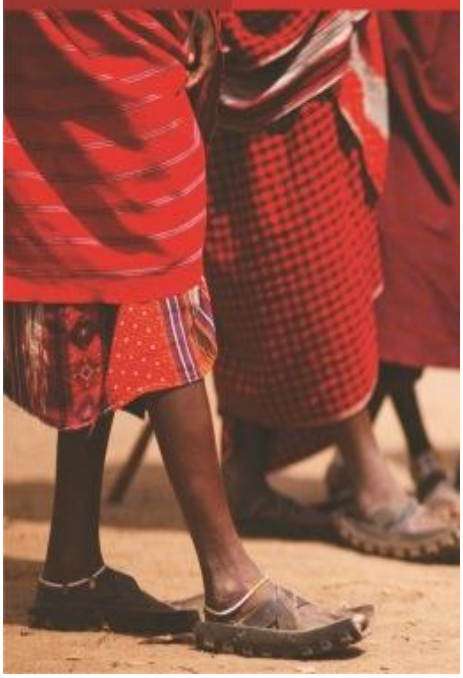

DIGBY WELLS
ENVIRONMENTAL

Air Quality Statement
Feronia PHC Oil Palm Plantations
Democratic Republic of Congo

Project Number:

CDC

Prepared for:

Feronia

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Matthew Ojelede	Report Writer		June 2015
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1 Introduction

Digby Wells Environmental (hereafter Digby Wells) was requested by Feronia PHC oil palm plantation to undertake an Environmental and Social Assessment (ESA) of the Feronia PHC oil palm plantations in the Democratic Republic of Congo (DRC). A suite of specialist studies were requested, along with a desktop air quality assessment.

The objective of the air quality was to give a high level statement about air quality with reference to the plantations, and receptors in and around the operations. No air quality sampling or modelling took place; the baseline air quality is based on visual observations and a desktop review. The notes that the social team compiled from meetings with individuals and communities were reviewed to gauge if air quality was an issue for stakeholders or perceived to be an issue.

2 Project Description

The project comprises the rehabilitation of three oil palm plantations and mills in the DRC, the oldest of which was established in 1911; palms are being replanted and there will be no greenfield development. Feronia operates across three plantations in two provinces, Boteka and Yaligimba which are located in Equateur and Lokutu in Orientale.

Lokutu oil palm plantation, that was first planted over 100 years ago, is located on the southern bank of the Congo River and covers approximately 63,500 Hectares (Ha) of which approximately 12,000 Ha is covered with oil palm (and some cocoa and coffee).

The Yaligimba oil palm concession lies in the Northern Democratic Republic of Congo, within the Equateur Province close to the border of the Orientale Province. The project area covers approximately 30,199 Hectares (Ha) of which approximately 16,000 Ha is covered with oil palm.

The Boteka oil palm plantation is located on the southern bank of the Momboyo River, a tributary of the Ruki River that flows into the Congo River approximately 120km to the west. The project covers approximately 13,542 hectares (Ha) of which approximately 4,000 Ha is covered with oil palm.

3 Air Quality at the Feronia Plantations, Mills and Communities

All three plantations are in remote areas and none have nearby industrial developments; thus, there are no large-scale operations that affect the overall air quality in or beyond the concessions.

Based on visual observations, the air is generally clear (in the concessions and surrounding areas) with only scattered point source emissions in the concessions and local communities (dust, and smoke); these are ephemeral and local in extent. The prevailing weather conditions influence the extent that these sources impact local air quality (e.g., dust is suppressed by rain during the wet season, and less dust is raised as soil moisture content increases). When soils have high moisture content it reduces the amount of dust being

generated during planting and harvesting of the fresh fruits bunches. Roads, where soils are exposed, have a propensity for dust to be raised as vehicles travel along them but this is a short-term, localised event and is commonplace throughout the DRC where roads are mostly unpaved.

One noticeable source of air pollution is from fires that are used by all communities for cooking and domestic purposes (e.g., boiling water). In the late afternoons and early evenings, fires are lit by each household and burn into the night; the net result is that smoke is trapped below the inversion layer with a visible layer hanging over communities throughout the night; it is only dispersed by air movements during the day. Particulates float in the air and the strong smell of smoke is striking. Burning of biomass for cooking results in smoke throughout the area. Agricultural practices adopted by local communities (such as slash and burn) result in periodic, short-term, and local sources of smoke. Slash and burn is considered a once-off event as communities work in an area until soils are exhausted and then move to work in another area.

The sources of emissions associated with Feronia activities are the mills, vehicles and boats; potential for raising dust is associated with planting, harvesting and removal of old palm trees (Section 3.1). The number and frequency of journeys is low so this is not a significant issue in terms of air quality; some the vehicles on the plantations are old and so do not incorporate modern emission control measures; however, as vehicles are replaced, performance will improve and emissions per vehicle will diminish. At the mills, perturbation of the ambient air quality occurs as a result of emissions from generators and the burning of biomass to produce steam and power.

3.1 Operations at Plantations and Mills

In terms of air quality, environmental aspects associated with processing mills and plantations include smoke, dust, odour and boiler ash. The rehabilitation process for the palm plantations involves replanting and pruning. The rehabilitation of the plantations and upgrading / renovations of the mills will have some effects on air, resulting in localised impacts and improved air quality on a long-term

Oil palm mills are generally self-sufficient in terms of energy which has a bearing on ambient air quality of the area. The use of empty fruit bunches (EFB), mesocarp fibres, and shell as biomass fuel in the boilers releases both particulate and gaseous emissions into the atmosphere encompassing smoke and boiler ash. This however should be seen in the context of current background conditions and effects from ongoing operations of mills and agriculture (slash and burn) activity not related to the oil palm plantations or industry. Emissions can vary based on the efficiency of the boilers and particulate matter collector system (if available).

3.2 Emissions from Oil Palm Plantations and Mills

Particulate emissions from the boilers at the three operations: Boteka, Lokutu and Yaligimba are potential sources of air pollution. Utilisation of mesocarp fibres, nut shell, palm kernel

and empty fruit bunches as biomass in boiler creates emissions with the release of particulate matter, NO_2, SO_2 and CO gasses and ash; with the ash content adjudged to be rich in silica (Si) (Rashid et al., 2013; Zarina et al., 2013). Smoke emissions from boilers at Lokutu and Boteka will cease to be a concern when the boilers are replaced.

The IFC EHS guidelines for vegetable oil production and processing make reference to atmospheric emissions from oil palm operations being those from fuel combustion (e.g., carbon dioxide, sulphur dioxide, nitrogen, and particulate matter); these emanate from mechanised equipment or combustion by-products from the generation of steam energy.

Greenhouse gases are not expected to be generated in major quantities as nitrous oxide, methane and ammonia generally result from use of fertilisers or soil conditions associated with crops such as rice; as the plantations are operating on brownfields, which will be beneficial in controlling greenhouse gas emissions.

The presence of silica (SiO_2) in boiler ash particulate emissions confirms the potential health significance of exposure (Table 3-1). Exposure level to silica and frequency of exposure should be assessed to determine the health impacts on human receptors (those working on the plantations and mills, in particular).

Table 3-1: Chemical composition of boiler ash (Rashid et al., 1992)

Composition	Boiler Ash (wt. %)
SiO_2	40.60
Al_2O_3	3.71
Fe_2O_3	25.74
CaO	19.60
MgO	1.30
P_2O_5	2.73
K_2O	13.80
SO_3	0.44
TiO_2	0.35
MnO	0.28

Table 3-2 presents a summary of gaseous emissions from boilers using biomass. The gaseous emissions will have implications for health, depending on the exposure levels and frequency; also effects on global warming with the emission of greenhouse gases (Table 3-2). As a result of chemical reaction in the atmosphere, the conversion SO_2 to H_2SO_4 and NO_2 to HNO_3 is a possibility with acidic effect on receiving receptors.

Table 3-2: Gaseous emissions from biomass fuelled boiler (Rashid et al., 1992)

Composition	Boiler Ash (wt. %)
CO_2 (%)	3.08±1.73

O_2 (%)	16.7±2.44
CO (ppm)	1275±1391
NO_2 (ppm)	22.5±23.9
SO_2 (ppm)	39.1±30.7

4 Assessment of Potential Effects on Ambient Air Quality and Sensitive Receptors

Due to a lack of comprehensive, site-specific weather data, information the nearest weather stations has used for this high level assessment.

4.1 Lokutu

Meteorological records for Kisangani (capital of Orientale province) were used for the (high level) assessment of Lokutu (Figure 4-1). The climate is tropical monsoon-driven, although the concession is relatively near to the Equator. The driest month is January with the average rainfall below 60 mm. The relative humidity is 86% and the annual total rainfall is approximately 1,620 mm. The temperature averages above 20 ˚C.

The oil palm mill at Lokutu is surrounded by residential receptors that may be affected by emissions from the mill (figure 4-2). The communities to the northwest, west and south have the greatest potential to be affected by emissions from the palm oil mill due to exposure to silica-rich ash.

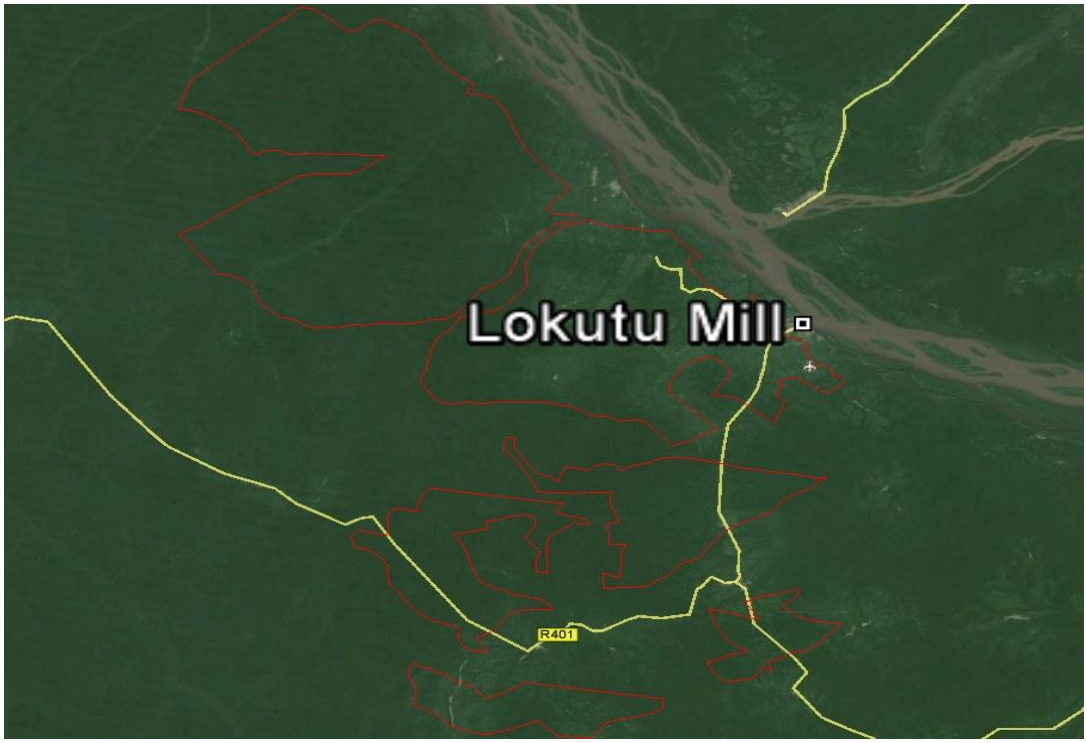

Figure 4-1: Map of the Lokutu PHC concession

Figure 4-2: Sensitive receptors in the vicinity of Lokutu mill

4.2 Boteka and Yaligimba

Meteorological records for Mbandaka (capital of the Equateur province) were used in the assessment for Boteka. The province experiences more wet than dry months; the driest month being January. The average monthly precipitation is 60 mm. The temperature ranges from 23 - 26˚C throughout the year.

The oil palm mill at Boteka and Yaligimba will have similar effects to those on ambient air quality at Lokutu, the difference is that the population density is lower (Figures 4-3 and 4-4).

Figure 4-3: Map showing Feronia PHC concession Boteka mill

Figure 4-4: Map showing Feronia PHC concession area - Yaligimba mill

5 Findings and Conclusions

The findings of the qualitative assessment of air quality are that Feronia is the largest operation, and employer, in the provinces where Feronia operates and there is no industrial development to affect air quality. The most commonplace holder of other large concessions are logging companies although not all are operating. Air quality is generally good.

The livelihoods of communities are based on employment with Feronia and subsistence agriculture. Thus, activities that may affect air quality can be broadly grouped into those associated with the operations of Feronia and those associated with local communities:

- Feronia; activities and sources that may affect air quality include the operation of the mills, vehicles, and boats; activities on the plantations such as growing, planting and tending the oil palms may raise dust.
- Local communities' activities' and sources include slash and burn agriculture, and lighting fires for domestic use (e.g., cooking, heating water).

Visually, the most significant effect on air quality is where smoke is trapped below the inversion layer; this is caused by fires burning at every household in communities throughout the study area. This is an indirect effect of the Feronia operation as their workers are in the communities and use fires.

Sources of dust include traffic along roads and activities associated with farming the land (in the plantation and local communities); these are local, short-term effects.

In the context of the continued operation of the three plantations, it is concluded the baselines (the existing environment) have remained unchanged for decades, even during periods of war the operations continued albeit at reduced capacity. Thus, air quality has changed very little and Feronia operations have no significant impacts on air quality. As Feronia rehabilitates the plantations and modernises vehicles and the mills, emissions should be reduced; the mills and vehicles will have specifications as per current standards.

It is assumed this relates to smokes as it is stated that high chimneys result in good dispersion of the smoke plume (Feddersen, 2014). The report also states that replacing the boiler will eliminate the problem and furthermore, there is little room for expansion of the mill, so when expansion is required the mill would be relocated as there is too little space.

Feronia, as part of its environmental and social action plan, will be implementing a monitoring programme that includes a number of aspects of the operations including air emissions from boilers and other equipment. This is a positive action and will enable Feronia to develop quantitative data over time to gauge air quality and seasonal changes. In addition, Feronia will implement an occupational health programme which will include health surveillance; annual medical checks will include monitoring for occupational diseases such as those associated with dust.

In the new capex deployment strategy, Feronia plans to invest in modern technologies when replacing obsolete equipment. This will include evaluation of project location alternatives and emission offsets.

Air quality was not raised as an issue during any focus group or other stakeholder meetings held by the Digby Wells team in 2014 and 2015; reference to health by those attending meetings focussed on the provision of services rather than particular health issues.

5.1 Gaps and limitations

The gaps associated with this study are lack of:

- Lack of site-specific meteorological data.
- Lack of historical air quality data.
- The study was based on visual assessment.
- Dispersion modelling was not part of the scope so the spread of anticipated pollutants from the boilers across the landscape is unknown.

6 Recommendation

Although the modus operandi at the plantations was not assessed by air quality specialist on site, the following general recommendations are made to help Feronia meet standards for good practice:

- Personnel protective equipment (PPE) should be part of the essential equipment supplied to workers who are exposed to sources of emissions and dust. There is often resistance to wearing dust masks, particularly when working in hot and humid conditions, but the need for PPE should be included in induction, and health and safety training. Already, PPE have been circulated since June 2015 in order to achieve the aforementioned.
- The amount of burning that takes place at the plantations should be minimised (e.g., burning of biomass for cooking and general household waste). With reference to general waste, if burning takes place to reduce mass, then a cover should be applied, post-burning, to reduce the potential for wind-blown dust and odours (which attracts vermin).
- Pre-conditioning of fuel can help with better combustion in the boiler (due to increased boiler efficiency), thus reducing particulate matter and ash emissions.
- Though insignificant by scale, effects on air quality also include evaporation of diesel fuel and heavy fuel from temporary tanks and possible spills during loading and re-fuelling of heavy machinery and trucks. Thus, there is need for the provision of secondary containment for fuel storage.
- Investigate the use of particulate filters at the plants. Monitor emissions at the mills to establish ambient levels of pollutants and the integrity of surrounding atmosphere.
- It is recommended that the monitoring programme being implemented be finalised to measure selected parameters on the basis of emissions associated with palm oil production and agricultural activity.

- The proximity of the mill to houses at Lokutu has been raised as a potential issue in the Feddersen report. Feronia is developing plans for upgrading the operations and this would be an opportunity to assess the need for relocating the mill, in due course. The results of air monitoring programmes, will help decision-making about potential relocation of the mill; results of monitoring can be analysed to assess potential impacts on health.

These recommendations will assist Feronia whilst the results of onsite monitoring which inform the development of a comprehensive management plan related to the specific activities taking place on site.

7 References

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