLE SHOW THE RAW WATER ANALYSIS (BORE WELL NO.1

الجمهورية اليمنية
وزارة المياه والبيئة
المؤسسة الوطنية للمياه والصرف الصحي
محافظة حضرموت - مناطق الساحل

Republic of Yemen
Ministry of Water & Environment
Local Corporation for Water Supply & Sanitation
In Hadramout Governorate - Coastal Areas

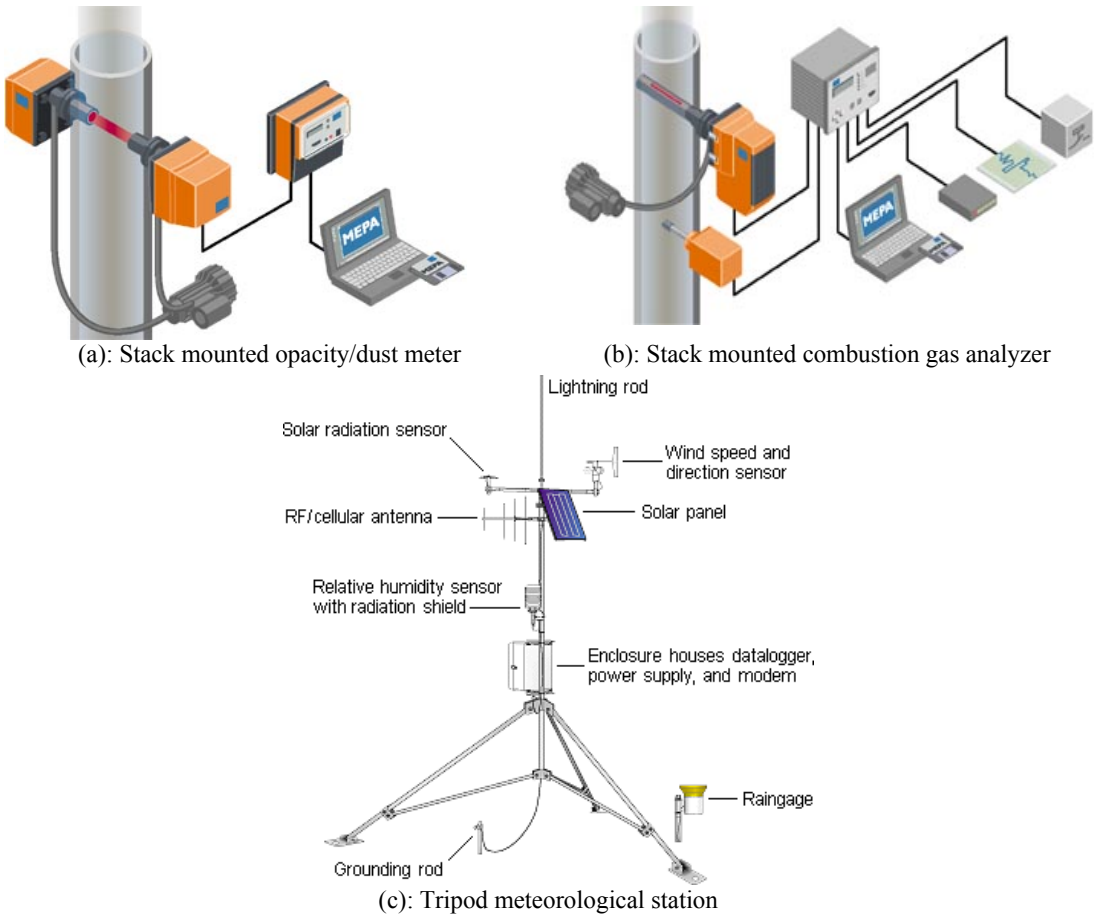
Sample No. : 1
Date of Collection : 21.2.2004
Sample Collection by:
Address:
Date of Sample to Lab: 22.2.2004
Date of Result : 23.2.2004

CHARACTERISTIC	RESULTS	WHO GUIDELINES MAX	YEMEN GUIDELINES MAX	UNITS
Temperature	27.7	25	25	°C
Colour	7	15	15	Unit
Turbidity	1.17	5	5	n.t.u
PH. Value	7.84	6.5-8.5	5.5-9.0	
Conductivity	1160	1500	2500	µ mos/cm
Total Dissolved Solides (T.D.S)	742	1000	1500	Mg/L
PH. Alkalinity as Ca Co ₃	—	—	—	Mg/L
Total Alkalinity as Ca Co ₃	170	120	500	Mg/L
Total Hardness as Ca Co ₃	328	500	200	Mg/L
Calcium Hardness as CaCo ₃	168	200	150	Mg/L
Magnesium Hardness as CaCo ₃	160	150	—	Mg/L
Carbonate Hardness as CaCo ₃	170	120	—	Mg/L
Non Carbonate Hardness as CaCo ₃	—	—	600	Mg/L
Chloride Cl	158	250	600	Mg/L
Sulphate SO ₄	185	400	400	Mg/L
Sodium Na ⁺	—	200	50	Mg/L
Nitrate NO ₃	17.2	45	50	Mg/L
Nitrite NO ₂	—	0.1	1.5	Mg/L
Fluoride F ⁻	1.2	1.5	1.0	Mg/L
Iron Fe ⁺⁺	0.21	0.3	0.3	Mg/L
Maganese Mn ⁺⁺	0.1	0.1	—	Mg/L

CATION	Mg/L	Meq/L	ANIONS	Mg/L	Meq/L
Calcium as Ca ⁺⁺	67	3.4	Chloride as Cl ⁻	158	4.4
Magnesium as Mg ⁺⁺	38	3.1	Sulphate as So ₄ ⁻	185	4
Potassium as K ⁺	—	—	Nitrate as NO ₃ ⁻	17.2	0.3
Sodium as Na ⁺	—	—	Bicarbonate as HCO ₃ ⁻	207.4	3.3

Supervisor:
Chieflab:

**APPENDIX - 4 CONTINUOUS AIR EMISSION MONITORING EQUIPMENT
AND METEOROLOGICAL PARAMETERS**



Appendix 4: Continuous air emission monitoring equipment and meteorological parameters

APPENDIX - 5 - AMBIENT AIR QUALITY MONITRING EQUIPMENT



(a): Portable PM high volume sampler



(b): Portable hand-held particle counter



(c): Portable gas analyzer



(d): Stationary full monitoring system



(e): Stationary PM monitoring station

Appendix 5: Ambient air quality monitoring equipment

APPENDIX - 6 - PRESENT DRAFT MONITORING FORMS

**AL- Mukalla Cement Plant
Monitoring Report and Assessment Manual**

1. RESOURCE USE

A- RAW MATERIALS

Raw material consumption	
Type of raw material consumed	Quantity consumed (tons/month)

B-WATER CONSUMPTION

Quantity of surface water being consumed in m ³ /month:	
Quantity of groundwater being consumed in m ³ /month:	

WATER QUALITY

1. Analysis of the water quality being used in production and groundwater quality from the wells surrounding the Cement Kiln Dust (CKD) disposal site:

Water source		Analysis parameters			
Location	Description	pH	Nitrates	Calcium	Other
Specify the time period between each sampling round:					

2. Analysis of drinking water quality at CP /AYCCL:

Source/sample location	pH	Calcium	E. Coli	Nitrates	Total Coliform	Fecal Coliform	Free chlorine
Specify the time period between each sampling round:							

Describe sampling procedures:
Specify water analysis lab:

C- ENERGY CONSUMPTION

1. Electricity:

Specify the annual average electricity consumption (kWhr/year):
Specify the percentage of the electricity being produced at CP /AYCCL (%):

2. Fossil Fuels:

Annual fossil fuel consumption rates		
Type of fossil fuel	Average annual consumption	Cost (USD/year)

Fuel type	Sulfur content	Source
Diesel		
Gasoline		
Heavy Fuel Oil		
Other		

Fuel storage tanks		
Tank number and location	Capacity	Fuel type

2. SOLID WASTE STREAM

Solid waste generation, and management						
Type	Source	Quantity	Storage site	Treatment option used (if available)	Hauling/transport technique	Final disposal site

3. HAZARDOUS WASTES

Do hazardous wastes undergo segregation according to type:	Yes	No
--	-----	----

In case the hazardous wastes undergo segregation describe the process by filling the following table:

Hazardous waste management					
Type	Source	Quantity	Storage method on- site	Treatment option (if adopted)	Final disposal site

4. EMISSIONS AND AMBIENT AIR QUALITY

1. Describe the main point emission sources:

Stack number	Site	Elevation	Diameter	Collects emission gases from	Adopted emission reduction technology (if present)	Flue gas exit temperature	Flue gas emission velocity or flow rate

2. Constituents of air emissions

Constituent	Concentration	Site/stack	Emission monitoring technique adopted	Treatment technology adopted (if available)	Flue gas flow rate (m ³ /hr)	Cement/clinker production during sampling	Prevalent meteorological conditions during sampling	Time of sampling
	Min: Max: Average: Averaging time:							
	Min: Max: Average: Averaging time:							
	Min: Max: Average: Averaging time:							
	Min: Max: Average: Averaging time:							
	Min: Max: Average: Averaging time:							
	Min: Max: Average: Averaging time:							
	Min: Max: Average: Averaging time:							

Monitoring constituent release into the atmosphere	
Specify the time period between each sampling round:	
Describe sampling equipment used:	
Specify party responsible for carrying out the sampling:	
Last date equipment undergo calibration:	
Party responsible for carrying out calibration:	

3. Ambient air quality

Site	Parameter	Concentration	Average time of sampling	Sampling method/equipment	Cement/clinker production during sampling	Date
CP /AYCCL employee residence						
Abdullah Greeb Village						
Nomadic and semi-nomadic Areas						
Grassing areas						
Proposed Dam site						
Carponet Calcium plant						
Specify the time period between each sampling round:						
Specify party responsible for carrying out the sampling:						
Last date equipment undergo calibration:						
Party responsible for carrying out calibration:						

5. EFFLUENT QUANTITY AND QUALITY

1. Estimate the quantity of the generated effluent

Source	Type	Quantity	Treatment option adopted	Final disposal site

2. Effluent quality assessment:

Source	Parameter	Concentration	Sampling method/ equipment	Date
Specify the time period between each sampling round:				
Specify party responsible for carrying out the sampling:				

6. NOISE MONITORING

1. Noise level at CP /AYCCL

Equipment/production section	Cement/clinker production during measurement	Noise level dB(A)	Date

2. Noise levels at nearby receptors

Location	Noise level dB(A)	Cement/clinker production during measurement	Date
CP /AYCCL residence complex			
Abdullah Greeb Village			
Nomadic and semi-nomadic Areas			
Carponet Calcium plant			
Specify the time period between each measurement round:			
Specify party responsible for carrying out the measurement:			

7. SOIL QUALITY

Site	Parameters analyzed for	Concentrations	Date

8. OCCUPATION HEALTH

Personal Protection Equipment				
Type	Use	Employees using it (number and job description)	Maintenance frequency	Party responsible for maintenance

Maintenance frequency for the ventilation system			
Adopted air changes for the ventilation system			
Is the indoor lighting sufficient?	Yes	No	List sections with insufficient lighting:
Are the walkways clean, dry, and easily accessible	Yes	No	List the walkways that are not safe:
Are the emergency exits clearly marked and easily accessible?	Yes	No	List the emergency exits that do not comply:
Are there certain jobs that are associated with a high rate of absence and/or sickness?	Yes	No	List these jobs:
Describe the type of accidents that happened during the last operational year			
Describe the causes that lead to these accidents			
Describe what has been done to avoid the occurrence of such accidents in the future			

9. FOR OFFICIAL USE ONLY

	Name and position	Contributed in section(s)	Date
Prepared by:			
Reviewed by:			
Quality control by:			
Approved by:			

APPENDIX - 7 RECORDS OF INTER AGENCY /NGO'S COMMUNICATIONS

Local council and NGO's of Modiriah Ghie Bawazeer (project area)

- o Mr.Nasser Salem Ba-Gharam - General secretary of local council.
- o Mr. Ahmed Mahfoud Souailem- Chairman of planning committee of local council.
- o Mr. Ahmed Salem Ba-Debar- Head section of Wild Life affairs of local council.
- o Mr.Ahmed Ba-Ghdeem - representative of Al-Eyoun Town at local council.
- o Mr.Yazeed Mohammed Bin-Shehnah- Chairman of Services Committee at local council.

1- Environment Friends Society- Shehear City

Mr.Ali Saleh Bin Taleb - Chairman of Society

Mr.Abdullah Omar Dokaik - Society secretary

Mr.Yazeed Mohammed Bin-Shehnah -General Secretary of Society

2- Environment and Development Supporter Society

Gheil Bawazeer - Hadhramout

Mr. Gehad Omar Ba-Wazeer - Chairman of Society

Mr. Abdullah Mubarak Ba-Himiesh- Member of Society.

Mr. Lotfi Aboud - Member of Society.

Mr.Khaled Hassen Bin-Kasem- Member of Society.

3- Civic Organizations Network and Social Development Society- Ghie Bawazeer -Hadhramout

Dr. Adnan Mohammed Homran - Chairman of Network

4- Environment and Social protection Society-Al-Naqa'a - Gheil Bawazeer

Mr. Awad Ba-Hashwan - Chairman of Society .

Almukalla- Hadhramout Governorate

Mr. Omare Mubarak Omare - Deputy of Hadhramout Governorate (Costal Affairs)

**Eng.Adel Ghareeb-General Director Assistance and Environmental Health Director of Ministry
Branch office of Public works and Highways- Hadhramout Governorate**

**Mr. Awad Ba-Ya-shout - General Manager of Health and occupation safty - Ministry of Health and
Population Branch-Al-Mukalla**

**Mr. Mohammed Faraj Abdoun - Office Branch General Manager of Ministry of Agriculture and
irrigation - Hadhramout Governorate**

Mr. Yahya Yosser - Branch General Manager of Geological survey and Mineral Resources Board

Mr. Mohammed Saeed Ba-Masoud - General Manager of Statistical

Mr.Abu-Baker Thabet - Transport Office at Al-Mukalla Seaport

بسم الله الرحمن الرحيم

الاجتماع رقم (١)

لقاء فريق الدراسة لتقييم الأثر البيئي لمصنع أسمنت المكلا مع الأخوة مسؤولي جمعية أصدقاء البيئة بمنطقة شحير في مديرية غيل باوزير.

أنه في يوم السبت الموافق ٢٠٠٦/٤/٨م عقد فريق الدراسة وبحضور الأخ/ ثابت حسين السعدي منسق الهيئة العامة لحماية البيئة محافظة حضرموت - المكلا والأخ/ عبدالله حسين البيضاني منسق مشروع اسمنت الشركة العربية اليمنية للأسمنت المحدودة الاجتماع المشترك مع الأخوة مسؤولي جمعية أصدقاء البيئة وهم :-

- ١ - علي صالح رئيس الجمعية
- ٢ - يزيد محمد بن شحري أمين عام الجمعية مسئول الخدمات بالمجالس المحلية
- ٣ - عبد الله عمر الدعكري سكرتير الجمعية

وكان ملخص المقترحات والآراء لمسؤول الجمعية النقاط التالية :-

- قيادة الجمعية في البداية ترحب و تدعم إقامة مشروع إسمنت المكلا لما يمثلها من أهمية اقتصادية وتنموية لمنطقة المشروع بصفة خاصة ولليمن بصفة عامة.
 - ضرورة وجود إدارة معنية بالبيئة في الهيكل الإداري للمصنع يتم عبرها التواصل مع الجمعيات البيئية في المنطقة .
 - الجمعية تحتاج إلى أجهزة كمبيوتر وأثاث وتدريب للقيام بعملية التوعية البيئية في المنطقة وتحتاج أيضاً إلى عدد من الدورات التأهيلية في مجال البيئة .
 - تفنقر المنطقة الى نظام لتصريف المخلفات الصلبة وإقامة مثل هذا المشروع سيساهم في تحسين الظروف الصحية والبيئية لمواطني المنطقة.
- انتهى الاجتماع.

هذا والله ولي الهداية والتوفيق...؛

الاجتماع رقم (٢)

لقاء فريق الدراسة لتقييم الأثر البيئي لمصنع أسمنت المكلا مع الأخوة في المجلس المحلي
وجمعية أنصار البيئة في مديرية غيل باوزير

أنه في يوم السبت الموافق ٢٠٠٦/٤/٨م عقد فريق الدراسة وبحضور الاخ/ ثابت حسين السعدي منسق الهيئة العامة لحماية البيئة محافظة حضرموت - المكلا والاخ/ عبدالله حسين البيضاني منسق مشروع اسمنت الشركة العربية اليمنية للأسمنت المحدودة الاجتماع المشترك مع الأخوة في المجلس المحلي وجمعية أنصار البيئة في مديرية غيل باوزير وهم :-

ناصر عبود باغرم	أمين عام المجلس المحلي
يزيد محمد بن شحري	رئيس لجنة الخدمات بالمجلس المحلي
احمد باسويلم	رئيس لجنة التخطيط بالمجلس المحلي
احمد سالم بادبر	رئيس شئون البادية بالمجلس المحلي
احمد بقديم	ممثل منطقة العيون

كما حضر من جمعية أنصار البيئة الاخوة:

جهد عمر باوزير	رئيس جمعية أنصار البيئة
عبد الله مبارك باحميش	عضو جمعية أنصار البيئة
لطف عبود جمعيه	عضو جمعية أنصار البيئة
خالد حسن بن قاسم	عضو جمعية أنصار البيئة

وكان ملخص المقترحات والآراء لمسؤولي المجلس المحلي وجمعية أنصار البيئة النقاط التالية :-

- قيادة المجلس المحلي لمديرية غيل باوزير وجمعية أنصار البيئة فيها يدعمون بقوة إقامة مشروع إسمنت المكلا لما يمثله من أهمية اقتصادية وتنموية لمنطقة المشروع بصفة خاصة ولليمن بصفة عامة.
- أهمية إعطاء الأولوية للتوظيف لآبناء منطقة المشروع.

- أهمية مساهمة المشروع المقترح في تنمية المنطقة من خلال دعم وتمويل بعض المشاريع في المنطقة وعلى سبيل المثال توسيع الوحدة الصحية القائمة في منطقة العيون لتصبح مركزاً صحياً.
 - أكد ممثلي شؤون الحياة البرية وممثل منطقة العيون في المجلس المحلي على ضرورة الحفاظ على النباتات والحيوانات المتواجدة والاخذ بعين الاعتبار الأنشطة القائمة للبدو الرحل جوار موقع المشروع .
- أما مقترحات وآراء جمعية انصار البيئة فكانت كالتالي :
- قيادة الجمعية في البداية ترحب و تدعم إقامة مشروع إسمنت المكلا لما يمثله من أهمية اقتصادية وتنموية لمنطقة المشروع بصفة خاصة ولليمن بصفة عامة.
 - التشديد على ضرورة الحد والسيطرة من الاضرار البيئية المحتملة التي قد تنجم عند تشغيل المشروع والتي قد تؤثر على البيئة المحيطة ومن أهمها التفجيرات والغبار والغازات المنبعثة والنفايات ومخلفات المصنع.
 - نظراً لأن الجمعية تفتقر الى مقر دائم لها للصعوبات المالية فان الجمعية تأمل في دعمها بتوفير مقر دائم مع التأثيث لتتمكن من القيام بمهامها على الوجه المطلوب.

انتهى الاجتماع.

هذا والله ولي الهداية والتوفيق؟؟؟

الاجتماع رقم (٣)

لقاء فريق الدراسة لتقييم الأثر البيئي لمصنع أسمنت المكلا مع رئيس شبكة منظمات المجتمع المدني في مديرية غيل باوزير

أنه في يوم السبت الموافق ٢٠٠٦/٤/٨م عقد فريق الدراسة وبحضور الاخ/ ثابت حسين السعدي منسق الهيئة العامة لحماية البيئة محافظة حضرموت - المكلا والاخ/ عبدالله حسين البيضاوي منسق مشروع اسمنت الشركة العربية اليمنية للأسمنت المحدودة الاجتماع المشترك مع الدكتور/ عدنان حمران رئيس شبكة منظمات المجتمع المدني في مديرية غيل باوزير

وكان ملخص المقترحات والآراء لرئيس الشبكة الآتي :-

- توجية الشكر والامتنان لصاحب المشروع لاخته بعين الاعتبار التشاور والتنسيق مع المجتمع المحلي مع فريق الدراسة المختص فيما يتعلق بالجوانب البيئية للمشروع وهذه تعتبر بادرة تستحق الاحترام والتقدير .
- ضرورة الأخذ بعين الاعتبار الطرق والوسائل الأساسية التي تقلل بقدر الإمكان من الأضرار البيئية التي سوف قد تنتج من تشغيل المصنع في حالة عدم اتخاذ تدابير تقليل وتقادي انبعاثات الأدخنة والغازات وكذلك بالنسبة للمخلفات الصلبة .
- الأخذ بعين الاعتبار السد المقترح في منطقة المشروع (سد مدحر) وكذا أهمية الأخذ بالتدابير والإجراءات اللازمة لتفادي وتقليل التأثيرات البيئية المحتملة للمشروع .

انتهى الاجتماع.

هذا والله ولي الهداية والتوفيق

الاجتماع رقم (٤)

لقاء فريق الدراسة لتقييم الأثر البيئي لمصنع أسمنت المكلا مع رئيس جمعية رعاية البيئة والمجتمع بمنطقة النعقة في مديرية غيل باوزير

أنه في يوم السبت الموافق ٢٠٠٦/٤/٨م عقد فريق الدراسة وبحضور الاخ/ ثابت حسين السعدي منسق الهيئة العامة لحماية البيئة محافظة حضرموت - المكلا والاخ/ عبدالله حسين البيضاني منسق مشروع اسمنت الشركة العربية اليمنية للأسمنت المحدودة الاجتماع المشترك مع الاخ/ عوض باحشوان رئيس جمعية رعاية البيئة والمجتمع بمنطقة النعقة في مديرية غيل باوزير

وكان ملخص المقترحات والآراء لرئيس الجمعية الآتي :-

- جمعية رعاية البيئة والمجتمع يدعمون بقوة إقامة مشروع إسمنت المكلا لما يمثله من أهمية اقتصادية وتنموية لمنطقة المشروع بصفة خاصة ولليمن بصفة عامة.
- أهم القضايا البيئية في منطقة النعقة كنضوب عيون المياه مما أدى إلى موت عدد كبير من أشجار النخيل كذلك مشاكل تكدس المخلفات الصلبة بصورة عشوائية.
- تعتبر النعقة من المواقع والأماكن التاريخية والثقافية الهامة في المنطقة حيث يتواجد فيها جامع محمد بن سعيد باوزير الذي يقدر عمره ٧٥١ عام وكذلك القباب والمزارات الصوفية .
- أهمية الدعم التقني للجمعية من خلال توفير اجهزة كمبيوتر وفرص تدريب وتوفير مكتبة إن أمكن .

انتهى الاجتماع.

هذا والله ولي الهداية والتوفيق؟؟

الاجتماع رقم (٥)

لقاء فريق الدراسة لتقييم الأثر البيئي لمصنع أسمنت المكلا

مع الأخ وكيل محافظة حضرموت

أنه في يوم الأحد الموافق ٢٠٠٦/٤/٩م عقد فريق الدراسة وبحضور الأخ/ ثابت حسين السعدي منسق الهيئة العامة لحماية البيئة محافظة حضرموت - المكلا والأخ/ عبدالله حسين البيضاني منسق مشروع اسمنت الشركة العربية اليمنية للأسمنت المحدودة الاجتماع المشترك مع الأخ / عمير مبارك عمير وكيل محافظة حضرموت.

وكان ملخص المقترحات والآراء للأخ وكيل المحافظة الآتي :-

- أهمية الأخذ بعين الاعتبار تركيب معدات (فلانتر) تعمل على تنقية انبعاث الغبار والغازات المتصاعده.
- الأخذ بعين الاعتبار السد الذي سيقام في وادي حويرة وأن يتم عمل الحلول المناسبة لتفادي الأضرار المستقبلية على السد .
- على الشركة عمل كل التدابير والإجراءات بحيث تكون المنطقة خالية من التلوث .
- أهمية الأخذ بعين الاعتبار ضمانات التنفيذ للحلول والتوصيات للحفاظ على البيئة .
- على الشركة عمل كل التدابير والإجراءات من أجل التخلص الآمن من المخلفات والمواد الخطرة الناتجة من المشروع .
- أهمية وجود إدارة للبيئة ضمن الهيكل الإداري للمصنع .
- أهمية الحفاظ على النباتات في منطقة الجوار .

انتهى الاجتماع.

هذا والله ولي التوفيق والهداية ؟؟؟

الاجتماع رقم (٦)

لقاء فريق الدراسة لتقييم الأثر البيئي لمصنع أسمنت المكلا

مع الأخ مديرعام الصحة والسلامة المهنية بمكتب الشؤون الاجتماعية والعمل المكلا

أنه في يوم الأحد الموافق ٢٠٠٦/٤/٩م عقد فريق الدراسة وبحضور الاخ/ ثابت حسين السعدي منسق الهيئة العامة لحماية البيئة محافظة حضرموت - المكلا مع الأخ / عوض بايعشوت مدير عام الصحة والسلامة المهنية بمكتب الشؤون الاجتماعية والعمل المكلا .

وكان ملخص المقترحات والآراء للأخ مدير عام الصحة والسلامة المهنية بمكتب الشؤون الاجتماعية والعمل الآتي :-

- ضرورة توافر نظام للسلامة المتكامل للحد من تأثيرات الغبار على الجهاز التنفسي ومشاكل الرؤية والتحسس والروماتزم .
- إتباع كل التدابير لنجاح السلامة المهنية للعمال في المصنع .
- ضرورة توافر وسائل الوقاية الفردية (كماسات ، ملابس ، أذنية ، نظارات ، سماعات ... الخ) وتوفيرها للعمال.
- ضرورة توافر مركز صحي في المصنع وسيارة إسعاف وأجهزة إسعافية للتنفس ومواد وأجهزة إسعافات أولية وتعقيم .
- ضرورة توافر جهاز الإنذار الخاص بالحرائق .
- ضرورة توافر خطة للطوارئ .
- ضرورة تجهيز المصنع بالمرافق الصحية حمامات تتناسب مع طاقم العمل في المشروع .
- ضرورة توافر لائحة طبية وإرشادات طبية للعاملين يوافق عليها من قبل مكتب الصحة والسكان والإدارة العامة للصحة والسلامة المهنية بمكتب العمل.
- أهمية الالتزام بعمل فحوصات طبية منتظمة ودورية للعمال .
- الرقابة والصرامة في تنفيذ شروط السلامة المهنية .
- أهمية أن تكون السلامة المهنية في المصنع مماثلة لما هو مطبق في المشروعات المماثلة.
- أهمية البدء بتنفيذ آلية السلامة المهنية من بداية تنفيذ المشروع .
- لا بد من وجود إدارة تعنى بالسلامة المهنية في المصنع .

أنتهى الاجتماع

هذا والله ولي الهداية والتوفيق ؟؟؟

الاجتماع رقم (٧)

لقاء فريق الدراسة لتقييم الأثر البيئي لمصنع أسمنت المكلا مع الأخ مدير عام مكتب الزراعة والري محافظة حضرموت

أنه في يوم الأحد الموافق ٢٠٠٦/٤/٩م عقد فريق الدراسة وبحضور الاخ/ ثابت حسين السعدي منسق الهيئة العامة لحماية البيئة محافظة حضرموت - المكلا والاخ/ عبدالله حسين البيضاني منسق مشروع اسمنت الشركة العربية اليمنية للأسمنت المحدودة الاجتماع المشترك مع المهندس/ محمد فرج عبدون مدير عام مكتب الزراعة والري محافظة حضرموت.

وكان ملخص المقترحات والآراء للأخ مدير عام مكتب الزراعة والري محافظة

حضر موت الآتي :-

- الأخذ بعين الاعتبار السدين الذين سيقاما (سد مدحر وسد بن يامين) والتي اجريت عليهما دراسات من قبل شركة استشارية متخصصة مع العلم بان سد مدحر المقترح يعتبر من السدود الكبيرة والاستراتيجية نظراً لسعة التخزينية المقدرة بأكثر من ١,٧ مليون متر مكعب .
- الأخذ بعين الاعتبار توسيع النشاط الزراعي في المساحات المجاورة للمشروع من خلال إقامة مشروع زراعي نموذجي يهتم بالتنمية الريفية والثروة الحيوانية والجانب النباتي والمزروعات في المنطقة والمكتب على استعداد لتقديم الخبرات في هذا المجال .
- أهمية الحفاظ على الغطاء النباتي في المنطقة .

أنتهى الاجتماع

هذا والله ولي الهداية والتوفيق ؟؟؟

الاجتماع رقم (٨)

لقاء فريق الدراسة لتقييم الأثر البيئي لمصنع أسمنت المكلا

مع الأخ مدير عام فرع هيئة المساحة الجيولوجية والثروات المعدنية

محافظة حضرموت

أنه في يوم الأحد الموافق ٢٠٠٦/٤/٩م عقد فريق الدراسة وبحضور الاخ/ ثابت حسين السعدي منسق الهيئة العامة لحماية البيئة محافظة حضرموت - المكلا والاخ/ عبدالله حسين البيضاني منسق مشروع اسمنت الشركة العربية اليمنية للاسمنت المحدودة الاجتماع المشترك مع المهندس/ يحيى يسر مدير عام فرع هيئة المساحة الجيولوجية والثروات المعدنية محافظة حضرموت.

وكان ملخص المقترحات والآراء للأخ مدير عام فرع هيئة المساحة الجيولوجية والثروات المعدنية محافظة حضرموت الآتي :-

- تم عمل دراسات للخامات الخاصة بالمصنع من قبل الهيئة بالإضافة إلى الدراسات الهيدرولوجية.
- أفاد بأن عمق الآبار في منطقة النقعة والتي تغذي المكلا بالمياه حوالي 180m .
- أفاد بأن الخزان المائي الذي يعتمد عليه بالمياه في غيل باوزير خزان سطحي مكون من الجبس .
- هناك تقارير سابقة عملت على المياه الجوفية في المكلا وخرائط هيدرولوجية عملت من قبل الشركات الروسية ومن قبل شركات أخرى موجودة في إدارة التوثيق والمعلومات -المركز الرئيسي هيئة المساحة الجيولوجية في صنعاء .

أنتهى الاجتماع

هذا والله ولي الهداية والتوفيق ؟؟؟

الاجتماع رقم (٩)

لقاء فريق الدراسة لتقييم الأثر البيئي لمصنع أسمنت المكلا

مع الأخ نائب مدير عام مكتب الأشغال العامة والطرق في المحافظة

أنه في يوم الأحد الموافق ٢٠٠٦/٤/٩م عقد فريق الدراسة وبحضور الاخ/ ثابت حسين السعدي منسق الهيئة العامة لحماية البيئة محافظة حضرموت - المكلا والاخ/ عبدالله حسين البيضاني منسق مشروع اسمنت الشركة العربية اليمنية للاسمنت المحدودة الاجتماع المشترك مع المهندس/ عادل الغريب نائب مدير عام مكتب الأشغال العامة والطرق محافظة حضرموت.

وكان ملخص المقترحات والآراء للأخ نائب مدير عام مكتب الأشغال العامة والطرق محافظة حضرموت الآتي :-

- بالنسبة لمنطقة العيون لا يوجد لها أي مخططات هندسية أو معمارية.
- بالنسبة للمقلب فإن المقصود به هو موقع لمعالجة المخلفات وليس مقلب لكب النفايات والمخلفات حيث تم حجز الموقع في الصلب لأن هناك مصنع لمعالجة المخلفات سوف يصل بعد فترة زمنية غير محددة .

أنتهى الاجتماع

هذا والله ولي الهداية والتوفيق ؟؟؟

الاجتماع رقم (١٠)

لقاء فريق الدراسة لتقييم الأثر البيئي لمصنع أسمنت المكلا

مع الأخ مدير عام مكتب الجهاز المركزي للإحصاء محافظة حضرموت أنه في يوم الأحد الموافق ٢٠٠٦/٤/٩م عقد فريق الدراسة وبحضور الأخ/ ثابت حسين السعدي منسق الهيئة العامة لحماية البيئة محافظة حضرموت - المكلا والأخ/ عبدالله حسين البيضاني منسق مشروع اسمنت الشركة العربية اليمنية للأسمنت المحدودة الاجتماع المشترك مع مدير مكتب الجهاز المركزي للإحصاء محافظة حضرموت. وكان هدف اللقاء الحصول على بعض المعلومات الإحصائية ذات الصلة وتم الحصول على المعلومات والبيانات المتوفرة .

الاجتماع رقم (١١)

لقاء فريق الدراسة لتقييم الأثر البيئي لمصنع أسمنت المكلا

مع الأخ مدير الشؤون المالية لفرع المؤسسة العامة للمياه والصرف الصحي المكلا. أنه في يوم الأحد الموافق ٢٠٠٦/٤/٩م عقد فريق الدراسة وبحضور الاخ/ ثابت حسين السعدي منسق الهيئة العامة لحماية البيئة محافظة حضرموت - المكلا والأخ/ عبدالله حسين البيضاني منسق مشروع اسمنت الشركة العربية اليمنية للأسمنت المحدودة الاجتماع المشترك مع مدير الشؤون المالية لفرع المؤسسة العامة للمياه والصرف الصحي المكلا . لم يتمكن فريق الدراسة من الحصول على المعلومات والبيانات ذات الصلة نظراً لعدم وجود المسؤولين المختصين في هذا المجال في تلك الفترة واستقبالنا من قبل مدير الشؤون المالية والذي قدم اعتذاره لتزويدنا بالمعلومات ذات الصلة لعدم اختصاصه في هذا المجال .