



Azura Power West Africa Ltd.

**ESIA Addendum (including Air
Modelling and Impact Assessment
Update)**

**For the Azura-Edo Independent Power
Plant**

ERM Document: 0172621_130729_V1.00

July 2013

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ESIS Addendum (including Air Modelling and Impact Assessment Update)

For the Azura-Edo Independent Power Project

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Date: 29 July 2013

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In 2012, ERM assisted Azura Power West Africa Ltd (hereafter referred to as “Azura”) in developing the Environmental and Social Impact Assessment (ESIA) for the Azura-Edo 450 MW Independent Power Project in Nigeria (hereafter referred to as “the Azura Project”). The final ESIA report was disclosed by the World Bank in 2012 and approved by the Nigerian government in February 2013 following a Panel Review and Public Hearing (approval Ref: *FMenv/EA/EIA/123.1693/Vol. 1/212*).

As part of developing the Azura Project, a short spur is required to connect the Azura Project to the existing off-site gas supply (the Escravos to Lagos Pipeline System – ELPS). ELPS is owned by National Gas Company (NGC). Three possible design options for the connection spur were assessed as part of the ESIA:

- *Option 1*: Gas spur along a cleared, existing right of way (which was constructed for the neighbouring NIPP plant), running for 1 km along the southern boundary of the NIPP site;
- *Option 2*: Gas spur running for 1km and buried parallel to the existing line used for the NIPP plant;
- *Option 3*: Gas spur along a route running a maximum of 50 m from the eastern corner of the site boundary.

The spur connection will be developed by NGC from the ELPS to the Azura site boundary. Following on from approval of the ESIA report, negotiations between NGC and Azura progressed and design *Option 3* (as described above) was selected. During the course of developing the detailed design for this option, NGS informed Azura that the Azura plant would have to be located closer to the north-eastern corner of the Azura site, in order to minimise the costs of the spur and the level of disturbance associated with construction and development.

The old and new plant locations are shown in *Figure 1.1*. As shown in the figure, the new plant location continues to be within the original Azura site boundary.

In Q2 2013, Azura took action to identify any World Bank and Nigerian regulatory ESIA requirements triggered by the change in plant location. Azura consulted the World Bank directly and Environmental Accord (Azura's in-country consultants) reviewed the relevant regulations. The following requirements were identified:

- According to the World Bank, their process would require a formal letter of notification to be issued to both the World Bank and the Federal Ministry of Environment (FMEnv) to communicate the change in plant location, and any associated change in environmental or social impacts and/or required mitigation and management measures. Resubmission of the ESIA is not required in this case; and
- Nigerian regulatory requirements do not necessitate any revisions to the ESIA in this circumstance but do require that any changes to the agreed mitigation measures be incorporated into the overarching Project ESMP, which must be updated and submitted to FMEnv prior to project commissioning. Resubmission of the ESIA is not required in this case.

In light of the above, Azura asked ERM and EnvirAccord to review the ESIA and identify any areas where further supplementary studies would be required to assess changes in environmental or social impacts and/or required mitigation and management measures. The results of that review are summarised in *Box 2.1*.

Box 2.1

Results of the ESIA Review

- The overall site boundary presented in the approved ESIA report has not changed.
- The baseline studies that informed the approved ESIA report addressed all areas within the site boundary and therefore baseline characteristics associated with the Azura Project have not changed and no update is required.
- The plant will continue to be located entirely within the site boundary. As part of the ESIA, the team assumed all areas within the site boundary would be cleared during construction. This assumption is still valid and therefore impacts within the site boundary will not change and no update is required.
- As part of the ESIA, the air and noise impacts associated with Project were assessed using a modelling approach that incorporated the original plant location. This location has now changed. The assessment of air and noise impacts therefore requires update.
- No other changes to the ESIA report (and associated ESMP) are required.

In summary, evaluation of the proposed changes indicates that the environmental and social impacts and proposed mitigation measures identified in the ESIA are still valid with the possible exception of impacts associated with air and noise emissions. These impacts require further evaluation.

To further evaluate the change, Azura commissioned:

- ERM to review and update the air modelling/ assessment for the Azura Project; and
- Siemens (the design engineers) to review and update the noise modelling for the Azura Project.

The next section of this report (*Section 3*) presents the results of ERM's work to review and update the air modelling and impact assessment.

The findings of Siemens' review of the noise modelling and updated noise impact assessment are available as a separate report, produced by Siemens.

3.1 INTRODUCTION

The section is structured as follows:

- *Section 3.2: Air Modelling and Impact Assessment Methodology* – summarises the methodology underpinning the air modelling exercise and the design parameters used as input values for the model. The design parameters that were used in the original modelling exercise are also shown in this section as a reference for the reader.
- *Section 3.3: Air Modelling and Impact Assessment Results* – presents the results of the air modelling exercise in terms of predicted emissions and impact significance. The results from the updated model and impact assessment exercise are compared to those that were predicted as part of the original modelling and impact assessment.
- *Section 3.4: Air Modelling and Impact Assessment Conclusions* – presents summary conclusions.

3.2 AIR MODELLING AND IMPACT ASSESSMENT METHODOLOGY

A detailed description of the air quality impact assessment methodology is set out in the original ESIA report (see *Section 5.3* of the ESIA report).

The same methodology was applied during this modelling exercise. The assessment was undertaken using computer-based dispersion modelling (USEPA AERMOD model). Please refer to *Section 5.3* of the ESIA report for further information.

Design & Emission Parameters

The design and emission parameters that were used during the original (ESIA) modelling exercise and this more recent (Addendum) exercise are shown in *Table 3.1*.

Table 3.1 *Model Parameters: Design and Emission Data*

Parameter	Units	Design		Comments
		Original	Updated	
Number of stacks	-	4	3	<ul style="list-style-type: none"> • As part of the original model, the 4 stacks were assumed to be co-located. • As part of the revised model, the 3 stacks are understood to be approximately 40m apart.
Number of flues per stack		1	1	<ul style="list-style-type: none"> • No change
Stack height actual	m	50	35	<ul style="list-style-type: none"> • Taken from design specifications provided by Azura.

Parameter	Units	Design		Comments
		Original	Updated	
Flue diameter	m	7.0	6.2	• Per stack
Stack Area	m ²	38.5	30.2	• Per Stack
Emission velocity	m/s	26.0	13.1	• Total plant emission.
Volume flow rate (actual)	m ³ /s	3,980	1,189	• The volume flow rate for this newest modelling exercise was calculated based on the mass emission data provided by the design engineers and following further detailed design. This led to a more accurate estimation of the volume flow rate, when compared to the data used in the original model.
Volume rate (mass)	kg/s	1,672	1,497	• Total plant emission. • Taken from design specifications provided by Azura.
Emission temperature (actual)	Celsius	543	544	• Per Stack
NO _x emissions	dry ppmv	20	25	• Per Stack
CO emissions	dry ppmv	30	30	• Per Stack
NO _x emissions	g/s	36.6	9.53	• Total plant emission.
CO emissions	g/s	50	6.96	• The volume flow rate for this newest modelling exercise was calculated based on the mass emission data provided by the design engineers and following further detailed design. This led to a more accurate estimation of the volume flow rate, when compared to the data used in the original model.

In order to assess the potential for cumulative impacts due to the Azura Project and NIPP plant, the NIPP plant was also included in the model. No design information is available for the NIPP plant so the plant was assumed to have design parameters and emissions similar to that of the Azura Project. This same approach was used in the original assessment.

As per the previous air modelling exercise, five years of meteorological data from the Bohicon meteorological station was used to provide an indication of meteorological conditions at the site. While this station is located around 400km from the site, the meteorological conditions are generally representative of weather conditions.

3.3

AIR MODELLING AND IMPACT ASSESSMENT RESULTS

The results of the modelling exercise are shown in *Table 3.2* and *Table 3.3*. Results are shown for the “Azura Project Only” (in isolation) in *Table 3.2* and for cumulative NO₂ emissions from both the Azura Project and the NIPP (in *Table 3.3*). The cumulative assessment only considers NO₂, as CO emissions from Azura are well below the relevant standards (between 1 and 5% of the

criterion). Combined CO emissions from NIPP and Azura are therefore expected to be well below 25% of the criterion and are therefore insignificant. In all cases, the results obtained from this modelling exercise are shown in comparison to the original results that were included in the approved ESIA report.

Table 3.2 *Modelling Results – Azura Project Only*

Pollutant	Averaging Period	Basis of assessment	Source	Criterion	Azura Project Only				
					Process Contribution		Significance		Overall Outcome
					Original	Updated	Original	Updated	
$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$							
NO ₂	Annual	Maximum	EU/WHO	40	0.330	0.394	Insignificant	Insignificant	No change
	1 hour	Maximum	EU/WHO	200	60.2	34.4	Minor	Insignificant	Improvement
	1 hour	Maximum	Nigerian	75-113	60.2	34.4	Minor	Minor	No change
CO	8 hour rolling average	Not to be exceeded >3 times p.a.	EU	10000	121	39.2	Insignificant	Insignificant	No change
	8 hour	Maximum	WHO	40000	121	39.2	Insignificant	Insignificant	No change
	1 hour	Maximum	WHO	30000	164	47.3	Insignificant	Insignificant	No change
	1 hour	Maximum	Nigerian	11400	164	47.3	Insignificant	Insignificant	No change

Table 3.3 *Modelling Results – Azura Project with NIPP*

Pollutant	Averaging Period	Basis of assessment	Source	Criterion	Azura with NIPP				
					Process Contribution		Significance		Overall Outcome
					Original	Updated	Original	Updated	
$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$							
NO ₂	Annual	Maximum	EU/WHO	40	0.49	0.45	Insignificant	Insignificant	No change
	1 hour	Maximum	EU/WHO	200	41.8	42.08	Minor	Insignificant	Improvement
	1 hour	Maximum	Nigerian	75-113	41.8	42.1	Minor	Minor	No change

As shown *Table 3.2*, the revisions to the plant design, along with refined calculation of the volume flow rate, have led to a reduction in predicted emissions (“Process Contribution”).

As noted in *Table 3.1*, the new design involves a reduction in stack height from 50 m to 35 m, and the stacks are now to be separated by 40 m (as opposed to being co-located, as was assumed in the original model). This will lead to poorer dispersion, and greater Process Contribution. However, the new design involves three stacks, rather than four stacks, and the emissions from these stacks were found to be less than that predicted as part of the original modelling exercise ⁽¹⁾. Overall impact significance has not therefore changed since the original ESIA study, with the exception of one occasion where impact significance has reduced from “Minor” to “Insignificant” (as noted in the “Outcome” column of *Table 3.2* and *Table 3.3*) giving a better outcome for communities.

As shown in *Section 3.3*, all impacts are considered to be insignificant, which the exception of NO₂ emissions, which when analysed relative to the 1 hour maximum limit (sourced from Nigerian legislation), are predicted to have minor adverse impacts. Minor adverse impacts are predicted to occur over a small area in the immediate vicinity of the plant. Significant cumulative impacts with the adjacent NIPP plant are therefore not likely to arise. In addition, due to the absence of other major sources of emissions in the vicinity of the plant, the baseline concentrations of nitrogen dioxide are expected to be substantially below the air quality standards, and therefore there is not anticipated to be a risk of air quality standards being exceeded.

In light of the above outcomes, the mitigation and management measures set out in the ESIA report continue to be considered valid and appropriate for the Azura Project.

¹ More refined estimation of volume flow rate and exit velocity has now become possible with the development of the detailed design.

ERM reviewed the Azura Project ESIA report to identify any supplementary studies required to address the proposed change in plant location within the site boundary.

During the course of this review, ERM identified the need to update the air and noise modelling for the Azura Project to ensure potential impacts are identified, assessed and fully mitigated and to identify any required changes to the Azura Project ESMP. No other studies were required.

The noise modelling is being re-run by Siemens (the design engineers) and is presented in a separate report.

The air modelling was re-run by ERM and the results are presented in this report. As shown in *Section 3*, air impacts continue to be insignificant or minor (in one case) and therefore do not deviate significantly from the findings presented in the original ESIA report. In light of that, the mitigation and management measures set out in the ESIA report continue to be considered valid and appropriate for the Azura Project.