

The Saudi Malaysian Consortium

Shuaibah Phase III IWPP

Environmental and Social Impact Assessment

Volume 2 – Non Technical Summary

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Shuaibah IWPP ESIA

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1 INTRODUCTION

1.1 WSP Environmental was commissioned by the Saudi-Malaysian Consortium (ACWA Power Projects/TNB/Malakoff) in May 2005 to carry out an Environmental and Social Impact Assessment (ESIA) for the first Independent Water and Power Project In Saudi Arabia (IWPP).

1.2 The site for the IWPP is located approximately 110km to the south of Jeddah on the Red Sea coast, adjacent to the existing Shuaibah I and II Power and Desalination Plants.

1.3 The Phase III IWPP Project principally comprises:

- The development, financing, design, construction and operation of a combined power and desalination plant with a power export of 900MW and water export of 880,000m³ per day; and
- The sale of the power and water to WEC (Water and Electricity Company) under a 20 year agreement.

1.4 The proposed Shuaibah III IWPP is the first of four similar plants identified as a national priority in Saudi Arabia, the location for the others being at Shuqaiq, Raz Azzour and Jubail.

1.5 In Saudi Arabia there is a requirement for Environmental Impact Assessment to be undertaken for all major projects, and this is overseen by the Presidency of Meteorology and Environment (PME), the principle agency for environmental protection in The Kingdom.

1.6 The Shuaibah IWPP is backed by an International Consortium responsible for the financing, design, construction and operation of the plant. The full ESIA including text and figures is provided in Volume 1 and is supported by Technical Appendices.



2 METHODS AND ENVIRONMENTAL STANDARDS

2.1 The identification of the primary and secondary issues has been undertaken through the consultation process and also with reference to recent experience of EIAs for other similar power station and desalination plants in the Middle East.

Part 1: Primary Issues

- Marine Water Quality, Recirculation and Coral Reef Ecology;
- Ambient Air Quality and Stack Emissions; and
- Solid Waste Management.

Part 2: Secondary Issues

- Social and economic impacts;
- Noise and Vibration;
- Ground Contamination;
- Transportation;
- Terrestrial Ecology;
- Cultural Heritage and Archaeology; and
- Landscape and Visual Impact.

Part 3: Environmental Management Plan and Monitoring

2.2 The environmental assessment has followed the requirements of the UK IEMA (Institute of Environmental Management and Assessment) using recognised assessment criteria and terminology and an established process by which effects are identified and their significance evaluated.

2.3 The significance of effects has taken account of criteria including: extent and magnitude, duration of effect, reversibility or irreversibility and sensitivity of receptors including people, cultural heritage and ecological habitats.

2.4 The ESIA has assessed the likely significant impacts of the proposed development in relation to both the construction and operational stages.

2.5 The construction and operation of the Shuaibah III IWPP has been assessed against the National Environmental Protection Standards for Saudi Arabia and The World Bank emission and ambient quality standards.



3 CONSULTATION AND STAKEHOLDER ENGAGEMENT

3.1 Consultations have taken place over a period of four months and have included technical, regulator and ministry representatives, local organisations, individuals and community groups. Their views have been recorded within the ESIA and noted in the development of appropriate mitigation measures, where required.

3.2 There are no NGOs operating at the site or within the Shoaba Region. Consultations were undertaken with the Yemeni fishermen who live 5km south of SEC because they earn their living by fishing the reef and therefore could be affected by existing/future plants.

3.3 Other villages are 20km to the east and 10km to the north and have no direct contact with the SWCC Plants. A meeting was held with their representative i.e. the Shuaibah Regional Administration Office which is responsible for the 15 villages in the Region which extend 80km north and 50 km east of the Power Plants.

3.4 This source of local site information has also been supplemented by reference to government and research organisation websites to obtain information for the baseline review and assessment including archaeology, wildlife, transportation and economic development, National Commission for Wildlife and Research Papers and relevant Ministry websites.

3.5 During the consultation process it has been important to assess the potential impacts of the Shuaibah IWPP in relation to the Equator Principles project categorisation. In this respect the IWPP site cannot be described as a wholly sensitive location as it is largely on a brownfield location, set aside for industrial development, in an area remote from cities, towns and villages.

3.6 With the exception of the adjacent coral reef which is a sensitive ecosystem, the resulting environmental impacts cannot justifiably be described as diverse and these are not unprecedented as there are two existing SWCC power and desalination plants at Shuaibah, the most recent of which was commissioned approximately 2 years ago. In addition there is a further large SEC power plant within 5km, with a second expansion plant which is currently under construction.



3.7 A *Category B* project is defined as those where the potential adverse environmental impacts on human populations, or environmentally important areas, are less adverse than those of *Category A* projects. The Shuaibah impacts are generally site specific (*Category B*) and few of them are irreversible while mitigation can be more readily designed than *Category A* projects.

3.8 The Shuaibah IWPP will result in few “sensitive impacts” (i.e. *Category A* criteria) because the project impacts are largely reversible and/or mitigated and:

- do not affect vulnerable groups;
- do not affect ethnic minorities;
- do not involve involuntary displacement/resettlement; and
- do not affect significant cultural heritage sites.

3.9 A review of the broad Equator Principles criteria and requirements for the classification of *Category A and B* projects has indicated that the Shuaibah IWPP is more closely aligned to *Category B* due to the relatively few “sensitive impacts”, as described under Equator Principles *Category A*, the reversibility of most effects and the ability to mitigate more readily those impacts which can be predicted.

3.10 A full list of comprehensive mitigation measures are provided in the main text together with proposal for monitoring and environmental management, both in construction and operation. The extent of mitigation being proposed will ensure that the Shuaibah IWPP sets a new environmental benchmark for power and desalination plants in Saudi Arabia.



4 EXISTING SITE AND SURROUNDING AREA

4.1 The coastal plain between Jeddah and Shuaibah forms much of the Shuaibah Region and is an area of dry desert plain with winter grasses and low lying scrub grazed by camel herds and goat herds. A new dual carriageway is currently under construction between Jeddah and Shuaibah and is being constructed alongside the new two lane road opened in 2004.

4.2 Mangroves are present on the shoreline 5km north of Shuaibah, while 5km to the south is the SEC site and several fish farms. A further 5km south there is a small fishing community (Al Sauda) at the coastguard station. To the east of the SEC site are extensive sabkha which are large areas of salt pans which do not support any vegetation due to the underlying salt layer.

4.3 The proposed site for Shuaibah Phase III is next to the existing Shuaibah Phase I (300MW and 50mgallons/day) and Shuaibah Phase II (550MW and 100mgallons/day) both plants are owned and operated by SWCC. The development area for the IWPP is mainly on a cleared brownfield site which was previously used for the temporary buildings and construction compounds for the development of Shuaibah Phase II.

4.4 The site for the third phase including construction and operational areas are within the fenced land owned by SWCC. There is currently existing worker housing on site for 50 families and other single accommodation for up to 500 staff situated in blocks which are located approximately 500m north east of the existing plants.

4.5 Another site with power generation (SEC) is located approximately 5 - 6 km to the south of the IWPP/SWCC site. A planned expansion (SEC Phase 2) which would comprise 6 x 393 MW generation facilities is due to be implemented by 2010 and is under construction by Saudi Archirodon.

4.6 The existing Shuaibah Plant has two seawater intakes for the desalination plant which are located within a few hundred metres of the shoreline. The cooling water discharges for Shuaibah Phase I and II are located in parallel concrete channels which merge at the point of discharge which is approximately 200m from the shoreline. There is one oil unloading jetty to the south of the Shuaibah for use by the Phase I/II and III Plants. There is also a deepwater jetty for temporary unloading of construction materials.



5 SITE JUSTIFICATION AND PROPOSALS

5.1 This project is one of four IWPPs being promoted by the Government of Saudi Arabia to meet the National Planning needs for continued social and economic development. It is therefore a unique project by providing water and power for Makkah, Jeddah and Taif to address existing shortages and as such cannot consider a “*No Project*” alternative.

5.2 There are no viable alternative sites between Shuaibah and Jeddah in the north which could be developed instead of this IWPP at Shuaibah (adjacent to the existing Phase I/II Plants) due to the requirement for shared infrastructure facilities in close proximity to the new Plant. No other site can provide the shared benefits listed above.

5.3 In a press release in June 2005, the Minister of Water and Electricity, said "The output from the Shuaibah IWPP will play a major role in meeting the increasing demand for water and power in the Western region covering cities such as Jeddah, Makkah and Taif".


5.4 The plant layout will be configured in three groups each comprising the following units:

- 1 steam generator unit;
- 1 steam turbine generator unit;
- 4 desalination units

5.5 The following key facilities will also be provided as part of the IWPP:

- Storage facilities for product water;;
- Storage facilities for liquid fuels;
- intake and outfall structures (open channel design);
- Disposal facilities for ash from flue gas cleaning (purpose built landfill within SWCC fence line); and
- Auxiliary systems including cooling water system, chlorination plant, sewage and storm water collection, process waste water and associated dosing and sampling systems).

5.6 The principal measures used to reduce stack air emissions are as follows:

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- Use of light crude oil fuel with maximum sulphur content of 2% compared with 3.8% used by SWCC and SEC;
 - Use of diesel for start up of generators;
 - Low NOx burners;
 - 95% flue gas desulphurisation;
 - Electrostatic precipitators; and
 - An Environmental Management Plan

5.7 Control of other atmospheric emissions including dust will be controlled by the following:

- Unloading of fuel oil using established system (SWCC);
- Storage of fly ash in enclosed hoppers;
- Transport of fly ash in tankers (instead of open bag system);
- Stabilisation of fly ash using cement in enclosed containers to prevent dust;
- Disposal in a purpose built landfill;
- Reduction in CO₂ emissions due to transport as landfill 3km from IWPP (other flyash currently taken to Jeddah 125km);

5.8 A Construction Environmental Management Plan will be prepared in compliance with the guidelines given in this EIA.

5.9 Prior to the Shuaibah Phase III Plant becoming fully operational, an Environmental Management Plan (EMP) will be prepared by the Consortium in consultation with PME based on requirements outlined in the ESIA.




6 MARINE WATER QUALITY AND CORAL REEF ECOLOGY

6.1 The potential effects of the water intake and outfalls on the marine water quality and coral reef ecology has been assessed through the following:

- A desk study review of existing information including water recirculation modelling to ensure that the new Phase III Plant does not have an adverse effect on the existing water intakes;
- A coral reef survey at 14 locations (October 2005) to assess the quality of the reef habitats and to minimise impacts during construction and operation;
- A water quality survey at three locations comprising a control together with existing and proposed outfall locations;
- A shoreline survey to assess the ecology of the shallow intertidal waters and the narrow band of habitat between the IWPP site and the sea; and
- Predictive modelling of water temperature, salinity (from brine), sulphate and chlorine from the existing and proposed outfall to assess cumulative effects.

6.2 The assessment of the construction works which includes an open channel seawater intake and outfall has shown that the impact on the coral reef ecology and shoreline habitats will be reduced by minimising the working corridor and also reducing the width of the outfall channel. A comprehensive list of mitigation measures have been identified and will be adopted within a Construction Environmental Management Plan. The impact on the coral reef has been minimised whilst providing structures which will encourage recolonisation of the outer channel walls with corals and associated fish. Temporary discharges during construction will comply with PME and World Bank Standards.

6.3 The assessment of the operational impacts of the discharge has involved the predictive modelling of four alternative outfall configurations to increase the dispersion of cooling water and brine. This has shown that a new outfall configuration (Scenario 9) provides enhanced dispersion resulting in a smaller mixing zone which fully complies with PME and World Bank effluent Standards. The modelling has also shown that the discharge locations are sufficiently far apart to avoid any cumulative adverse effects on the coral reef.



6.4 There are no designated sites, habitats or species with special protection that will be adversely affected, either directly or indirectly, by the proposals. The operational mitigation requirements including continuous water quality monitoring of the discharge and monitoring of the coral reef communities will be undertaken in accordance with the proposed site Environmental Management Plan. A framework for this plan is presented within the ESIA.

6.5 It is concluded that the impacts on water quality and coral reef ecology during construction and operation, and as part of the cumulative effects will be of minor significance after all mitigation measures have been implemented.


7 AIR QUALITY AND STACK EMISSIONS

7.1 The potential effects of atmospheric emissions from the IWPP have been assessed through the following:

- An extended desk study review of existing emissions (Shuaibah I and II) and SEC (Phase 1) together with proposed emissions from SEC (Phase 2) and the new IWPP;
- Ambient air quality monitoring at 10 locations to assess existing SO_x and NO₂ values in relation to monitoring and sensitive receptor locations;
- Detailed modelling of SO_x, NO₂ and particulates using ADMS (2005) which is an internationally approved model used in Europe and USA and assessment against PME and World Bank Standards;

7.2 The results of the modelling have shown that the existing and future emissions comply with all relevant NO₂ and particulate standards. The results of the SO_x modelling have confirmed that the existing emissions from SEC and SWCC do not comply with either PME or World Bank Standards. However the new IWPP with 95% flue gas desulphurisation produces a peak SO_x concentration which is <10% of the permitted standard and does not cause the standards to be breached. In addition the IWPP is located outside the modelled World Bank degraded air sheds and therefore does not require off set mitigation (i.e. enhanced emissions from either SEC or SWCC as part of this project).

7.3 The IWPP will set a new benchmark standard for sulphur removal at power plants in Saudi Arabia. The use of light crude oil provides a 50% reduction in sulphur over the normal fuels and this combined with the FGD



provides a reduction in SO₂ emissions of >97%. The use of low NO_x burners and electrostatic precipitators will also reduce nitrogen and particulate emissions providing a high level of pollution abatement on all the principle emissions.

7.4 The modelling has demonstrated that the SWCC worker housing complex located to the east of the Shuaibah IWPP is not affected by the IWPP emissions. The results of monitoring data from the worker housing site have also shown that this location is compliant with the SO_x PME and World Bank Standards.

7.5 The residual impact of the IWPP emissions will be of minor negative significance due to the high level of pollution abatement being provided. In addition the monitoring of ambient air quality is proposed as part of the Construction Environmental Management Plan whilst longer term monitoring during operations will form a key part of the Environmental Management Plan for the site operations over the next 20 years.

8 WASTE MANAGEMENT

8.1 The assessment of solid waste arising from the construction and operation of the Shuaibah IWPP has considered opportunities to minimise waste from the outset, identify a flexible waste mitigation strategy and consider specific requirements for dealing with hazardous waste which will comprise the fly ash residues from burning of the light crude oil.

8.2 The proposal for a landfill within the SWCC site boundary will have specific environmental and social benefits for containing the fly ash material compared with current disposal methods. The advantages include:

- Reduction in travelling distance (up to 90%) to disposal site;
- Knowledge that fly ash is being disposed of in a purpose built landfill site suitable for hazardous waste and with leachate control facilities;
- Avoidance of unofficial release of fly ash in the Shuaibah region;
- Storage and transfer within an enclosed system to avoid dust dispersion;
- Proposal to stabilise the fly ash with cement to further minimise potential wind blown dust or leachate;



- Construction of a sealed landfill above the groundwater table thereby reducing potential for leachate;

8.3 The residual environmental impacts arising from the solid waste disposal activities will be neutral to minor negative.

9 SECONDARY ISSUES


9.1 The construction of the Shuaibah III Plant will provide opportunities to have a positive impact on the local economy in terms of local employment by creating temporary local jobs and opportunities for “up-skilling” of the local construction work force. There will be no negative impacts on the local fishing industry as this is undertaken approximately 30km from the site due to the security exclusion zone around the SEC and SWCC Plants.

9.2 During operations, the social assessment has identified the lack of local infrastructure provisions, in the form of secondary high school facilities and also a local mosque, to serve not only the local Bedouin communities but also the incoming operational workforce, some of whom will have families. The incoming workers will be accommodated in the permanent worker housing adjacent the proposed site and investment by the appropriate Ministries in the provision of further social infrastructure in the immediate vicinity of the site will be required.

9.3 During construction, the noise and vibration assessment has identified that pile driving will be the noisiest potential activity. The construction noise impact assessment has, therefore, been based on this activity in order to represent the worst case scenario. It has been predicted that noise levels at the nearest sensitive receptors would meet the recommended noise standards and that vibration levels would be imperceptible.

9.4 With respect to the World Bank 1998 Standards the noise model indicates that the daytime residential criteria of 55dB will be achieved at the worker accommodation to the east of the development during the daytime period. However, should the plant operate at a steady state load and bypass operation level; during the night, the World Bank night-time residential limit would be exceeded and may require an acoustic barrier to reduce night time levels.

9.5 A ground investigation of the site in June 2005 has indicated that the site is uncontaminated with only localised residues arising from previous



construction works on the site. The adoption of good on site working in the form of appropriate storage practices, the implementation of suitable control measures and on site training and emergency preparedness will ensure that the potential ground contamination is minimised to a residual effect which is temporary in nature and is of minor negative to negligible significance. This will be detailed in the Construction Environmental Management Plan.

9.6 The operational Environmental Management Plan and the Shuaibah III Health, Safety and Environmental Policy will contain operating procedures that are to be implemented at the Shuaibah III site to prevent contamination to soils and groundwater during the operational phase.

9.7 The accommodation of a high percentage of construction workers in temporary worker compounds coupled with transporting the remaining workers to and from Jeddah on a daily basis via a series of buses will reduce the need for multiple journeys by private car and minimise the residual effect on the local highway network to temporary and of negligible significance. The accommodation of full time workers on site during the operational phase will minimise the potential for cumulative traffic impacts due to the need for daily commuting to and from Jeddah by car.

9.8 While the construction of the IWPP will have negligible impact on existing terrestrial ecology and flora, the location of temporary housing compounds, laying out areas and access roads are of greater significance due to the fairly extensive floral cover to the east of the site. However it is proposed that the main access road to the site is outside the SWCC fence line for security reasons and this will be along an existing track with little or no vegetation. This route would have benefits in retaining the existing vegetation where there is at least 70% ground cover and where there are secondary benefits for associated fauna including birds and terrestrial invertebrates. In addition existing swamp habitat to the north of the worker housing (inside the SWCC fence line) will not be directly affected by temporary facilities. Opportunities to create terrestrial habitats during site operations have also been identified.

9.9 In relation to cultural heritage and archaeology, consultations undertaken with local Bedouin communities in the vicinity of the site confirmed the following regarding the site of the existing and proposed power and Desalination plants:



- there are no known features of historical interest such as former Shuaibah settlements;
- there are no historic trading routes or features of cultural or archaeological importance; and
- the site currently does not have a mosque situated either on the site or in the immediate vicinity.

9.10 The potential for adverse environmental impacts on local features of archaeological importance during construction are therefore negligible.

9.11 Landscape impacts during construction and operation have been considered to be of minor significance due to the existing power and desalination plants, the distance to the nearest towns and villages and also the distance between the site and the main north south highway from Jeddah.

9.12 The Framework for Site Environmental Management and Monitoring has identified the principal requirements for the CEMP and EMP which will be developed in association with the EPC prior to construction works commencing on site.