



Alba Power Station 5 Block 4 Supplementary ESIA Cumulative Impact Assessment

February 2023
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Table of contents

| | Page |
|---|------|
| 1 INTRODUCTION | 1 |
| 1.1 Background | 1 |
| 1.2 Assessment approach | 1 |
| 1.3 Impact assessment methodology | 2 |
| 1.3.1 Impact magnitude | 2 |
| 1.3.2 Receptor sensitivity | 3 |
| 1.3.3 Impact significance | 4 |
| 1.4 Project overview | 5 |
| 2 STAGE 1 – SPATIAL AND TEMPORAL BOUNDARIES | 7 |
| 2.1 Spatial project boundaries | 7 |
| 2.2 Temporal project boundaries | 9 |
| 3 STAGE 2 IDENTIFY RECEPTORS AND OTHER DEVELOPMENTS | 10 |
| 3.1 Valued Environmental and Social Components (VECs) | 10 |
| 3.2 Identification of third-party developments | 13 |
| 4 STAGE 3 RECEPTOR BASELINE | 18 |
| 4.1 Introduction | 18 |
| 4.2 Site setting | 18 |
| 4.3 Air quality | 21 |
| 4.4 Local noise environment | 23 |
| 4.5 Road users | 23 |
| 4.6 Social baseline | 26 |
| 5 ASSESS CUMULATIVE IMPACTS AND DETERMINE EFFECT SIGNIFICANCE | 27 |
| 5.1 Introduction | 27 |
| 5.2 Air quality | 28 |
| 5.2.1 Construction phase | 28 |
| 5.2.2 Operation phase | 29 |
| 5.3 Local communities | 30 |
| 5.3.1 Construction noise | 30 |
| 5.3.2 In-migration/social cohesion (construction phase) | 30 |
| 5.4 Road users | 31 |
| 5.4.1 Construction traffic | 31 |
| 5.5 Summary | 32 |

Tables

| | | |
|-----------|-------------------------------------|----|
| Table 1.1 | Impact magnitude factors..... | 2 |
| Table 1.2 | Impact magnitude guidance..... | 3 |
| Table 1.3 | Receptor sensitivity guidance | 4 |
| Table 1.4 | Impact classifications | 4 |
| Table 1.5 | Impact descriptions | 4 |
| Table 2.1 | AOIs relevant to assessment..... | 9 |
| Table 3.1 | Identification of VECs..... | 10 |

| | | |
|-----------|--|----|
| Table 3.2 | VECS identified for the Block 4 construction and operation phases | 12 |
| Table 3.3 | Third party developments..... | 13 |
| Table 4.1 | Project sensitive receptors (Envirotech 2022)..... | 18 |
| Table 5.1 | Identification of potential inter-project cumulative impacts of Block 4 construction phase | 27 |
| Table 5.2 | Identification of potential inter-project cumulative impacts of Block 4 operation phase | 28 |
| Table 5.4 | Summary of potential project cumulative impacts | 33 |

Figures

| | | |
|------------|---|----|
| Figure 1.1 | Steps to be taken in the RCIA..... | 1 |
| Figure 1.2 | PS5 Block 4 location | 6 |
| Figure 2.1 | Area of influence | 8 |
| Figure 4.1 | Sensitive receptors (Envirotech, 2022)..... | 20 |
| Figure 4.2 | Baseline air and noise monitoring locations | 22 |
| Figure 4.3 | Local road network..... | 25 |

Table of abbreviations

| | |
|-------|---|
| AAQMS | Ambient Air Quality Monitoring Station |
| AOI | Area of Influence |
| APC | Aromatics Production Complex |
| BMP | Bapco Modernisation Programme |
| BNLR | Bahrain Northern Link Road |
| CCGT | Combined Cycle Gas Turbine |
| CIA | Cumulative Impact Assessment |
| EACS | Environment Arabia Consultancy Services WLL |
| ESG | Environmental Social and Governance |
| ESIA | Environmental and Social Impact Assessment |
| ESLR | East Sitra Link Road |
| IFC | International Finance Corporation |
| PS5 | Power Station 5 |
| RCIA | Rapid Cumulative Impact Assessment |
| SCE | Supreme Council for Environment |
| TMP | Traffic Management Plan |
| VEC | Valued Environmental Component |

1 INTRODUCTION

1.1 Background

Environment Arabia Consultancy Services has been appointed by Aluminium Bahrain (Alba) to undertake a Cumulative Impact Assessment (CIA) as part of a Supplementary Environmental and Social Impact Assessment (ESIA) for an expansion of the existing Power Station 5 (PS5) within the Alba complex.

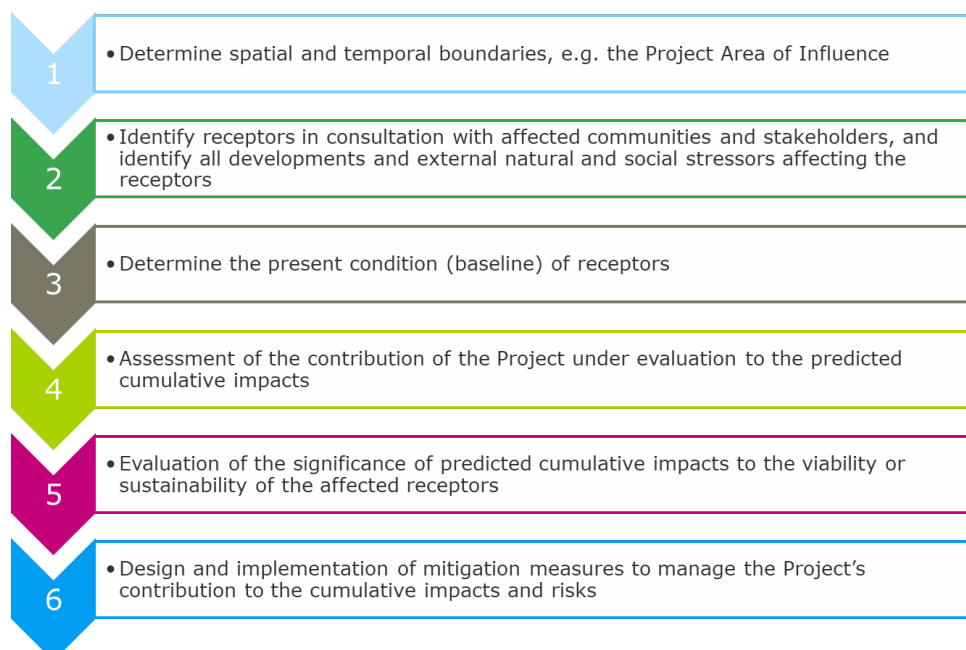
An ESIA was undertaken for the expansion (Power Station 5 Block 4) by Envirotech in 2021 culminating in the submission of the ESIA Report in January 2022 to the Supreme Council for Environment (SCE) for the purposes of securing an environmental permit (Environmental and Social Impact Assessment Study, Alba Power Station 5 – Block 4, Doc No. ENV-RJC-20-00070-PS5/ESIA-01, January 2022). Alba is seeking international funding for the project and hence the ESIA was reviewed by the potential lender’s environmental consultants. Subsequent to the review, an addendum was prepared in September 2022. Gaps were identified in the Addendum and further information/study is still required to satisfy lender’s requirements.

This report presents the CIA which comprises an analysis of the predicted environmental and social impacts relating to the PS5 Block 4 Project and the contribution of these predicted impacts to potential cumulative affects when combined with impacts associated with relevant future planned developments in the Project’s Area of Influence.

1.2 Assessment approach

This CIA follows the method given in ‘Good Practice Handbook Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets’, IFC, August 2013 for the preparation of a Rapid CIA (RCIA) which is the appropriate method to assess the cumulative impacts for a single private development project. The RCIA logical framework has been used which comprises an iterative six-step process as shown in Figure 1.1.

Figure 1.1 Steps to be taken in the RCIA



1.3 Impact assessment methodology

The potential cumulative impacts will be assessed using the following methodology.

1.3.1 Impact magnitude

The magnitude of an impact is a measure of the scale of a change from baseline conditions for a receptor. This measure of change can be described by considering the following factors in combination:

- Extent: spatial extent (e.g. habitat impacted) or population extent (e.g. proportion of the population/community affected);
- Duration: period over which an impact will interact with a receptor;
- Frequency: how often the impact will occur; and
- Reversibility: restoration of the pre-impact status of a receptor.

For each impact, a decision needs to be made as to its extent, duration, frequency and reversibility based on the definitions provided in **Table 1.1**.

Table 1.1 Impact magnitude factors

| Factors | Elements | Explanation |
|-----------|---------------|--|
| Extent | Local | Impacts that affect receptors in areas close to the source of impact, e.g. within a radius of 10km from a project boundary. |
| | Regional | Impacts that affect receptors beyond the defined local level, but are not experienced at the national level. |
| | National | Impacts that affect receptors at a national level. |
| | Transboundary | Impacts that affect receptors beyond the boundaries of the country in which the project is located. |
| Duration | Short-Term | Impacts that are predicted to last only for a limited period (e.g. noise during the period of a certain construction activity that will occur only during a six-month period), but will cease either on completion of the activity or soon afterwards. |
| | Medium-Term | Impacts that are predicted to last for a longer period. Examples include impacts occurring during a period of extended construction activities which may occur over two to three years. |
| | Long-Term | Impacts that are predicted to continue over an extended period, (e.g. noise from operation of a development, impacts from operational discharges or emissions). These include impacts that may be intermittent or repeated rather than continuous if they occur over an extended period (e.g. impacts resulting from annual maintenance activities). |
| | Permanent | Impacts that will continue for the full life-cycle of the Project, and potentially indefinitely. |
| Frequency | Infrequent | Impacts are predicted to be rare in nature over a certain period. |
| | Periodic | Impacts are predicted to be recurring over a certain period. |

| Factors | Elements | Explanation |
|---------------|--------------|---|
| | Constant | Impacts are predicted to be permanent during a certain period. |
| Reversibility | Irreversible | Impacts that cause a permanent change in the affected receptor. |
| | Reversible | Impacts that cause an impermanent change in the affected receptor. Restoration of the pre-impact status of a receptor is possible through mitigation/reinstatement measures and/or natural recovery. The time periods over which impacts may reverse link to the duration over which an impact is experienced (see 'Duration' above). |

The next step is to determine the impact magnitude itself. **Table 1.2** provides criteria to be used to determine the impact magnitude.

Table 1.2 Impact magnitude guidance

| Magnitude | Criteria |
|------------|--|
| High | Prominent impacts which are: Extent: national or transboundary Duration: long-term Frequency: constant Reversibility: irreversible |
| Medium | Noticeable impacts which are: Extent: regional Duration: medium-term Frequency: periodic to constant Reversibility: reversible |
| Low | Limited impacts which are: Extent: local Duration: short-term Frequency: infrequent to periodic Reversibility: reversible |
| Negligible | No discernible impact. Receptor change is essentially indistinguishable from natural background variation. |

1.3.2 Receptor sensitivity

Once the respective magnitudes of each impact have been allocated the next step is to determine receptor sensitivity. Receptor sensitivity is based on two components:

- The degree to which a receptor is resilient to a change; and
- The value attributed to the receptor by stakeholders or applicable regulations/policies.

Receptor resilience takes into consideration not only activity-receptor-impact pathways, but also the characteristics of a receptor that might make it more or less resilient to change. As such, a receptor can be considered as existing within a spectrum of vulnerable to resilient.

Receptor value takes into consideration its importance as represented, for example, by its conservation status, its socio-cultural importance and/or its economic value. Certain receptors are deemed to be of greater importance than other receptors. For each impact, receptor sensitivity must be determined using the criteria in **Table 1.3**.

Table 1.3 Receptor sensitivity guidance

| Sensitivity | Description |
|-------------|---|
| High | High significance to quality of life, health, habitat, flora and fauna, or ecosystem service. |
| Medium | Medium significance quality of life, health, habitat, flora and fauna, or ecosystem service. |
| Low | Low significance to quality of life, health, habitat, flora and fauna, or ecosystem service. |
| Negligible | Negligible significance to quality of life, health, habitat, flora and fauna, or ecosystem service. |

1.3.3 Impact significance

To calculate the level of significance, the product of impact magnitude and receptor sensitivity is considered as presented in **Table 1.4**, and the impact descriptions are presented in **Table 1.5**.

Table 1.4 Impact classifications

| | | Sensitivity | | | |
|-----------|------------|-------------|------------|------------|------------|
| | | Negligible | Low | Medium | High |
| Magnitude | Positive | Beneficial | Beneficial | Beneficial | Beneficial |
| | High | Negligible | Moderate | Major | Major |
| | Medium | Negligible | Minor | Moderate | Major |
| | Low | Negligible | Minor | Minor | Moderate |
| | Negligible | Negligible | Negligible | Negligible | Negligible |

Table 1.5 Impact descriptions

| Impact significance | Impact characteristic |
|---------------------|---|
| Beneficial | The effect or impact would be beneficial for environmental and/or social receptors. |
| Negligible | Either no impact or the impact is neutral (neither adverse nor beneficial). |
| Minor Adverse | The impact is small and of little concern; it is undesirable but acceptable. |
| Moderate Adverse | The impact gives rise to some concern but is likely to be tolerable in the short-term (e.g. during the construction phase) or would require a value judgement as to its acceptability. |
| Major Adverse | The impact is large-scale, giving rise to great concern; it should be considered unacceptable and requires mitigating, compensating or a significant change to the development if no alternative is available. If no mitigation is possible, then the impact would require a value judgement as to its acceptability. |

1.4 Project overview

Alba currently has five power stations PS1 to PS5. PS5 was commissioned between 2019 and 2020 and consists of 3 Combined Cycle Gas Turbines (CCGTs). With the implementation of PS5, PS1 was largely decommissioned and is no longer operational, PS2 is non-operational, but is being kept in a black start state as emergency reserve capacity, and the need for PS3 and PS4 has vastly reduced and so they are not used to their full capacity.

Alba propose to expand PS5 by adding a block (Block 4) to increase the capacity from 1,800 MW to 2,481 MW. The efficiency of the CCGT is superior when compared to the existing PS3 and PS4 combined. Following the construction of Block 5, PS3 will be shut down and will be kept as emergency standby and PS4 will be partially operated.

Block 4 will be constructed to the immediate south of PS5 on land that was used as a construction laydown area during construction of PS5 (**Figure 1.2**). The site is approximately 20,000m². The Project laydown yard is located to the south of the Al Dur Power Station (**Figure 1.2**).

It is anticipated that up to 1,500 workers will be required to construct the Project. They are being housed in existing purpose-built accommodation south of the Al Dur Power Station within the laydown yard shown on **Figure 1.2**.

Construction commenced in July 2022 and is expected to last approximately 2 years including commissioning and testing. The commercial operation date is expected to be 29th June 2024. The operation lifetime of Block 4 is approximately 25 years.



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| | | | |
|----------------|--|--------------|---------------|
| LEGEND: |  Project location (PS5 Block 4 & Al Dur laydown yard) | | NORTH ARROW: |
| FIGURE TITLE: | Project plan | DATE: | February 2023 |
| PROJECT TITLE: | Alba Power Station 5 Block 4 Supplementary ESIA | DATUM: | 1.2 |
| | | PREPARED BY: | MS |
| | | SCALE (A4): | 1:115,826 |

NORTH ARROW:



2 STAGE 1 – SPATIAL AND TEMPORAL BOUNDARIES

2.1 Spatial project boundaries

The spatial scope of the CIA is based on the environmental and social study areas presented in the ESIA (Envirotech, 2022), the results of the impact assessments undertaken in both the ESIA and its addendum, local knowledge of the study area and professional judgement. Furthermore, in accordance with International Finance Corporation (IFC) guidance, the areas that will be directly affected by the Project have been taken into consideration.

Figure 2.1 presents the Areas of Influence (AOIs) and **Table 2.1** provides a summary. The Project is set within an existing industrial plant in an industrial area of Bahrain.

The air quality modelling undertaken for the ESIA, predicted that the air quality impact zone during operations will extend across a radius of 5km from the power station site. Emissions to air from the power station will combine with emissions from other industrial sources in the area to create cumulative impacts on air quality.

The AOI for construction dust is described as 500 m from the source in the Project ESIA. However, the UK Institute of Air Quality Management (IAQM, 2014) sets a screening limit of 350m for emissions of dust from construction sites. Therefore, a distance of 350 m has been used for screening potential overlapping projects.

For the impact of road traffic emissions, the UK Highway Agency guidance (Highway Agency, 2007) indicates that road traffic emissions reduce to background values within 200 m of the road centre and this distance has been used to screen for cumulative impacts.

Background noise levels in the area are close to or exceed the local standard of 70 dBA for industrial areas. The ESIA states that the nearest noise sensitive receptor to the site is 650 m to the north. For the construction phase, predicted noise levels were calculated up to a distance of 1 km from Block 4, but for operation, no specific distance was stated although modelling does cover the sensitive receptor to the north. Similarly, to construction dust, noise emissions will be limited to localised impacts as noise emissions reduce with distance according to the inverse square law. An AOI of 1 km has been determined for noise impacts.

The spatial boundaries with respect to social impacts comprise the whole of Bahrain with respect to economic and employment impacts. With respect to other social impacts such as demand on public services these may have local as well as national impacts. There are several residential communities within the AOI for Block 4 which are Riffa Views (2.5 km) and Awali (4.5 km) to the north west, East Riffa (3 km) and Nuwaidrat (4.5 km) to the north, Ma'ameer (4 km) to the north-north east, and the village of Askar (3.5 km) to the south. There are also worker accommodation blocks to the north of the site on the northern side of Highway 96 approximately 750 m away and within Ras Zuwayed to the east across King Hamad Highway. There are several light industrial commercial properties bordering Alba to the west. The Project sensitive receptors are provided in **Section 4, Table 4.1**.

With respect to road users, impacts have been considered on local roads during the construction phase, specifically King Hamad Highway, Highway 96, the local roads within the South Alba Industrial Estate and Road 5146. There are no operational traffic impacts predicted because no additional vehicle movements are required for the operation of Block 4.

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




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| LEGEND: | | NORTH ARROW: | |
|---|-------------------------------|---|---------------------------------------|
|  | Project location |  | (3) 200 m radius from road centreline |
|  | (1) 5 km radius from Block 4 |  | (4) 1 km radius from Block 4 |
|  | (2) 350 m radius from Block 4 |  | (5) Construction vehicle routes |
| FIGURE TITLE: | | DATE: | DATUM: |
| Area of influence | | February 2023 | 2.1 |
| PROJECT TITLE: | | PREPARED BY: | SCALE (A4): |
| Alba Power Station 5 Block 4 Supplementary ESIA | | MS | 1:130,276 |


NORTH ARROW: 

Table 2.1 AOIs relevant to assessment

| AOI No. | Parameter | Notes |
|---------|------------------------------------|---|
| 1 | Air Quality Stack Emissions | 5 km radius from Block 4 based on air quality modelling |
| 2 | Air Quality Construction Dust | 350 m radius from Block 4 |
| 3 | Air Quality Road Traffic Emissions | 200 m from road centreline |
| 4 | Noise | 1 km radius from Block 4 |
| 5 | Construction traffic | Based on construction vehicle routes provided by the contractor |

2.2 Temporal project boundaries

Temporal boundaries for the analysis were set considering the following information:

- Construction phase (including commissioning & testing): 2-year period;
- Operation phase: 25 years;
- Bahrain 2030 National Land Use Plan.

Decommissioning activities associated with the Project are unknown and will be assessed as part of any future decommissioning assessments and closures plans. Decommissioning activities are scoped out of this CIA.

The assessment includes planned developments up to 2030 as the current national plan runs to that date. Beyond 2030 details of further developments are not known.

3 STAGE 2 IDENTIFY RECEPTORS AND OTHER DEVELOPMENTS

3.1 Valued Environmental and Social Components (VECs)

The IFC CIA guidance documents note that “VECs for which the project will have no direct or indirect impact do not need to be the subject of CIA. Priority should be given to those VECs that are likely to be at the greatest risk from the development’s contribution to cumulative impacts”.

The ESIA and addendum have been reviewed to identify those impacts that warrant inclusion in the CIA based on their impact significance (e.g. minor, moderate, major) (**Table 3.1**). Where residual impacts are negligible or where an impact has not been included in the ESIA, but it is thought that it should be assessed in the CIA based on professional judgement, this is noted in the Table. The relevant VECs are noted in each case.

Table 3.1 Identification of VECs

| Construction phase | Residual impact | Reason/comment | VEC |
|---|---|---|-------------------|
| Air quality | | | |
| Construction phase dust | Negligible | Negligible but could interact with other projects in close proximity | Air quality |
| Construction emissions | Negligible | Could interact with other projects in close proximity | Air quality |
| Noise | | | |
| Construction noise during the day | Minor adverse | Closest receptor to the project site is 650 m to the north; there could be impact on receptors from other projects | Local communities |
| Traffic and access | | | |
| Transport of oversized loads, other equipment and personnel to site | Minor adverse | Potential for interaction with other projects. Ongoing congestion in the project area especially on King Hamad Highway | Road users |
| Social and community | | | |
| Impact on local communities from an influx of expatriate labourers | Not assessed in ESIA | Disturbance to local communities from the presence of project workers. Workforce will most likely be housed in dedicated labour accommodation | Local communities |
| Operation phase | | | |
| Air quality | | | |
| Direct stack emissions (CO, NO ₂ , SO ₂) | CO: winter & summer - insignificant SO ₂ & NO ₂ : winter & summer - moderate adverse | Air emissions will combine with emissions from other developments in the AOI | Air quality |

| Operation phase | Residual impact | Reason/comment | VEC |
|-----------------------------|--|---|-------------|
| Operation vehicle emissions | Not assessed in ESIA as no additional traffic generated during operation | Operation phase traffic emissions will not be included in the CIA | Air quality |

Based on the issues identified through stakeholder engagement and the residual impacts of the ESIA, the VECs identified in relation to the AOIs are summarised in **Table 3.2** for the construction and operational phases of the Project respectively.

Block 4 will be operated by existing staff at PS5 and so no additional workers are required during operation. No additional vehicle movements are anticipated during operation; the levels will be as for the existing PS5.

Table 3.2 VECS identified for the Block 4 construction and operation phases

| VEC | Block 4 impact | AOI1 | AOI2 | AOI3 | AOI4 | AOI5 | AOI6 | Block 4 Project Site |
|---------------------|---|--------------------|---------|-----------------|-------|----------------------|-------------------|----------------------|
| | | AQ stack emissions | AQ dust | AQ road traffic | Noise | Construction traffic | Local Communities | |
| Construction | | | | | | | | |
| Air quality | Construction phase dust | | x | x | | | | x |
| | Construction vehicle emissions | | | x | | | | x |
| Local communities | Excessive noise emissions during the daytime | | | | x | | | x |
| | In-migration/social cohesion | | | | | | x | |
| Road users | Transport of oversized loads, other equipment and personnel to site | | | | | x | | |
| Operation | | | | | | | | |
| Air quality | Direct (stack) emissions | x | | | | | | x |

3.2 Identification of third-party developments

The future, third-party developments identified for consideration in the CIA are provided in Table 3.3. Third party developments have been screened to identify those with the potential to result in cumulative impacts when the spatial and temporal scope of the project is considered.

Where existing operational developments have been captured as part of the baseline for the Project, these have been scoped out of the CIA as any impacts will have been captured as part of the topic assessment baselines. Planned developments were screened subject to publicly available information.

Furthermore, due to the fact that the existing airshed is degraded (Section 4.3), the existing air quality has been included as a stressor for this CIA.

Table 3.3 Third party developments

| Project name | Status | Description | Screened in/out |
|-------------------------------------|--|--|--|
| Bapco Modernisation Programme (BMP) | Construction is in progress. Estimated operation date is 2023-2024 | A major expansion and upgrade of the Bapco Refinery, located in close proximity to Alba to the north east. The BMP will include the construction of several new process units and auxiliary plants, alongside the revamping of existing process facilities. The BMP will also require changes and development of Sitra Tank Farm, Sitra Wharf and the transfer pipelines between the Refinery and the Sitra facilities. | Screened in |
| Alba Line 7 | Planned | Feasibility study for Line 7 was awarded on 5 th December 2022. The study is expected to take 9 months and be completed in September 2023. The study will provide a comprehensive evaluation of all the factors to determine the viability of the project. Sanction of this potential Project will depend on the results of the feasibility study and therefore no dates for the start of construction are available. | Screened in |
| Bahrain Metro | Planned with a predicted operational start of 2028 | The Metro will have a total length of 109 km that will be developed in phases. The length of Phase 1 is 29 km and will include an elevated corridor with 20 stations which will be operated through two lines. Phase 1 (the Red Line) will run from Seef, via Manama, to Bahrain International Airport, while the Blue Line will run from Juffair, via the Diplomatic Area, Manama, Al Farouq Junction and Salmaniya, to Isa Town Educational Area. Phase 2 of | Screened out – no spatial overlap for Phase 1 and unknown spatial area for Phase 2 |

| Project name | Status | Description | Screened in/out |
|---|--|--|---|
| | | the scheme is not yet in the public domain. | |
| Aromatics Production Complex (APC) | Development not approved; no precise timeframe available. Maybe an overlap with Block 4 construction | Development of the APC will include the construction of an aromatics plant with a capacity of 1.44 million tonnes, producing products such as ethylene glycol, and ethylene. The APC will be integrated within the BAPCO refinery which will supply feedstock for the complex. | Screened in (although no programme information available) |
| South West Sewage Treatment Plant | Planned – Design phase | The Ministry of Works, Municipalities Affairs and Urban Planning, represented by the Sanitary Engineering Projects and Planning Directorate, is planning the construction of a Sewage Treatment Plant to serve the southwest part of the Kingdom of Bahrain. It is planned to be located in Hourat Ingah, near Al Areen Wildlife Park (outside of the Field), on a parcel of land approximately 12 hectares in extent. | Screened out – no spatial overlap |
| Future International Marine Fibre Telecommunications projects | Planned | Future International Marine Fibre telecommunication projects, covering all regions of Bahrain with Broadband services, development of the international land and sea fibre optic lines, establish several data centres for cloud computing. | Screened out – no spatial overlap |
| Bahrain Northern Link Road (BNLR) | Planned | The BNLR will be spread between the Bahrain Bay development and the proposed second causeway (King Hamad) linking the Kingdom of Saudi Arabia with Bahrain. It will provide transportation and infrastructure corridors for the planned strategic housing and investment projects along the north periphery of Bahrain. A large extent of the BNLR will be reclaimed from the sea and will pass through some islands that are reclaimed but not currently populated; however, the supporting links and local access roads will be passing through heavy residential areas along the northern coastline. The BNLR will be approximately 29.5 km in length with a corridor width of 150 m. | Screened out – no spatial overlap |
| King Hamad | Planned | King Hamad Causeway, the second bridge linking the Kingdom of Bahrain | Screened out – no spatial |

| Project name | Status | Description | Screened in/out |
|--|---------|---|--|
| Causeway | | and the Kingdom of Saudi Arabia, will run parallel to the existing King Fahd Causeway. The bridge's length is estimated to be 25 kms and will have four lanes for car and a two-track railway. The project will link the two countries through the passenger terminal in Dammam in Saudi Arabia, to King Hamad International Station in the Ramli area in Bahrain. This project is led by the Ministry of Transportation and Telecommunications. | overlap |
| 5 new cities: Fasht Al Jarim, Hawar Islands, Fasht Al Adhm, Sunhaila Island, and Gulf of Bahrain | Planned | The total area of these five new areas in Bahrain is 387 km ² , which will be divided between residential, industrial, investment, recreational and tourist areas. The development will expand Bahrain's land mass by 60%. The closest island is approximately 5km from Alba in the sea. Baseline studies and environmental sensitivity analysis being undertaken at present. Construction not expected to start for at least 3-5 years. | Screened out – no spatial overlap |
| Freight Railway Corridor: South of Bahrain to Khalifa Bin Salman Port Hidd Area | Planned | The Ministry of Transport and Telecommunications is currently in the preliminary phase of studying the feasibility of a freight railway corridor connecting the South of Bahrain to the proposed freight yard at the Khalifa Bin Salman Port Hidd Area. This project makes up part of the Kingdom of Bahrain 2030 Transportation Masterplan aiming to enhance the transportation and logistics sector. The planning permission was submitted for the project to obtain the relevant stakeholder inputs to complete the feasibility study but the route is not publicly available. | Screened out (route unknown) |
| East Sitra Link Road (ESLR) | Planned | The ESLR will commence in the south of Um Al Hassam at the Mina Salman junction and terminate at the junction of King Hamad Highway and Highway 96 adjacent to Alba. As part of this project there will be widening of Highway 96 and King Hamad Highway and improvements to the critical intersections of: <ul style="list-style-type: none"> King Hamad Highway and Highway 96; | Information on timescales not publicly available but due to the complexity of the project and the fact that it is adjacent to Alba it is screened in |

| Project name | Status | Description | Screened in/out |
|---|---|---|--|
| | | <ul style="list-style-type: none"> Highway 96 and Alba North Gate; Al Bandar Resort and Alba Haul Road; and Um Al Saad intersection. | |
| Alumicor Bahrain W.L.L. – Aluminium Dross and Dross Residue Recycling Plant | Construction commenced in November 2022. Expected to be operational by March 2024 | <p>Alumicor is planning to establish a dross and residue recycling plant to recycle the dross residues and thus avoiding the landfilling of dross recycling waste in the Kingdom of Bahrain.</p> <p>The project will be implemented in two phases. Each phase will have a dross processing capacity of 30,000 MT. The implementation will be as follows:</p> <ol style="list-style-type: none"> Phase 1: November 2022 – September 2023 Phase 2: November 2023 – March 2024 | Screened in |
| UCO Steel Company W.L.L. – Aluminium Scrap Recycling Plant | EIA is in progress. Will be operational in 2023 | The UCO steel plant is an existing factory located in Al Mazara'a Industrial Park (previously known as South Alba Industrial Area). The steel plant components will be removed and an aluminium scrap recycling plant will be established within the existing plant building. | Screened in |
| Siddhi Manufacturing W.L.L. – Aluminium Dross and Dross Residue Recycling Plant | Construction in progress. Operational by 2023 | 1,000 MT per month Aluminium Dross and Dross Residue Recycling Plant under construction in Ras Zuwayed Area. Operation is expected to be in the first quarter of 2023. | Screened out – already being constructed, therefore included in the baseline in the ESIA |
| Energy Recyclers – Aluminium Dross Recycling Plant | Planning Stage – Operational by Q4 2023 | <p>The scope of the Project is to build and operate a plant for the recycling / treatment of the following waste streams through an innovative and environmentally friendly process using bio-solvents:</p> <ol style="list-style-type: none"> Aluminium dross from smelter and downstream aluminium industries; Oil sludge and waste, oil contaminated sand, and oil from tank cleaning; and Carbon dust from aluminium industries. | Screened in |

On the basis of the screening information provided in **Table 3.3**, the following projects have been included in the CIA:

- BMP;
- Alba Line 7;
- APC
- ESLR;
- Alumatic Bahrain – Aluminium Dross and Dross Residue Recycling Plant;
- UCO Steel Company – Aluminium Scrap Recycling Plan; and
- Energy Recyclers – Aluminium Dross Recycling Plant.

4 STAGE 3 RECEPTOR BASELINE

4.1 Introduction

A series of environmental baseline surveys were undertaken and secondary data was gathered during the Project ESIA and subsequent additions. For the VECs that have been screened into the CIA, the baseline conditions are summarised in the following sections. For all VECs, more detailed baseline information is provided in the topic specific impact assessments within the Project ESIA (Envirotech, 2022).

4.2 Site setting

Block 4 will be constructed within the confines of the existing Alba site boundary to the immediate south of the existing PS5. The proposed development land was utilised during the construction of PS5 as a construction laydown yard with offices, canteen, medical facilities, toilets and washing facilities, site storage and waste management.

Alba is located within an industrial area of Bahrain. To the north there are industrial facilities and labour accommodation blocks, to the east is the Bapco Refinery including the BMP, to the south is the Al Mazara'a Industrial Park which contains a wide variety of industry, and to the west there are light industrial facilities. The Project ESIA presents the sensitive receptors which are provided in **Table 4.1** and shown on **Figure 4.1**.

Table 4.1 Project sensitive receptors (Envirotech 2022)

| Receptor ID | Receptor | Type | Description |
|-------------|-----------------------|------------------------|---|
| SNR 1 | Camp Areas | Residential/commercial | Accommodation camp and commercial area located ~ 700 m north |
| SNR 2 | Camp Areas | Residential/commercial | Accommodation camp and commercial area located ~ 750 m north |
| SNR 3 | Riffa Views | Residential/commercial | Residential area and recreational facilities located ~ 2.75 km west |
| SNR 4 | Princes Sabeeka Oasis | Conservation area | Conservation area located 1.7 km south east within the Alba complex |
| SNR 5 | BSPCA | Animal welfare | Animal protection centre located 2 km south |
| SNR 6 | Camp Areas | Residential/commercial | Accommodation camp and commercial area located ~ 2 km south |
| SNR 7 | Askar Village | Residential/commercial | Residential and commercial area located 3.5 km south east |
| SNR 8 | Camp Areas | Residential/commercial | Accommodation camp and commercial area located ~ 2.7 km south east |
| SNR 9 | Camp Areas | Residential/commercial | Accommodation camp and commercial area located ~ 2.2 km east |
| SNR 10 | Camp Areas | Residential/commercial | Accommodation camp and commercial area located ~ 1.7 km north east |
| SNR 11 | Ma'ameer Village | Residential/commercial | Residential and commercial area located 4.2 km north east |

| Receptor ID | Receptor | Type | Description |
|-------------|----------------------|----------------------------|--|
| SNR 12 | Riffa | Residential/ commercial | Residential and commercial area located 4 km north |
| SNR 13 | Tatweer Petroleum | Offices | Tatweer Petroleum headquarters local 2.7 km south west |
| SNR 14 | Muaskar Camp | Defence | Bahrain Defence Camp located 1.4 km north |

458000

460000

462000

2890000

2890000

2888000

2888000

2886000

2886000

2884000

2884000

2882000

2882000



458000

460000

462000





CLIENT:

 Aluminium for the world

CONSULTANT:

 Environment Arabia

| | | |
|----------------|---|---|
| LEGEND: |  Sensitive receptors | NORTH ARROW:  |
| FIGURE TITLE: | Location of sensitive receptors | |
| PROJECT TITLE: | Alba Power Station 5 Block 4 Supplementary ESIA | DATE: February 2023 |
| | | DATUM: 4.1 |
| | | PREPARED BY: MS |
| | | SCALE (A4): 1:36,303 |

4.3 Air quality

The air quality baseline was monitored during the Project ESIA using passive sampler monitoring and by the installation of an ambient air quality monitoring station (AAQMS) (Scentinal SL 50). Passive samplers for CO, NO_x and SO₂ were deployed at six locations around the proposed site from 8 November 2020 to 6 December 2020 (Figure 4.2). The AAQMS was deployed within the proposed site for Block 4 between the 22 August 2021 and 11 September 2021.

The passive monitoring showed that there were slight exceedances in the annual mean guideline values for NO_x at West Point Home adjacent to Alba to the west, at the Princes Sabeeka Oasis and the BSPCA animal shelter. SO₂ concentrations exceeded the annual mean guideline value at all locations apart from the BSPCA shelter and Askar Village to the south east.

A summary of the results of the AAQMS are as follows:

- The hourly concentration of NO₂ was 56.6 ppb and the daily average concentration was 57.2 ppb. The recorded maximum hourly concentration was 155.6 ppb and the recorded maximum daily concentration was 85.74 ppb. Ten exceedances were recorded against the SCE and IFC standard of 106 ppb (hourly average) and one exceedance was recorded against the SCE standard of 80 ppb (daily average);
- The hourly concentration of SO₂ was 61.7 ppb and the daily average concentration was 62.6 ppb. The recorded maximum hourly concentration was 151.8 ppb and the recorded maximum daily concentration was 97.21 ppb. Seventeen exceedances were recorded against the SCE guideline value of 115 ppb (hourly average) and fifteen exceedances were recorded against the SCE standard of 48 ppb (daily average);
- The hourly average concentration of O₃ was 55.1 ppb and the 8-hours average concentration was 55.51 ppb. There were 63 exceedances of the SCE standard of 100 ppb (hourly average). There were fifteen and twenty-six exceedances of the SCE 8-hour average standard of 76 ppb and the IFC standard of 50 ppb respectively;
- The hourly average concentration of CO was 0.43 ppm and the 8-hour average concentration were 0.44 ppm. The maximum hourly concentration was 2.5 ppm and the maximum 8-hour average concentration was 1.38 ppm. No exceedances of any standards were recorded;
- The daily average concentration of PM₁₀ was 48.43 µg/m³ and the maximum daily concentration observed was 68.2 µg/m³. Six exceedances were recorded against the IFC standard of 50 µg/m³ and no exceedances of the SCE standard of 340 µg/m³.
- The daily average concentration of PM_{2.5} was 45.71 µg/m³ and the maximum daily concentration observed was 65.5 µg/m³. Twenty-one exceedances were recorded against the IFC standard of 25 µg/m³ and there were five exceedances of the SCE standard of 50 µg/m³.



CLIENT: **alba**
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| | | | |
|----------------|---|-----------------|----------------------|
| LEGEND: | | | |
| FIGURE TITLE: | Air quality and noise monitoring locations | | DATE: February 2023 |
| PROJECT TITLE: | Alba Power Station 5 Block 4 Supplementary ESIA | | DATUM: 4.2 |
| | | PREPARED BY: MS | SCALE (A4): 1:26,686 |

NORTH ARROW:

4.4 Local noise environment

The main noise sources in the vicinity of the Block 4 site are the existing PS5, Potline 6, light industry to the west of the site and road traffic noise. A noise monitoring survey was undertaken as part of the Project ESIA on 19 and 20 November 2020 at 6 locations around the site (**Figure 4.2**).

The weekday, daytime average noise levels (L_{Aeq}) ranged from 61.8 dB(A) to 74.0 dB(A) and at night the average noise levels (L_{Aeq}) ranged from 60.6 dB(A) to 73.2 dB(A). There was little difference in the levels experienced during the day and night.

There was little change in the weekend noise levels from the weekday levels. At the weekend in the day the L_{Aeq} ranged from 58.4 dB(A) to 72.5 dB(A); no monitoring was conducted at night for the weekend.

The noise levels recorded are very close to the guideline value limit of 70 dB(A) for industrial classified areas, and at some sites and times they exceeded this value.

4.5 Road users

The Kingdom of Bahrain has a highly developed road traffic network and there are several road and rail infrastructure projects being considered such as the Bahrain Metro, King Hamad Causeway (a second road and rail crossing between Saudi Arabia and Bahrain) and the East Sitra Link Road.

The road density in Bahrain, which has been tracked across all GCC countries since 2015, is considered relatively high on a regional basis. During this time period, the road density was about 582 per 100 km², compared to 5 per 100 km² in the United Arab Emirates (UAE)¹. The second highest density within the GCC is Qatar, which has a density of 85 per 100 km². Bahrain also has a relatively high car ownership rate, which has been reported in the media as being 342 cars per 1,000 people, making it the third highest amongst the Arab nations, and 40th globally². The most recent car ownership data from 2019, provided by the General Directorate of Traffic, outlines that there were 711,000 vehicles registered in Bahrain which shows an upward trend as it was an increase of 10% on the previous year.

The high car ownership rates are also reflected in the fact that Bahrain is ranked 11th globally in terms of traffic congestion levels according to the Economist magazine³. This equates to 154.8 cars per kilometre of Bahrain's road network.

As discussed above, Bahrain, unlike larger Gulf countries, has a fully functioning, affordable and extensive public bus service which comprises a fleet of 140 buses across 29 bus routes, including peak time express routes. The take up of the service is also relatively high.

The main gate to the Alba complex is located off King Hamad Highway via a dedicated T-junction with traffic lights. The King Hamad Highway is an arterial carriageway running in a north-south direction commencing at Riffa power station and running to the tip of the island at Durrat Al Bahrain. It is considered the main access route from the north of the

¹ Statista (2022), Road density in the Gulf Cooperation Council from in 2015, by country, <https://www.statista.com/statistics/732351/gcc-road-density-by-country/> (Accessed 10 March 2022).

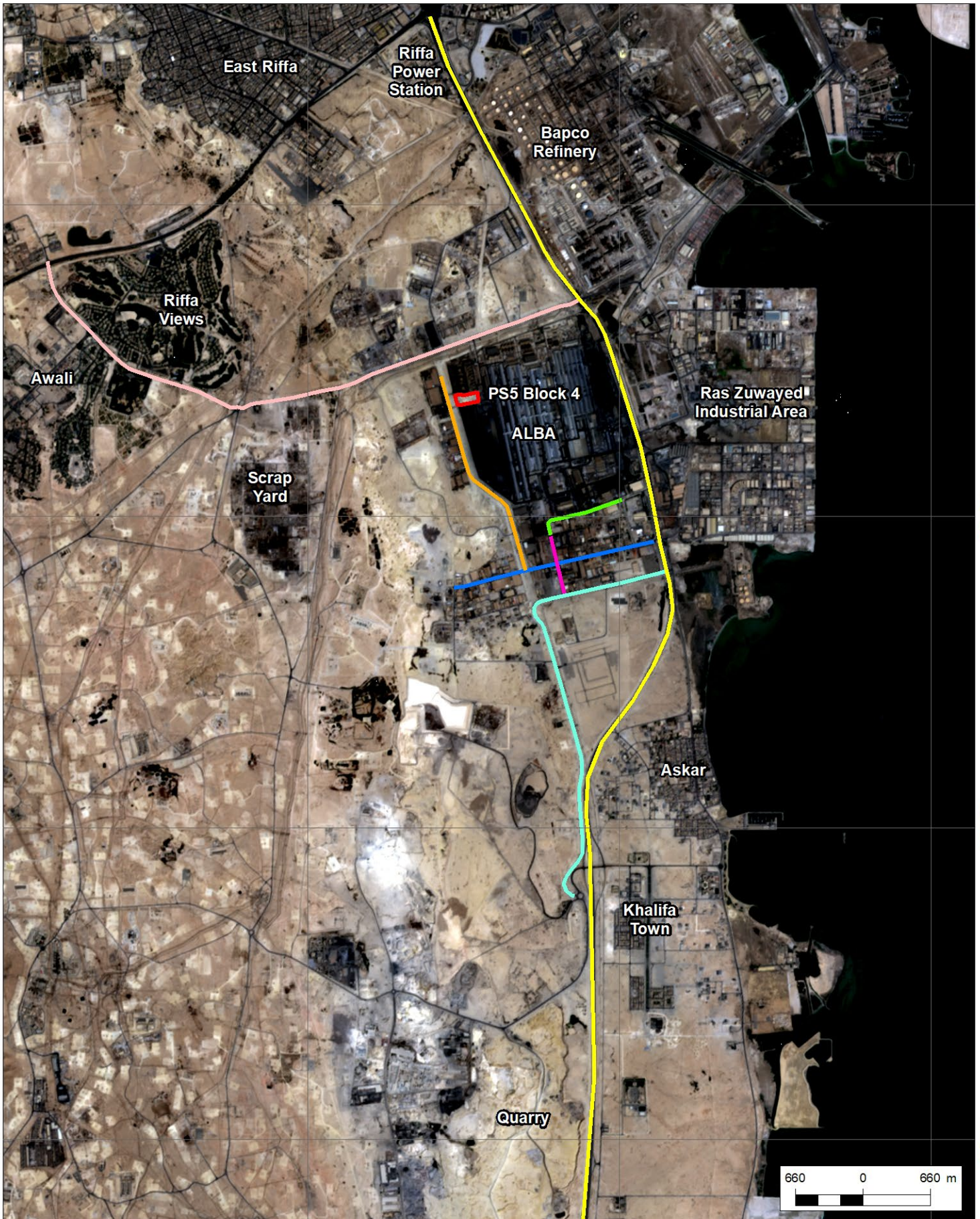
² News of Bahrain (2021). Bahrain has 343 cars per 1000 people. <https://www.newsofbahrain.com/bahrain/74797.html> (Accessed 10 March 2022).

³ News of Bahrain (2021). Bahrain ranked 11th globally in traffic congestion. <https://www.newsofbahrain.com/bahrain/75230.html> (Accessed 10 March 2022).

island to areas in the south such as Askar, Jaw, Al Dur and Durrat Al Bahrain. The Highway is often congested between its junction with Sh. Jaber Al Subah Highway north of Alba and its junction with Road 5156 south of Alba.

To the immediate north of the Alba complex is Highway 96. This road carries a considerable amount of industrial traffic and currently has a single lane in each direction.

Access to PS5 Block 4 is possible without going through the main gate of Alba via the industrial estate to the south of the Alba complex via Roads 5156, Road 5136 and Road 5146. These roads are all single carriageway and provide access to all the businesses and industries within the industrial estate. These roads are shown on **Figure 4.3**.



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LEGEND:

- King Hamad Highway
- Road 5135
- Road 5141
- Road 5156
- Highway 96
- Road 5136
- Road 5146
- Project location

NORTH ARROW:



FIGURE TITLE: Local road network

DATE: February 2023

FIGURE NO.: 4.3

PROJECT TITLE: Alba Power Station 5 Block 4 Supplementary ESIA

PREPARED BY: MS

SCALE (A4): 1:49,511

4.6 Social baseline

The Bahraini society is characterised by its cultural, ethnic and religious diversity. According to the official census for the year 2020 issued by the Central Informatics Organisation, the Kingdom of Bahrain had a total resident population of 1,501,635. Growth is driven by immigration and natural growth of the native population. Average life expectancy is increasing due to advances in health care and higher living standards increasing from 73.7 years in 2002, 74.9 years in 2010 to 77.1 years in 2016 (Source: United Nations). The Bahraini population is predominantly Muslim, both Sunni and Shi'a denominations.

The average literacy rate (both sexes expressed as percentage aged 15 years and above) was 85.5% in the year 2000 and 87.9% in the year 2005. However, in the year 2010 the average increased to 90%.

Approximately 72.4% of the labour force in Bahrain is comprised of non-Bahraini workers (mostly male) engaged in the private sector while the Bahraini work force is employed mostly in the public sector. Expatriate workers are mainly from Asian countries such as India, Pakistan, Bangladesh and the Philippines. Unemployment rates have slightly gone up from 3.6% in 2010 to 4.3% in 2016. Only 1% of the population is in the retirement age group (60-65) (CIO Website).

Economic activity in the economy of the Kingdom of Bahrain is diverse. The oil and natural gas sector is the largest contributor to the nation's Gross Domestic Product followed by the manufacturing sector, which in 2016 contributed 19.21% and 14.92% respectively. Although total revenue from the oil and gas sector dropped from 2,600.16 Million BD in 2013 to 1,436.46 Million BD in 2016, this is expected to change in the coming years with the most recent discovery of large oil reserves in Bahrain where 80 billion barrels of shale oil were discovered in 2018 (CIO Website).

Bahrain has four Governorates: Capital, Northern, Southern and Muharraq. Alba is situated in the Southern Governorate. The Southern Governorate is the largest of the four governorates and most diverse. Much of the Southern Governorate is open space and undeveloped land but there are also significant areas of industrialization, suburban development, educational and leisure facilities.

In addition to Alba, there are a number of important industrial sites within the Southern Governorate including Bapco, GPIC, Banagas (natural gas purification and processing), Al Dur (integrated desalination and power plant), Al Mazara'a Industrial Park and the Bahrain oil and gas field.

The Bahrain oil and gas field occupies much of the centre of the island and residential areas occupy the coastal zone (Hamad Town, Zallaq on the west coast, Jaww and Askar on the east coast and the new development of Durrat Al Bahrain to the south). The Southern Governorate also hosts important leisure and educational resources in the western area including Bahrain International Circuit, Bahrain University and equestrian facilities.

The population in the Governorate was estimated to be 305,547 in 2020 (Bahrain 2020 census).

5 ASSESS CUMULATIVE IMPACTS AND DETERMINE EFFECT SIGNIFICANCE

5.1 Introduction

A summary of the potential for cumulative impacts with the construction and operation of Block 4 and screened-in projects is provided in **Table 5.1** and **Table 5.2**. Where there is potential for a cumulative impact, the table cell has been shaded in green. The potential impacts are discussed in Sections 5.2 to 5.4.

Table 5.1 Identification of potential inter-project cumulative impacts of Block 4 construction phase

| Project | VECs | | | | |
|------------------|-------------------------|------------------------|--|------------------------------|---|
| | Air quality | | Local communities | | Road users |
| | Construction phase dust | Construction emissions | Excessive noise emissions during the daytime | In-migration/social cohesion | Transport of oversized loads, other equipment and personnel to site |
| BMP | N | Y | Y | Y | Y |
| Alba Line 7 | Y | Y | Y | Y | Y |
| APC | N | Y | N | Y | Y |
| ESLR | N | Y | Y | Y | Y |
| Alumicor Bahrain | N | Y | N | N | Y |
| UCO Steel | N | Y | N | N | Y |
| Energy Recyclers | N | Y | Y | N | Y |

Table 5.2 Identification of potential inter-project cumulative impacts of Block 4 operation phase

| Project | VEC |
|----------------------|--------------------------|
| | Air quality |
| | Direct (stack) emissions |
| BMP | Y |
| Alba Line 7 | Y |
| APC | Y |
| ESLR | N |
| Alumicor Bahrain | N |
| UCO Steel | N |
| Energy Recyclers | N |
| Existing air quality | Y |

5.2 Air quality

5.2.1 Construction phase

Considering the same principles as for the Block 4 dust screening assessment, i.e. the UK Institute of Air Quality Management screening limit of 350 m for emissions of dust from construction sites, the only known planned project that has the potential for a cumulative impact with Block 4 is Alba Line 7. The feasibility study for Line 7 has been recently awarded and is planned to take 9 months; construction is unlikely to start within the same timeframe as Block 4, but if it does then the potential cumulative impact is minor.

From time to time due to the local arid climate it is likely there will be short-term episodes of very poor air quality where dust levels may exceed 1000 µg/m³. In such circumstances, the natural dust levels will far exceed the worst case emissions of dust from the project and will be the dominant impact on air quality. In such circumstances the project health and safety officer will require that outside workers wear dust masks to mitigate the impact and in extreme circumstances may require outside work to be suspended. Dust generated during Project construction is considered to have potentially minor adverse cumulative impact

Emissions associated with the construction of the BMP and the smaller industrial projects planned in the area may interact with Block 4 PS5 construction emissions as there is some overlap in the project timeframes. The emissions from Block 4 PS5 construction will add to the load in the already degraded airshed, but the impact of this will be insignificant during construction. The local roads are heavily congested and waiting times at the traffic-light junction of Highway 96 and King Hamad Highway can be long exacerbating vehicle emissions. In this local area, there are limited sensitive receptors. There are potential receptors in terms of labour accommodation buildings, but these are likely to be too distant (+ 500 m) to be impacted and their occupants are

likely to be at work when emissions will be elevated. This impact is considered negligible.

As the ESLR and associated road improvements and the APC are not yet permitted and their schedules are uncertain, and due to the negligible nature of anticipated cumulative impacts, no additional mitigation beyond that in the ESIA is likely to be required. The emissions from the smaller projects in the area will be very minor and will not have a significant cumulative impact.

5.2.2 Operation phase

As stated in the air quality assessment baseline for the Project, the airshed is degraded and, on occasion, ambient concentrations of some pollutants (NO₂, SO₂, O₃, PM_{2.5} and PM₁₀) surpass Bahrain Standards and the World Health Organisation (WHO) guideline levels for ambient air quality. As well as Alba, existing industries such as the Bahrain Refinery have contributed to the degradation of local air quality. The degraded airshed has the potential to present risks to the health of humans.

The ESIA used computer modelling to model the stacks of Block 4 for CO, NO_x as NO₂ and SO₂. As discussed in Section 1, with the introduction of Block 4 to PS5, PS3 will be shut down and will be kept as emergency standby and PS4 will be partially operated. The scenarios modelled are as follows:

- Scenario 1A existing conditions, winter base case:
 - PS5 – 3 gas turbines and 3 steam turbines
 - PS4 – 4 gas turbines and 2 steam turbines
 - PS3 – 1 gas turbine and 1 steam turbine
 - PS2 – non-operational
- Scenario 1B existing conditions, summer base case:
 - PS5 – 3 gas turbines and 3 steam turbines
 - PS4 – 4 gas turbines and 2 steam turbines
 - PS3 – 2 gas turbines and 1 steam turbine
 - PS2 – non-operational
- Scenario 2A future conditions, winter base case
 - PS5 – 4 gas turbines and 4 steam turbines
 - PS4 – 2 gas turbines and 1 steam turbine
 - PS3 – non-operational
 - PS2 – non-operational
- Scenario 2B future conditions, summer base case
 - PS5 – 4 gas turbines and 4 steam turbines
 - PS4 – 4 gas turbines and 2 steam turbines
 - PS3 – non-operational
 - PS2 – non-operational

Modelled alone, the emissions from Block 4 do not exceed any of the relevant standards; however, when added to the already degraded baseline air quality, the model predicted that exceedances in air quality standards will occur. However, with the decommissioning of PS3 and PS4, there will be a reduction in overall emissions to air from Alba. The development and operation of additional industrial projects in the local area such as Alba Line 7, the BMP, the future-planned APC and the ESLR and associated road improvements will exacerbate this situation and a cumulative impact of moderate adverse can be expected.

The following measures are recommended based on the discussion between EACS and Alba ESG representatives on 01st February 2023:

- Undertake an air dispersion model using CALPUFF for the Alba complex to assess the impacts and contribution of process emissions to the local air shed. This can be included in the air quality impact assessment scope for Alba Potline 7 Expansion Project;
- Continue with the ambient air quality monitoring at following locations and identify exceedances at the monitoring locations:
 - north street (north east of Alba complex);
 - security north gate street (north west of Alba complex);
 - south street (south west of Alba complex);
 - forest street (south east of Alba complex);
 - Crown metals street (south side – outside Alba complex);
 - Manama textiles street (south west – outside Alba complex);
 - Road 442 (south west of Alba complex);
 - Road 443 (north west of Alba complex); and
 - Road 558A (west of Alba complex).
- discuss the issue of the degraded air quality with the SCE and recommend initiate an Air Capacity Study for the area including industries in the airshed;
- Prepare an annual report to submit to the lenders on the progress made and identify any exceedances;
- Develop a continuous improvement plan for Alba emissions.

As with the construction phase, from time to time there will be short-term episodes of very poor air quality due to high natural dust levels. However, during operation it will be much easier to manage the issue as there will be far less outside work required which will generally be able to be scheduled to avoid dust storms. Therefore, in the case of Block 4 operations the impact is considered negligible.

5.3 Local communities

5.3.1 Construction noise

Based on the AOI for noise, the upgrade of Highway 96 (as part of the ESLR Improvements) may interact with noise emissions from the Block 4 construction, potentially impacting the two sensitive receptors to the north of Block 4, both identified as labour accommodation buildings. However, the programme for the Highway 96 upgrade is unavailable and it may not coincide with the construction of Block 4. The potential impact of the improvements to Highway 96 alone could be moderate to major on properties to the north of the Highway, and the contribution from Block 4 minimal in comparison and at the nearest sensitive receptor no noise impacts were predicted from Block 4. The cumulative impact is assessed as negligible and no further mitigation is required.

The BMP project is outside the AOI for noise impacts and the cumulative impact is assessed to be negligible.

There may be some overlap between the Energy Recyclers Project to the north of Highway 96 and Block 4, but this is assessed to be negligible, given that these projects are nearly 0.9 km apart across a busy road.

5.3.2 In-migration/social cohesion (construction phase)

The workforce required for the construction of Block 4 is minor (1,500 no.) in comparison with some of the adjacent developments under construction such as the BMP (approx. 15,000), and the future planned APC, Line 7 and ESLR. The arrival of a large number

of workers in the local area creates the potential for a range of impacts on the local community such as:

- Workers may use the facilities and services in local communities, potentially reducing their availability or appeal for local residents. This could include recreational, medical and municipal infrastructure facilities;
- inappropriate behaviour by some workers resulting in significant consequences for the workers (e.g. deportation or jail). Disruptive or rude behaviour can cause significant offence and therefore it is important that workers understand what is deemed appropriate and behave accordingly. This is especially important when interacting with members of the opposite sex; and
- the spread of communicable diseases among local communities, which is particularly relevant for those people in the vicinity of worker accommodation.

The cumulative impact is assessed a negligible for in-migration/social cohesion. Site workers for Block 4 are housed in purpose-built accommodation units remote from residential communities and labourers for the BMP are housed in purpose-built accommodation buildings to the north close to the Sitra Tank Farm. Although the accommodation strategy cannot be known at this stage for future planned projects, it is likely that workers will be housed in either purpose-built blocks or existing accommodation blocks throughout the main southern industrial areas of Bahrain. These existing labour camps are removed from residential areas and supported by shops and services. There would be no direct links to local communities.

The worker accommodation for the Project should be inspected every 3 months to make sure that the following measures are in place:

- All immigrant construction workers should be housed in accommodation which meets in full the requirements of Ministerial Order No. 40 of 2014 with respect to the requirements and specification of workers' accommodation;
- workers should have access to the following:
 - medical and dental facilities;
 - places of worship;
 - a range of sports and leisure facilities including indoor and outdoor facilities;
 - shops and banking facilities;
 - internet and telecommunications;
 - organised transportation to allow them to leave the accommodation and have access to Manama centre and major shopping centres, on no-working days.

5.4 Road users

5.4.1 Construction traffic

The predicted impact of construction traffic on the local road network was assessed to be minor adverse for traffic conditions, transport of Project components and road intersections in the Project ESIA. The roads that will be mostly affected are Roads 5146, 5135, 5136, 5141, 5156 and King Hamad Highway.

The entrance to the site is through the west gate. As a general rule, all vehicles driven to site from the south will use Road 5156 to enter the industrial area, while all vehicles driven from the north will use Roads 5135 or 5136 to enter the industrial area.

Site workers will be transported to site in buses, and it has been estimated that 22 buses will be required. The buses will travel from the accommodation in the south in Al Dur to the site twice a day (morning and evening). Deliveries of materials and equipment will be made to the Al Dur laydown area where they will be received and unloaded. From here they will be delivered to the site via the Main Gate when required.

The Block 4 components will be shipped to the Khalifa Bin Salman Port. From here they will be transported by barge to the Muharraq Engineering Jetty in Askar. They will then be transported to site as oversized loads from the Muharraq Engineering Jetty. These loads will avoid Roads 5135 and 5156 and will enter the Project site via the south west gate.

As construction of the BMP is already in its third year, the traffic movements associated with this project are included in the baseline. It is unlikely that traffic movements for the BMP will increase because of the advanced state of the construction programme (the operation of the BMP is anticipated for 2023-2024). The cumulative impact of the Project related construction traffic in relation to existing traffic which includes BMP construction traffic is negligible.

Should construction of Alba's Line 7 be initiated during the construction lifetime of Block 4 PS5 construction, along with construction traffic related to ongoing BMP construction, then a cumulative impact of moderate would be possible for roads within the industrial estate, the King Hamad Highway and Highway 96. The intersection of King Hamad Highway and Highway 96 is already very congested especially at peak times and the roads within the industrial estate, particularly Road 5156 are subject to congestion. There could be an increase in congestion and travel times and an increased risk of accidents. This is also the case if construction of the ESLR and associated road improvements is initiated during Block 4 PS5 construction.

The APC is not in the spatial scope of Block 4 and therefore there will be no cumulative impacts. There will also be no cumulative impacts with the Energy Recyclers Project due to the fact that there is no spatial overlap.

It is likely that traffic relating to the development of the UCO Steel plot and the Alumicor plot will be routed along Road 5156 and so there is potential for cumulative impacts. Given the small scale of the development plots, an impact of minor is assigned.

The following mitigation measures are recommended in addition to the Project Traffic Management Plan (TMP):

- Alba to liaise with the developers of the Alumicor Project to determine whether any changes need to be made to the Project TMP; and
- In the event that construction of either the Line 7 Project or the ESLR Project construction is commenced during Block 4 construction, the TMP is to be reviewed to determine if any changes are required.

5.5 Summary

A summary of the predicted cumulative impacts for Block 4 is provided in Table 5.3.

Table 5.3 Summary of potential project cumulative impacts

| VEC | Cumulative impact | Magnitude | Sensitivity | Pre-mitigation impact | Mitigation | Magnitude | Sensitivity | Residual cumulative impact |
|--|--|-----------|-------------|-----------------------|---|-----------|-------------|----------------------------|
| Construction | | | | | | | | |
| Air quality | Construction dust | L | M | Minor adverse | <ul style="list-style-type: none"> Covered in the Project ESIA; no additional mitigation required | N | M | Negligible |
| | Natural dust storms | L | M | Minor adverse | <ul style="list-style-type: none"> Provide dust masks to staff required to work outside Work suspended during dust storms | N | M | Negligible |
| | Construction vehicle emissions | L | L | Negligible | <ul style="list-style-type: none"> Covered in the Project ESIA; no additional mitigation required | L | L | Negligible |
| Noise | Cumulative impact of Block 4 PS5 construction with the upgrade of Highway 96 and the BMP | N | M | Negligible | <ul style="list-style-type: none"> Covered in the Project ESIA; no additional mitigation required | N | M | Negligible |
| Local communities (in-migration/social cohesion) | Cumulative impact of Block 4 PS5 construction with construction activities at BMP, APC, ESLR | N | M | Negligible | <ul style="list-style-type: none"> Workers housed in appropriately contained accommodation camps at distance from community areas Worker accommodation should be inspected every 3 months | N | M | Negligible |
| Road users | Cumulative impact of Block 4 PS5 construction traffic with BMP construction traffic | L | M | Minor adverse | <ul style="list-style-type: none"> Covered in the Project ESIA and TMP; no additional mitigation required | N | L | Negligible |
| | Cumulative impact of Block 4 PS5 construction traffic with BMP, Line 7 and ESLR construction traffic | M | M | Moderate adverse | <ul style="list-style-type: none"> TMP to be reviewed to determine if any changes to the transport policy and measures in place are required | L | M | Minor adverse |

| VEC | Cumulative impact | Magnitude | Sensitivity | Pre-mitigation impact | Mitigation | Magnitude | Sensitivity | Residual cumulative impact |
|------------------|--|-----------|-------------|-----------------------|--|-----------|-------------|----------------------------|
| | Cumulative impact of Block 4 PS5 construction traffic with Alumicor construction traffic | L | M | Minor adverse | <ul style="list-style-type: none"> Alba to liaise with the developers of the Alumicor Project to determine whether any changes need to be made to the Project TMP | L | L | Minor adverse |
| Operation | | | | | | | | |
| Air quality | Cumulative impact of Block 4 emissions with Alba, BMP, APC, ELR | | M | Moderate adverse | <ul style="list-style-type: none"> Undertake an air dispersion modelling using CALPUFF for the Alba complex to assess the impacts and contribution of process emissions to the local air shed as part of upcoming Potline 7 Expansion; Continue with the existing monitoring program at 9 location within and outside Alba complex and identify exceedances; Discuss the issue of the degraded air quality with the SCE and recommend initiate an Air Capacity Study for the area including industries in the airshed; Prepare an annual report to submit to the lenders on the progress made and identify any exceedances; Develop a continuous improvement plan for Alba emissions. | L | M | Minor adverse |