
An Environmental Due Diligence Failure

A Critique of the Palm Oil Mill Effluent Study of July 25, 2011 related to Inspection Panel Request No. RQ 09/10, Smallholder Agriculture Development Project (SADP)

Annex to
The World Bank's Duty in PNG: Actions Needed to Prevent a Worsening of Poverty and Environmental Degradation from the Smallholder Agricultural Development Project



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ACCOUNTABILITY
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I. Introduction

The July 2011 Papua New Guinea Smallholder Agriculture Development Project Effluent Study (“Effluent Study” or the “Study”) is not comprehensive and, in fact, tends to raise more questions than it answers. This is troubling given that the Study is at least five years overdue. The World Bank Board of Directors approved the Papua New Guinea (“PNG”) Smallholder Agriculture Development Project (“SADP” or the “Project”) on December 18, 2007. This Study, released on July 25, 2011, which purportedly addresses the harm that this Project may cause to the environment from an increase in palm oil mill effluent (“POME”), should have been done prior to Board approval and the results used to inform the design of the Project. Moreover, the Study was already outdated at the time it was published – constantly referring to things that were “anticipated” to happen in late 2010 and early 2011 (*see* pp. 19, 21, 27),¹ which suggests that the

Study was not released to the smallholders until well after it was completed.



In addition to being untimely, the Effluent Study is not sufficiently comprehensive to give Bank Management an adequate understanding of whether mills in the Project area have the capacity adequately to treat increased POME due to SADP, not to mention whether there will be any health or environmental impacts from the Project. Bank Management itself recognized these problems and helped develop an Action Plan (*see* pp. iii-

v) “to follow-up on the issues that have been raised in the SADP effluent study and ensure adequate mitigation measures are in place to deal with increased palm oil mill effluent due to the Project.” (pp. i-ii). SADP should not go forward until a more complete study is done and mitigation measures are put in place.

This report discusses important findings, deficiencies and questions raised by the Effluent Study, as well as suggestions for mitigation measures that should be incorporated into SADP.

Specifically, Part II of the report discusses important findings and recommendations from the Effluent Study, including (A) information regarding the potentially significant environmental impacts of POME; (B) deficiencies in PNG regulation of POME; (C) the need for more technical analysis; (D) four mills that pose a high environmental risk; and (E) commitments made by the milling companies to improve POME management.

¹ All citations to page numbers in parenthesis are to the July 25, 2011 Effluent Study.

Part III analyzes issues inadequately addressed by the Effluent Study, including (A) issues set forth in the Study’s own terms of reference, such as capacity and health impacts; (B) environmental data and operating procedures; and (C) the World Bank’s Environmental Health and Safety (“EHS”) Guidelines on Vegetable Oil Processing.

Part IV then summarizes the key questions raised by the Study, and Part V suggests mitigation measures that should be incorporated into SADP.

II. Important Findings and Recommendations

Although overall the Effluent Study was inadequate, it did make several important findings and recommendations that will be helpful to subsequent studies and should be incorporated into Project design. The Study’s findings show that POME is not being properly managed at all of the mills in the project area and that therefore the Project will harm the environment if implementation continues without addressing these problems.

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A. Potentially Significant Environmental Impacts of POME

The Effluent Study confirmed that if POME is not properly managed, “it can have a series of significant environmental impacts affecting water quality, modifying watercourses and impacting soils and vegetation.” (p. vi). According to the Study, “[t]he most striking characteristic of POME is its strength measured as Biochemical Oxygen Demand (“BOD”),² [which] at between 10,000 – 44,000 mg/l . . . is as much as 125 times the strength of typical raw urban sewage.” (p. 11). POME also contains oil and grease, and minerals such as phosphorus, nitrogen, potassium, magnesium and calcium. *Id.*

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Impacts on water quality from POME are mostly due to oxygen depletion. Impacts from direct oxygen depletion include: reduction in biodiversity; changes in species composition and

² According to Wikipedia, BOD “is the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to break down organic material present in a given water sample at certain temperature over a specific time period.” It is often used as an indication of the organic quality of water and as a surrogate for the degree of organic pollution of water. See http://en.wikipedia.org/wiki/Biochemical_oxygen_demand (last visited October 27, 2011).

dominance; and, in extreme circumstances, “toxicity effects.”³ (p. 10). Improperly managed POME can also lead to indirect oxygen depletion by supplying excess nutrients to a waterway and stimulating plant (especially algae) growth, which may lead to odors, production of toxins, and increased turbidity of the water. *Id.*

In addition to direct environmental impacts, POME can cause indirect environmental impacts because of its odor and due to emissions of methane. (p. vi). The Study noted that POME and its treatment produce gases such as volatile fatty acids (“VFA”) and hydrogen

POME “[t]reatment also generates significant volumes of methane [which] has a global warming potential 21 times that of carbon dioxide.”

sulfide, “which are pungent at relatively low concentrations.” (p. 11). POME “[t]reatment also generates significant volumes of methane [which] has a global warming potential 21 times that of carbon dioxide.”⁴ *Id.*

“To avoid gross local pollution POME must be treated before release to the environment.” *Id.* The Study projected that SADP will increase POME production by 182,000 metric tons/year (p. 9), which poses a significant danger to the environment if that additional POME is not properly treated.

As noted below, the Study found that out of the eleven mills studied in the Project area, four pose a high environmental risk. Additionally, it identified systemic problems that could pose a risk. First, although POME treatment pond design and operation is integral to ensuring the POME is properly treated (pp. 11-14), the author of the Study noted that he was not shown any management guidelines or procedures for pond design and operation. (p. 24). Additionally, several of the mills have ponds that are improperly or atypically designed or maintained, which in some instances has led to the release of improperly treated effluent. (pp. 32-33, 35-36, 38, 40-41, 48). Moreover, the Study noted that POME may enter groundwater if treatment ponds are unlined (p. 13), which all but one of the ponds mentioned in the Study are. Finally, some of the mills had no data available regarding effluent quality and/or have unmonitored discharge points (pp. viii, 36, 41, 48, 50), despite the fact that “[m]onitoring effluent flow and quality is fundamental for robust POME management.” (p. 25). The Study reported that “some sites would benefit from additional monitoring” and noted issues regarding data quality. Recommendations for improving monitoring and data quality include:

- Greater use of flow meters to reduce the risk of pond flooding. (p. 25).

³ The Study failed to mention what these “toxicity effects” are or what extreme circumstances lead to them.

⁴ The Study mentioned a drive inspired by the Clean Develop Mechanism of the United Nations Convention on Climate Change to capture methane for flaring or to produce energy. (p. 15). All of the milling companies in the Project area have present or future plans for methane recovery. (p. vii). If they choose to flare the captured methane, it will likely cause additional air pollution and health impacts.

- More targeted and timely in-pond quality monitoring to enable optimization of pond performance. (p. 25).
- Monitoring of additional parameters such as phosphorous and nitrogen. (p. 30 n.38).
- Development of biological indicators in order to make more sophisticated assessments of environmental quality. (p. 30 n.38).
- Greater use of standard solutions.⁵ (p. 25).
- Determination of “accepted” test precisions. (p. 25).
- Using “trip blanks” to identify potential systemic error in measuring BOD at the National Analytical Laboratory.⁶ (p. 25).
- Exchanging of samples between company laboratories as part of a quality control program. (p. 25).
- Undertaking a detailed statistical analysis to identify reasons for the variation between company lab BOD results and the results of the national lab. (p. 25).

B. Deficiencies in National Regulations

According to the Effluent Study, “national regulation is not robust” (p. viii), and is, in fact, less protective than World Bank Environmental Health and Safety (“EHS”) Guidelines. (p. 24). The Study highlighted the importance of updating the PNG Environmental Code of Practice for the Oil Palm Processing Industry (“Code of Practice”),⁷ strengthening national regulations and improving environmental monitoring. (p. i). Further, the PNG Smallholder Agriculture Develop Project (SADP) Palm Oil Mill Effluent (POME) Management Agreed Action Plan (“Action Plan”) located in the forward to the Study calls for creating “draft” updated standards for wastewater discharge and associated monitoring, record keeping, and reporting based on the PNG Environmental Code and international standards, including World Health Organization Guidelines and World Bank Guidelines (although it is unclear what will happen once the draft standards are created). (p. v). Other specific recommendations include:

⁵ The Study did not explain what this means.

⁶ The Study noted that company test results for BOD are generally lower than those from the national laboratory, and hypothesized that this was due to systemic error at one or both labs. (p. 25). The Study recommended detailed statistical analysis to identify reasons for the variation. (p. 25).

⁷ The Code of Practice is a set of standards jointly developed by the palm oil industry and the PNG Department of Environment and Conservation (“DEC”). The Study stated that “the Code is used as [a] basis for regulation” (p. 20), but did not explain how this takes place. Nor did the Study indicate whether national regulation is more or less strict than the standards set forth in the Code.

- Using the proposed updating of the Code of Practice to:
 - (a) improve the quality and scope of effluent-related environmental monitoring;
 - (b) establish accepted monitoring frequencies;
 - (c) provide greater guidance on the design and operation of POME treatment systems;
 - (d) define in more detail “targets” and “limits” for discharge of treated POME to land and surface waters, including limits for oil and grease, total suspended solids and nutrient discharge; and
 - (e) define “full-compliance.” (pp. ix, 51).

- Formalizing the currently informal relationship between the Code of Practice and government regulation. (pp. ix, 51).

C. Need for More Technical Analysis

As noted above, Bank Management itself acknowledged that the Effluent Study was not conclusive and that “[f]urther in-depth technical analysis of each mill’s capability to treat liquid waste is needed in order to facilitate a more comprehensive analysis of current operations.” (p. i). The Action Plan appears reasonably well thought-out, although it does have some gaps, as discussed in more detail below. If each of the points and sub points within the plan are implemented, the smallholders and Bank Management will be better able to make an informed decision about SADP. However, until all of the studies and other documents in the Action Plan have been published and the smallholders have had an opportunity to comment on them, the project should not move forward.



D. High Environmental Risk Mills

The Study identified numerous pond design and other operational issues at the mills in the Project area, many of which may pose environmental risks if not corrected. As mentioned above, such issues include: (1) lack of management guidelines or procedures for pond design and operation; (2) improperly or atypically designed ponds; (3) unlined ponds; (4) insufficient pond retention time; (5) sludge, scum and/or vegetation build-up in ponds; (6) a lack of environmental

performance data at some mills; and (7) issues with data quality. Additionally, the Study identified the following four mills that pose a high environmental risk.⁸

i) Sangara Mill

Sangara Mill, commissioned in 1980 and located in Oro, Northern Province, poses a high environmental risk because of its history of pollution and poor management, site characteristics and unusual treatment system. (pp. iv, viii). Discharge from Sangara’s POME treatment ponds flows into the Ambogo River, which in turn flows into Oro Bay. (p. 40). In the 1980s, the mill and treatment ponds were not properly maintained, leading to a “complete failure of the biological processes in the treatment ponds” and significant oil losses. *Id.* The smell from the mill was reportedly bad, and local people complained of itchy skin and excessive sedimentation in the river. *Id.* The Effluent Study concluded that “the mill may have contributed to pollution of the River Ambogo” at that time. *Id.*

In the 1990s, the mill was ordered to stop discharges into the river and committed to improving performance as part of the World Bank’s Oro Smallholder Oil Palm Development

“‘[L]imited attention’ is given to pond management, and there is an ‘extensive mat of vegetation in the middle sections of the pond sequence.’”

Project. *Id.* The “solution” was to build a series of dams used to recirculate effluent from pond 5 back to pond 1 “with the hope of volume reduction through loss to atmosphere (evaporation) or possibly infiltration.”⁹ *Id.* Composting was introduced in 2001, but excess supply led “to an explosion in the local rat population.” *Id.* The composting site has not been tidied up, and the Study found suggestions “that the rat population is still numerous.” (p. 41). In 2007, Sangara Mill began using effluent to irrigate

crops with a sprinkler system, which reportedly led to crop scorching “probably owing to inadequate POME treatment.” *Id.* Irrigation is now occurring through a trench system. *Id.*

“‘[L]imited attention’” is given to pond management, and there is an “extensive mat of vegetation in the middle sections of the pond sequence.” *Id.* Although the Study reported that the treated effluent used for irrigation “has been well below the BOD limit for land application,” it also noted that environmental monitoring data was not available. *Id.* The Study further reported that the mill is exceeding its limit for the amount of treated effluent discharged to land, “adding to the volume of water in the gully and placing hydraulic strain on the gully pond dams that seem to be exceeding the ‘norm.’” *Id.*

⁸ As discussed in more detail below, the Study did not identify the sources used in reaching this conclusion.

⁹ Both of these “solutions” seem to have their own problems. It seems evident that evaporation of water could lead to a higher concentration of pollutants in the remaining effluent. Similarly, infiltration simply means that the effluent would mix with groundwater, rather than surface water. It is unclear why that would be considered a better result.

Despite these observations, the Study was unable to confirm whether the treatment system was incapable of handling heavy rainfall, leading to effluent flowing into the River Ambogo, as suggested in a 2006 report commissioned by CELCOR. *Id.* The Study also found that while water quality in the area “appears contaminated . . . it is unlikely that today it can be substantially attributed to the Sangara Mill.” (p. 43).

Nonetheless, the Action Plan calls for a commitment from Kula Palm Oil Ltd. (KOPL),¹⁰ Sangara Mill’s operator, to study POME treatment and site drainage issues at the mill. (p. iv). The Study also recommends that the mill operator thoroughly investigate these issues in order to: (a) obtain greater understanding of the system and the hydraulic regime in particular; (b) reduce the volume of water in the gully ponds; (c) improve the efficiency of pond operation; and (d) ensure adequate environmental performance. (pp. x, 42, 51).

ii) Hargy Mill

Hargy Mill, commissioned in the 1970s and located in Bialla, West New Britain, presents a high environmental risk because of its low lying status, its proximity to the sea, and space constraint issues. (pp. iv, viii, 35). The site also has a high water table due to its coastal location. (p. 35).

For its first two decades of operation, Hargy Mill discharged minimally treated POME directly into the Bismark Sea. *Id.* In 1989, the nearby Ewasse village filed a successful complaint and received compensation for environmental damage. *Id.* The mill subsequently installed a pond treatment system in 1992, but problems continue. *Id.* The ponds are of insufficient depth due to the high water table, and one of the ponds is also covered in vegetation, which the Effluent Study noted is “contrary to typical POME pond design and HOPL [Hargy Oil Palm Ltd.] Management Guidelines (MG 11) and will reduce pond operating volume.” (pp. 35-36). Although the Study found that treatment “generally reduces BOD below limit at the environmental contact point,” it also reported that the mill has other discharge pipes that are not monitored. (p. 36). Finally, at times, third parties willfully damage the ponds at Hargy Mill, leading to discharge of untreated POME directly into the sea. *Id.*

The Action Plan and the Study’s own recommendations call for a commitment from HOPL, the mill operator, to improve pond performance. (pp. iv, ix, 51). HOPL is also commissioning a study from James Cook University regarding the impacts of pond discharges to the Bismark Sea and examining marine currents, water quality parameters, and flora and fauna. (p. 37). The company will use the results to shape its 2011 pond modification plans.¹¹

¹⁰ At the time of the Study, KOPL was trading as Higaturu Oil Palm (HOP) and had recently been acquired by New Britain Palm Oil Ltd.

¹¹ The Study does not mention a timeline for the study from James Cook University, nor any information regarding whether the planned 2011 pond modification at Hargy Mill was on schedule as of July 2011 when the Study was published.

iii) Navo Mill

Navo Mill, commissioned in 2002 and located in Bialla, West New Britain, was the only modern mill specifically identified by the Study as posing a high environmental risk. (p. iv). While BOD levels of the treated effluent from this mill are apparently consistently below the Code of Practice's criteria for discharge to land, the effluent grossly exceeds other limits. For example, total suspended solids were exceeded, often significantly and once by a factor of ten, for 24 out of 28 weeks of the most recent data looked at by the Study. (p. 38). During that same time, oil and grease concentrations reached levels up to 52,000mg/l – 100 times the 50mg/l criteria in the Code of Practice – with 45 of 53 samples exceeding 50mg/l. *Id.* According to the Study, this could “lead to excessive local nutrient supply, blockage of trenches intended to disperse treated effluent to groundwater, and local topsoil erosion.” *Id.* Moreover, at the time of the site visit, “the irrigation system was out of control and a stream of treated effluent was flowing through the plantation . . . and ultimately to the Kianga Creek.”¹² *Id.*

The Action Plan calls for a commitment from HOPL to improve pond performance. (p. iv). The Study also recommends that HOPL issue and implement an improvement plan that includes a description of planned changes to POME treatment and management at this mill. (pp. ix, 51).

iv) Mosa Mill

Mosa Mill, commissioned in the early 1970s¹³ and located in Hoskins, West New Britain, presents a high environmental risk due to the proximity of its ponds to a spring and the River Lameski.¹⁴ (pp. viii, 29). After treatment, POME from this mill is “discharge[d] into a small spring-fed watercourse then to the Lameski.” (p. 29). There was at least once incident between January 2008 and May 2010 in which one of the treatment ponds overflowed into the final drainage channel, causing a release of POME that had not been properly treated. (p. 30). The Action Plan calls for a commitment from New Britain Palm Oil Ltd. (NBPOL), the mill operator, to investigate cooling pond overflows into discharge channels and to implement mitigation measures. (p. iv).

¹² Apparently the Environmental Permit for Navo Mill states that effluent should not impact the water quality of Kianga Creek. The Study found no evidence that this had been assessed. (p. 38 n. 40). The Study hypothesized, however, that the drainage to the Kianga Creek was “probably a temporary operational issue,” considering the mill’s extensive irrigation trenches. (p. 38).

¹³ The Study identifies its commission date as 1971 on page 29, but as 1972 on pages vii and 49.

¹⁴ On a positive note, this mill is building a methane recovery pond, which it intends to use to supply electricity to the local grid, benefiting the local community. (p. 30).

E. Commitments Made by Companies

The Effluent Study discussed several commitments by the milling companies regarding investigation of environmental impacts and improvements to POME management. While such commitments are significant, work may need to be done to make sure that the companies follow through with their commitments in a timely manner.¹⁵

Commitments secured as part of the Effluent Study include:

Commitments by All Milling Companies

- To establish baseline information for each Project area mill and conduct one follow-up environmental audit of these mills. (p. iii).

Commitments by KOPL

- To investigate POME treatment and site drainage at Sangara Mill. (p. iv).

Commitments by HOPL

- To implement actions to improve pond performance at Hargy and Navo Mills. (p. iv).
- To study the potential impact of POME discharges from the Hargy Mill on the Bismark Sea. (p. 37).

Commitments by NBPOL

- To investigate cooling pond overflows into discharge channels at the Mosa Mill and implement mitigation measures. (p. iv).
- To construct five methane recovery projects that provide energy substitution for its own operations, as well as electricity to surrounding communities. (p. vi).

II. Issues Inadequately Addressed in the Effluent Study

As noted above, the Effluent Study failed to answer many fundamental questions about the impacts of increased POME from this Project. This section presents an overview of the most significant of those failures.

A. Failure to Meet Objectives in the Terms of Reference

The Effluent Study's first major deficiency is its failure adequately to address the objectives outlined in its own terms of reference. According to the Study, its objective was "to determine whether the palm oil milling companies in the SADP Project areas have the capacity

¹⁵ As noted below, while the Action Plan does briefly identify who is responsible for supervising some of these commitments, most of which have apparently been made in writing, it is not clear how these commitments will actually be regulated and enforced.

in their mills to adequately treat the increase in Palm Oil Mill Effluent (POME) anticipated due to an increase in production of Fresh Fruit Bunches (FFB) under the SADP.” (p. vi). Additionally, the terms of reference directed the Study to investigate current and historic health issues associated with POME. (p. viii). Despite explicitly referencing these objectives, the Study essentially sidestepped these important issues.

i) Inadequate Study of Mills’ Capacity to Handle Increased POME

The Study interpreted the term “capacity” to mean: “sufficient infrastructure to manage and treat POME to adequate standards prior to final use or disposal; adequate sampling and monitoring to demonstrate treatment to these standards; and management practices, capability and controls to ensure adequate environmental performance.” (p. ix). Despite its thorough interpretation, however, the Effluent Study failed to analyze each of these factors and ultimately failed to reach a concrete conclusion on the question of whether mills in the Project area could adequately treat the increased effluent associated with the Project. Instead, the Study relied almost entirely on the fact that mills in the area are or will shortly be certified to ISO 14,001 and RSPO standards in concluding that “capabilities and controls *should be in place* to treat the increase in POME due to SADP.” (p. ix).

Current or future third party certification and “commitments for continuous improvement” are no substitute for concrete analysis of whether each mill has the physical, technical and operational capacity to adequately treat the increase in POME projected as part of SADP.

Current or future third party certification and “commitments for continuous improvement” (p. ix) are no substitute for concrete analysis of whether each mill has the physical, technical and operational capacity to adequately treat the increase in POME projected as part of SADP. Even Bank Management acknowledged that the Study did not adequately address this issue and that in-depth technical analysis was needed. (p. i).

Tellingly, although the Study noted that “[i]f not accounted for in the design of the treatment system, rainfall can readily lead to flooding, and inadequate treatment” of POME (p. 9), it never addressed whether any of the mills in the Project area had actually accounted for the heavy rains typical of the rainy season in PNG when designing their POME treatment systems. Nor did it directly assess whether such systems could handle the future increase in POME due to SADP during the rainy season. In fact, that Study did not directly analyze the mills’ capacity to *treat* POME at all. Instead, it charted the *milling* capacity, which may not amount to the same thing.¹⁶

¹⁶ Interestingly, several of the mill groups currently lack even the milling capacity to handle the increase in FFB due to SADP, calling into question whether they would be able to handle the increased POME. (See pp. 28-29).

Furthermore, although the Study described the designs of the treatment ponds at each mill, and mentioned some irregularities, it failed to address the impact of pond design on the mills' ability to treat the increased POME associated with SADP. In fact, the Study explicitly did not undertake a detailed assessment of the adequacy of pond design (p. 27), despite acknowledging that improper pond design could impact treatment rates and quality. (pp. 12-13). The manner in which the treatment ponds work is highly technical, and a mere description of the ponds at each mill and their irregularities is not sufficient to inform smallholders of whether the mills have the capacity to ensure high quality treatment at a sufficient speed to accommodate the increased POME from SADP.



Additionally, the Study never addressed whether the milling companies have the technical and managerial capacity to ensure adequate environmental performance. Thus, the Effluent Study never answered the fundamental question it was meant to address: whether the milling companies in the Project area have the capacity to properly manage the increase in POME that will be caused by SADP.

ii) No Analysis of Health Impacts

The Study concluded that “there is no reason to believe that any health issues can be attributed to current operations” (p. viii) without studying the issue or identifying any relevant third-party studies, and despite admittedly lacking high quality environmental performance data. According to the report, “[n]o studies have been identified looking at the health impacts of POME,” although it admitted that “[e]nvironmental health concerns might result from oxygen depletion in water bodies, complaints about odour and tainting the taste of water contaminated by POME.” (p. 10).

The Study also noted that “POME treatment ponds may be used as a sink for septic tank debris,” but that “sterilisation should take place owing to the initial high temperature of POME received from the mill or by subsequent treatment in shallow aerobic ponds exposing any pathogens to Ultra Violet light.” *Id.* If septic tank debris is being placed in POME treatment ponds in the Project area, it would pose an obvious health concern, particularly given that some of the ponds have flooding problems and/or are discharged to water used for drinking, cooking and agriculture. Yet, the Study failed to clarify whether any of the mills in the Project area use treatment ponds as a place to dispose of septic tank debris. If they do, an assurance that “sterilisation should take place” due to the high temperature of POME or exposure to Ultra Violet light is not sufficient to conclude that there are no health impacts from such practices.

Rather than performing a legitimate analysis of the potential health impacts of POME, the Effluent Study simply maintained that current effluent management infrastructure negate the possibility that negative health impacts could be occurring at this time. (pp. viii, 50). As for historic issues, the Study admitted that poorly controlled effluent releases from one mill likely impacted the well being of the community in that region in the past, but did not even address whether other mills may have impacted communities in other regions. (p. 50). While it may be true that current operations in the Project area do not pose a health risk, such a conclusion must be supported by some type of health study or analysis of environmental data. The approach taken by the Study does not constitute an investigation of current and historic health issues associated with POME.

B. Insufficient Analysis of Environmental Data and Operating Procedures at Mills

In addition to its failure adequately to address health impacts and the mills' capacity to properly manage additional POME, the Effluent Study's analysis of environmental data and mills' operating procedures was deficient. The Study's presentation of past data lacked standardization and was ultimately of little use in understanding the environmental impact of past operations. Its analysis of operational policies suffered from similar problems. Additionally, the Study's projections of future environmental impacts from the mills' operations lacked detail and improperly relied on such measures as third-party certification in concluding that future impacts would not be harmful.

i) Problems With Analysis of Past Data Make the Study of Little Use

The Effluent Study is of limited usefulness because its presentation of the environmental performance of the mills in the Project area lacked standardization and thus did not allow for comparisons between mills or for an overall picture of their performance. For example, the Study provided data on the amount of POME produced per metric ton of FFB processed for the four mills (pp. 9-10), but failed to provide such information for all of the mills. Similarly, the Study showed a comparison of company and national lab BOD results for one environmental impact point, but not for others. (pp. 25-26). Finally, the Study gave information on the BOD and oil and grease levels before and after the environmental point of impact for one mill, but not for others. (pp. 30-31). Such information is interesting, but does not provide any general sense of the environmental performance across all of the mills in the Project area.

The Study also failed to identify the source of much of the data relied on and did not include the type of analysis necessary to ascertain legal compliance or environmental impacts. While the Study provided some useful data about some mills, it was not comprehensive and in general failed to present a picture of the overall environmental impact of oil palm mills in the Project area.

a. No Information About Source of Data

When the Study did discuss environmental performance data for particular mills, it consistently failed to identify the source of the data, despite noting that “[g]enerally the company results are lower [than those of the national lab] suggesting systematic rather than random error at one or both laboratories.” (p. 25). While citation of the source of data would have been important regardless of any data quality issues, the fact that the Effluent Study found systematic discrepancies between data from company labs and national lab makes the identification of the source of data particularly important.

b. Inadequate Information Regarding Legal Compliance

The Study raised serious questions about whether the mills are currently operating within legal requirements. Specifically, while the Study stated that “most if not all mills are legally compliant,” it admitted that “[a] categorical statement about full legal compliance for all mills is not made because the issuing of permits is going through a transitional phase . . . , permits are not always clear, and environmental performance data were not always available (notably from Oro sites).” (p. viii). Moreover, the Study conceded that “there are issues concerning data quality.” *Id.*

The Study raised serious questions about whether the mills are currently operating within legal requirements.

Similarly, the Study’s conclusion that “most if not all mills are legally compliant” is belied by reports of standards being grossly exceeded at some mills. For example, at Navo Mill, the standard for total suspended solids was exceeded, often significantly and once by a factor of ten, in 24 out of 28 weeks of the most recent data looked at by the Study. (p. 38). During that same time, oil and grease concentrations reached levels up to 52,000mg/l – 100 times the 50mg/l criteria in the Code of Practice – with 45 of 53 samples exceeding 50mg/l. *Id.*

It is not possible to conclude that “most if not all mills are legally compliant” when some mills are grossly exceeding limits, some points of discharge are unmonitored, “[a] number of operational issues” have been identified (p. viii), data is admittedly not always available, there are quality concerns regarding the data that is available, and four mills have been identified as posing a high environmental risk. There is simply no credibility to the Study’s assertion regarding legal compliance. Legal compliance is a baseline requirement that all mills in the Project area must meet. Under no circumstances should SADP go forward if any of the mills in the Project area do not meet this requirement.

c. Limited Analysis of Environmental Impacts

The Effluent Study relied on limited observations and unanalyzed data points in concluding that effluent in the Project area is not causing negative environmental impacts. For

example, the Study concluded that effluent from the Mosa Mill “has little impact” on the quality of the river into which it is discharged based on graphs showing that higher BOD and oil and grease levels in the river 10 meters after the environmental point of contact did not always correspond to when the effluent had higher levels of BOD and oil and grease. (pp. 30-31). On the basis of the graphs alone, however, such a statement cannot be made. To determine that the discharge had little impact, one would first need to establish what constitutes little (or significant) impact, and then would have to do a statistical analysis to determine the impact the



effluent was having. This is particularly true given that other sources, in addition to the effluent, are potentially polluting the water in question because pollution from other sources does not mean that the effluent is not also impacting the water. Moreover, even if these graphs were conclusive in establishing that Mosa Mill has little impact on the nearby river, it still would not establish whether other mills were impacting other water sources. Yet, the Effluent Study did not provide similar data for other mills.

Throughout the Study, potential environmental issues were acknowledged, but not adequately investigated or analyzed. For example, the Study failed to do a detailed assessment of the adequacy of pond design (other than reviewing discharge performance) (p. 27), despite having highlighted the crucial nature of pond design in determining whether the desired quality of treatment can be achieved in a given amount of time. (pp. 11-14).

In terms of potential direct environmental impacts, the Study noted instances in which treated effluent is being discharged into mangrove swamps, yet it did not discuss whether these mangrove swamps are sensitive or important ecosystems or what effect (if any) the effluent is having on them. (pp. 32, 36). Similarly, the Study mentioned that the issue of fish kills due to mill effluent came up during consultations, but hypothesized that the kills were actually due to the use of insecticides to kill prawns and fish. (p. 39). It does not appear that any independent research was done on this issue. Instead, the Study relied on an investigation by one of the milling companies, under which a fish kill was found to have no link to effluent. *Id.*

Finally, the Study noted that all but one of the ponds in the Project area are unlined, creating a risk of groundwater contamination. Nonetheless, it failed to do any testing for groundwater contamination. Instead, it simply reported that “[t]his question was asked during some site visits but no comments were received or observations made to indicate this is a

risk.” (p. 27). The Study then concluded by hypothesizing that any groundwater problems would be observed and corrected because “[f]or most if not all sites the most proximate groundwater users are the companies who analyse water quality on a regular basis.” *Id.* Such causal questions and observations are not sufficient to determine that there have been no environmental impacts on groundwater.

d. Inadequate Analysis of Operational Policies at Each Mill

The Study acknowledged that “[t]he chemical properties of POME vary widely . . . and depend on the operation and quality control of individual mills.” (p. 11). Poor operational practices can lead to an increase in POME production (p. 9), as well as problems with effluent ponds such as sludge build-up (pp. 32, 48) or even a complete failure of the biological processes needed to treat POME. (pp. 40, 48). Yet, while the Study mentioned best practices for mill and pond management and commented on certain positive and negative operations at specific mills, it failed systematically to analyze the policies (or lack thereof) at each mill and make appropriate recommendations for improving them.

e. Limitations of the Environmental Baseline Studies and Follow-Up Audits Identified in the Action Plan

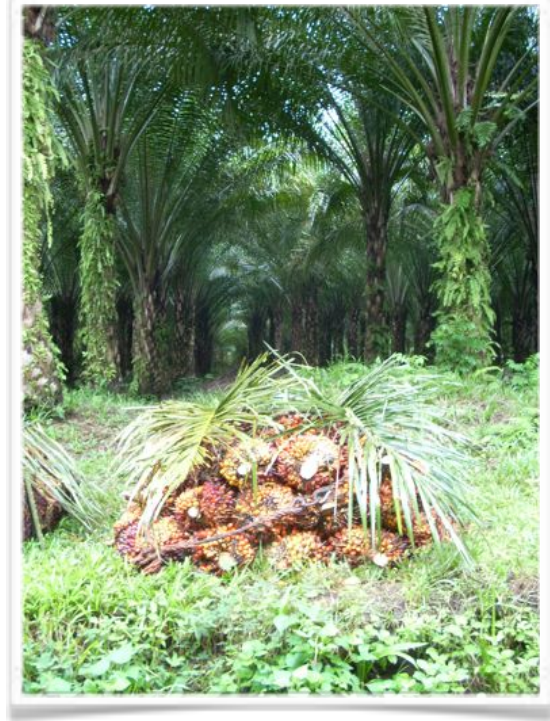
The Action Plan laid out in the forward to the Effluent Study calls for written commitments from each milling company to establish baseline information for each Project area mill, as well as conduct one follow-up environmental audit at each mill. (p. iii). While the Action Plan is reasonably well thought-out in terms of the technical assessments that must be made, there are some gaps. For example, it does not mention studying groundwater, despite the Study’s acknowledgement that POME may get into groundwater if treatment ponds are unlined (p. 13). All but one of the treatment ponds in the Project area are unlined, and the soil in PNG is porous, creating at least “a theoretical risk that POME may infiltrate into groundwater.” (p. 27; *see also* p. 40). The Study also mentioned that treated POME is sometimes disposed of in trenches for dispersal into groundwater. (pp. 14, 38, 48). Thus to the extent that such POME has not been properly treated, it could also lead to groundwater contamination.

In addition to testing groundwater, the studies identified in the Action Plan should assess the adequacy of pond design at each mill. Although pond design is crucial in achieving the desired standard of treatment in the desired amount of time (pp. 11-14), the current Action Plan does not call for a detailed assessment of the design of the ponds in the Project area.

Moreover, in order to gain a better understanding of the quality of the POME being discharged to water and land, there must be sampling of the treated effluent before it combines with other water sources such as drainage channels or springs. It is unclear from the Effluent Study where monitoring is taking place at all of the mills, but some of the monitoring appears to happen only after treated POME has been combined with other water sources. (*See* pp. 32-33,

34, 57-60). The baseline studies and follow-up audits must make sure to gather data attributable solely to the POME being released from the mills (as well as other data, as necessary).

Finally, issues of accountability, transparency and timeliness were unaddressed in the Action Plan. While the Effluent Study indicated that the plan will be jointly implemented by the Oil Palm Industry Corporation (“OPIC”), the PNG Department of Environment and Conservation (“DEC”) and the milling companies, with assistance from the World Bank (p. ii), nothing in the Action Plan provides an assurance to smallholders that it will be carried out in a timely manner and that the baseline studies and audits will be objective and accurate. These are significant concerns, considering the untimely manner in which the Effluent Study was published and the often-biased outlook of the Study. SADP should not move forward until these studies are completed and Bank Management and smallholders have had a chance to review and provide feedback on the results.



ii) Future Projections

Finally, while the Study included some graphs regarding the future milling capacity of some of the mills and mentioned that POME production will likely increase by 182,000 metric tons/year due to SADP (p. 9), it did not analyze future projections of POME production in terms of potential pollutants, nor their predicted impact on health or the environment. SADP should not go forward until there is clarity regarding the future health and environmental impact of increasing POME production in the area by 182,000 metric tons/year.

C. World Bank Guidelines for Vegetable Oil Processing

Although the Effluent Study mentioned the World Bank’s EHS Guidelines on Vegetable Oil Processing, it failed to analyze whether any of the mills meet these standards. The Guidelines set “performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs.” (p. 18). The Guidelines specify that they are “achievable under normal operating conditions in appropriately designed and operated facilities through the application of pollution prevention and control techniques”

discussed in the Guidelines themselves. (Guidelines at 7).¹⁷ Effluent “levels should be achieved, without dilution, at least 95 percent of the time that the plant or unit is operating.” *Id.*

The Guidelines’ application “to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them. . . . [and] should be tailored to the hazards and risks established for each project on the basis of the results of an environmental assessment in which site-specific variables are taken into account.” (p. 18). However, “[d]eviation from these levels . . . should be justified in the environmental assessment.” (Guidelines at 8). Nevertheless, the Study failed to make an individualized assessment of whether the older mills in the Project area should be allowed to deviate from the performance standards set in the Guidelines. Instead, the Study seemed to acknowledge the mills’ inability to meet the Guidelines by stating that they “are significantly stricter than those adopted by the palm oil industry in PNG (and other countries).” (p. 24).

Comparison of Effluent Standards ^a				
Pollutants	World Bank Guidelines – Water	Code of Practice – Water	Code of Practice – Land	PNG Law
pH	6-9	5-9	5-9	n/a
BOD ₅	50 mg/l	100 mg/l	5,000 mg/l	n/a
COD	250 mg/l	n/a	n/a	n/a
Total nitrogen	10 mg/l	n/a	n/a	n/a
Total phosphorus	2 mg/l	n/a	n/a	n/a
Oil & grease	10 mg/l	^b	50 mg/l	n/a
Total suspended solids	50 mg/l	n/a	n/a	n/a
Total solids	n/a	“Ref a law” ^b	4,000 mg/l	n/a
Suspended solids	n/a	^b	1,000 mg/l	n/a
Temperature increase	<3°C	n/a	n/a	n/a
Total coliform bacteria	400 MPN ^d / 100ml	n/a	n/a	n/a

a – This information is exclusively what was provided in the Effluent Study. The designation “n/a” indicates that no information was provided. For example, the Study provided no information regarding effluent standards under PNG law, nor did it clarify whether PNG law is the same as the standards in the Code of Practice.

b – as written in the Code of Practice (taken directly from the Effluent Study).

c – At the edge of scientifically established mixing zones.

d – MPN = Most Probable Number.

The Effluent Study stated that “effective privatisation of regulation through third party certification is a positive initiative which *should ensure* POME management consistent with World Bank policies.” (p. viii). This statement is not sufficient because it is unclear that third party certification requires compliance with the World Bank’s performance standards. SADP must comply with the World Bank’s performance standards for effluent discharge to surface

¹⁷ Available at [http://www.ifc.org/ifcext/enviro.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_VegetableOilProc/\\$FILE/Final+-+Vegetable+Oil+Processing.pdf](http://www.ifc.org/ifcext/enviro.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_VegetableOilProc/$FILE/Final+-+Vegetable+Oil+Processing.pdf) (last visited October 27, 2011).

water, even if they are stricter than PNG regulations and/or the requirements of third party certification. To the extent mills in the Project area are not even testing for all of the pollutants identified in the Guidelines, they must do so before the Project moves forward.

iv. Questions that Must Be Addressed Prior to Project Implementation

As mentioned above, the July 2011 Effluent Study raises more questions than it answers. This section summarizes the most important questions raised by the Study. Each of these questions must be addressed prior to further implementation of the Project.

A. General Questions

- The forward to the Effluent Study noted that the milling companies “have concerns over the objectivity of the main report”? (p. ii). What, specifically, are their concerns?
- If Bank Management agrees that the report is not conclusive and lacks technical analysis of each mill (p. i), why hasn’t it halted the Project until such technical analysis is complete?

B. POME Management Action Plan

The Action Plan set forth in the forward to the Effluent Study leaves many issues unaddressed. In particular, the Plan fails to set forth any standards for accountability or transparency, leaving smallholders without any assurance that the environmental studies will be objective, accurate and available and that new standards actually will be implemented. Specific questions include:

- What assurance do the smallholders have that the Action Plan will be carried out?
- What measures will be taken to ensure that the baseline studies and audits are objective and accurate?
- When and how will the information from the baseline studies and follow-up audits be shared with the smallholders?
- What measures will be taken to ensure that the new draft standards are sufficient to protect the environment?

- Will there be a public comment period or some other way for smallholders to have their voice heard in this process?
- How will the new “draft” standards be used? Will all mills in the Project area have to comply with these new standards, even if they are only “drafts” and may not be incorporated into PNG law?

The Action Plan also fails to provide sufficient information about the timeline for the baseline studies, follow-up audits and updated standards. Given the significant delay in the Effluent Study, this raises a concern that the Action Plan will not be implemented in a timely manner. Specific questions include:

- Have the baseline studies been completed?
- Were the follow-up audits initiated by August 30, 2011, as indicated in the Action Plan (p. iv)?
- Will the technical assessments be completed by March 31, 2012, as indicated in the Action Plan (p. iv)?
- When will the smallholders have access to these studies?
- Have the PNG Department of Environment and Conservation (“DEC”) and the milling companies begun working on “draft” updated standards for wastewater discharge and associated monitoring, record keeping and reporting, as indicated in the Action Plan (p. v)?
- When will the draft standards be complete?
- When will the updated standards be incorporated into the operations of each of the mills?

C. Capacity to Handle Increased POME

The Study failed adequately to address whether the milling companies in the Project area will be able to properly manage the increase in POME associated with SADP. Specific questions include:

- Were the treatments systems at all of the mills designed to account for the heavy rains during the rainy season, so as to avoid flooding and inadequate treatment?

- Can the treatment systems handle the increase in POME during periods of heavy rain?
- Were the treatment ponds designed properly and in such a way that they can ensure high quality treatment at a sufficient speed to accommodate the increased POME from SADP?
- In addition to the proper infrastructure, do the milling companies have the technical capabilities and the managerial capacity to ensure adequate environmental performance?

D. Analysis of Health Impacts

In failing to identify *any* studies regarding the health impacts of POME or do its own health assessment, the Effluent Study provided no useful information on the current or historic health impacts of POME. Remaining questions include:

- Do POME or its environmental impacts pose any type of health risk?
- Are people in the Project area suffering from any of those risks? Did they in the past?
- If so, is there a correlation between those suffering and exposure to POME?
- Are any of the milling companies in the Project area using POME treatment ponds as sinks for septic tank debris?
- If so, what assurances are there that water released (accidentally or after treatment) from these ponds has not been contaminated in a way dangerous to human health by the septic tank debris?

E. Environmental and Health Standards for Mills in SADP Project Area

It is unclear from the Study what standards are being applied to the mills in the SADP Project area. The Study acknowledged deficiencies in national law and regulations and encouraged reliance on “privatisation of regulation.” (p. viii). Additionally, the Study admitted that World Bank standards “are significantly stricter than those adopted by the palm oil industry in PNG.” (p. 24). Nevertheless, the Study only discussed legal compliance and failed to analyze whether mills were in compliance with World Bank standards. More information is needed regarding whether these standards are being met. Specific questions include:

- To what environmental and health standards are the mills in the Project area currently being held?

- Are any of the effluent discharges to surface water currently meeting the World Bank's EHS Guidelines on Vegetable Oil Processing?
- If some of the mills are not meeting the performance standards specified in the Guidelines, when and how will those Guidelines be met?
- Why do the Code of Practice discharge standards allow for much higher levels of BOD, total solids, suspended solids and oil and grease when effluent is discharged to land instead of water? Is this environmentally appropriate?

v. Mitigation Measures

SADP should not go forward until all of the questions above are adequately addressed. Moreover, regardless of the answers to those questions, there are various mitigation measures that should be put in place to reduce the impact of increased POME from the Project. Some of these measures are taken from recommendations and information given in the Effluent Study, while others relate to deficiencies in the Study.

A. World Bank Policies, Procedures and Guidelines

As a World Bank project, SADP must not move forward if the project area mills do not comply with World Bank standards. Any deviations must be justified in the environmental assessment, required under Operational Policy and Bank Procedure 4.01. In order for SADP to meet World Bank standards:

- All new mills and treatment ponds, including Waraston (commissioned in 2011) and Barema (to be commissioned in 2012), must be designed and operated in such a way as to meet the performance standards in the EHS Guidelines on Vegetable Oil Processing.
- Site-specific targets and appropriate timelines should be developed to bring older mills into compliance with the Guidelines.
- Monitoring and evaluation plans should be developed to ensure that new facilities continue to meet the performance standards and older facilities meet their targets on time.
- Companies should monitor additional parameters found in the Guidelines such as phosphorous and nitrogen.

Moreover, to ensure that the standards are being met, companies must eliminate the data quality issues identified in the Study. In addition to a general requirement that all mills must be monitoring their effluent and keeping records of the results, quality control should be improved by:

- Greater use of standard solutions.¹⁸ (p. 25).
- Determination of “accepted” test precisions. (p. 25).
- Using “trip blanks” to identify potential systemic error at the National Analytical Laboratory. (p. 25).
- Exchanging of samples between company laboratories as part of a quality control program. (p. 25).
- Undertaking a detailed statistical analysis to identify reasons for the variation between company lab results and the results of the national lab. (p. 25).
- Development of biological indicators in order to make more sophisticated assessments of environmental quality. (p. 30 n.38).

B. Health Impacts

Due to the Study’s failure to adequately address this issue, smallholders still have no information about health issues associated with POME. Moreover, while the Action Plan addresses many of the data deficiencies in the Effluent Study, it does not include any provisions for studying health impacts. SADP should not move forward until a legitimate health impact assessment has been completed and relevant mitigation measures have been put in place, as necessary.

. . . while the Action Plan addresses many of the data deficiencies in the Effluent Study, it does not include any provisions for studying health impacts.

C. Pond Design and Management

Many if not all of the mills studied appear to suffer from deficiencies in pond design and management. For example, Kapiura Mill has had “issues with meeting discharge expectations” because of structural problems such as insufficient pond retention times and operational problems such as sludge build-up. (p. 32). There are a number of measures companies should

¹⁸ The Study does not explain this in any detail.

be taking to ensure that all of the ponds are being managed in a way that will protect the environment, including:

- Desilting ponds suffering from sludge build-up.
- Lining all ponds to prevent POME from leaching into groundwater.
- Designing all new ponds to ensure they have the proper shape and depth to ensure high quality treatment and to allow for hydraulic upsets, sediment accumulation and excess precipitation. (See pp. 12-13).
- Installing high-rate oxidation systems if feasible. (See p. 14).
- Hiring pond management specialists.¹⁹
- Using flow meters to reduce the risk of pond flooding.
- Performing targeted and timely in-pond quality monitoring to enable optimization of pond performance. (p. 25).
- Drafting and implementing policies regarding pond design and management, and creating systems to ensure that they are followed. Policies should address issues such as: (1) adequate mixing within and between ponds; (2) prevention of excessive accumulation of solids; and (3) measurement of different parameters between ponds (temperature, BOD, acidity, VFA and alkalinity) to ensure better performance. (See pp. 13-14).
- Providing trainings for all employees concerned with pond management to ensure that they have the necessary technical capabilities and that they understand and can implement company policies regarding pond management.

D. Milling Practices

The Effluent Study noted that poor milling practices can lead to increased POME production. Companies must take steps to ensure this does not happen, including:

- Drafting and implementing policies regarding milling practices and creating systems to ensure that they are followed.

¹⁹ The Study notes that “NBPOL is taking a positive step to enhance its technical pond management capabilities by employing a pond specialist.” (pp. viii, 50). All of the companies operating in the Project area should be taking such steps, and should employ more than one pond specialist if necessary, depending on the scope of their operations.

- Providing trainings for all employees to ensure that they have the necessary technical capabilities and that they understand and can implement company milling policies.

E. Technology Upgrades

The Effluent Study mentioned modifications that can be made to the traditional palm oil milling process that can reduce water demand and POME production, while increasing the proportion of oil recovered. (pp. 7, 9). All new mills built in the Project area should be designed to include these features and, when feasible, older mills should be retrofitted to allow for:

- Direct centrifuging of screened raw press oil and/or other technological advances to improve water efficiency, thereby reducing POME production.²⁰ According to the Study, direct centrifuging can reduce POME production by 40-60%. (pp. 7, 9).
- Recycling and recovery of sterilizer condensate, which can reduce the overall volume of POME produced by approximately 10%.²¹ (p. 7).

F. Methane Recovery

Anaerobic POME treatment produces large quantities of methane, which has a significant global warming impact. SADP's global warming impacts should be mitigated by:

- Ensuring that all mills follow through, in a timely manner, with their methane recovery plans.
- Ensuring that companies use captured methane for energy production and do not implement gas flaring.
- Encouraging companies to design methane recovery projects that meet the Worldwide Fund for Nature's Gold Standard. (See p. 15).

²⁰ At least some of the mills in the Project area already have this type of technology. The Numundo Mill has an automatic sand removal cyclone and a 2-phase decanter system that apparently produces much less POME. (p. 9). Kumbango Mill upgraded to a vertical sterilizer in 2009, which "should require less water and produce less effluent." (p. 32).

²¹ At least two mills, Sumbaripa Mill and Mamba Mill, are already recycling condensate. (p. 47). To the extent milling companies have not adopted condensate recycling because they are concerned that condensate recycling is too risky when the quality of fresh fruit bunches ("FFB") is low, they can avoid this risk by diverting flow to the effluent system at such times. (p. 7).

vi. Conclusion

The July 2011 Effluent Study raised more questions than it answered. SADP clearly should not move forward on the basis of this Study alone, as neither Bank Management, the author of the Study, nor smallholders have a clear idea of the environmental and health impact of SADP, nor of the capacity of the mills in the Project area to properly treat increased POME from SADP. Nonetheless, the Study functions as a good roadmap for identifying issues that need further study, as well as major problems that must be addressed prior to the implementation of SADP. Moreover, recommendations and information from the Study will be helpful in developing a robust mitigation plan.

Glossary

Action Plan	PNG Smallholder Agriculture Develop Project (SADP) Palm Oil Mill Effluent (POME) Management Agreed Action Plan
BOD	Biochemical Oxygen Demand
Code of Practice	PNG Environmental Code of Practice for the Oil Palm Processing Industry
DEC	Department of Environment and Conservation
EHS Guidelines	World Bank Environmental Health and Safety Guidelines
FFB	Fresh Fruit Bunches
HOP	Higaturu Oil Palm
HOPL	Hargy Oil Palm Ltd.
ISO	International Organization for Standardization
KOPL	Kula Palm Oil Ltd.
NBPOL	New Britain Palm Oil Ltd.
OPIC	Oil Palm Industry Corporation
PNG	Papua New Guinea
POME	Palm Oil Mill Effluent
RSPO	Roundtable on Sustainable Palm Oil
SADP	Smallholder Agriculture Development Project
VFA	Volatile Fatty Acids



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