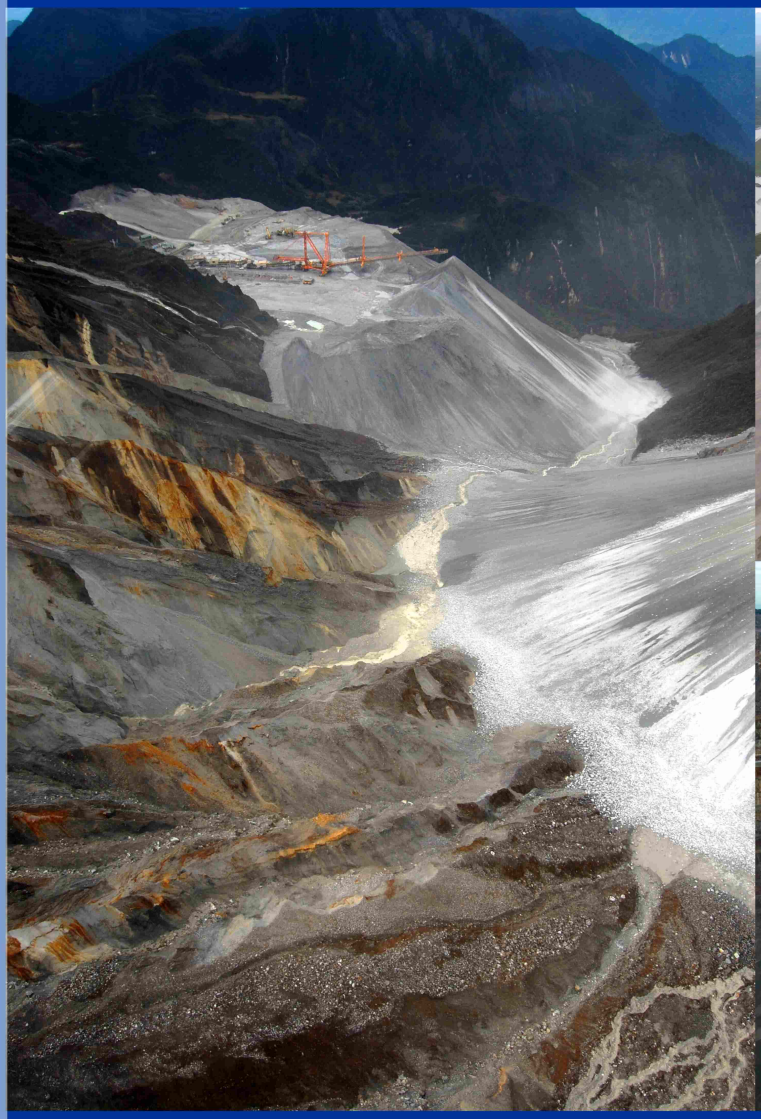
2011 EXTERNAL ENVIRONMENTAL AUDIT

AUDIT REPORT

Executive Summary



Prepared for

PT FREEPORT INDONESIA

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EXECUTIVE SUMMARY

Environmental management is an important aspect in mining activities. As described in the integrated environmental impact analysis that in 1997 was approved by the Minister of the Environment (better known as 300K AMDAL), external audits of environmental management are voluntary commitments of PT Freeport Indonesia (PTFI) in addition to a wide range of other duties such as management and monitoring of impacts that have to be implemented. An external audit is scheduled to take place once every three years. In 2011, PTFI conducted its sixth external environmental management audit, which was carried out by the Institute for Research and Community Services of the Bandung Institute of Technology (LPPM ITB). The Audit team consisted of experts from ITB and MWH. Audit observers from the Ministry of Energy and Mineral Resources, the Natural and Environmental Resources Management Body (BAPESDALH) of Papua Province and the Environment Agency (BLH) of Mimika District were invited and being present during the field observation. The field portion of the audit took place from 6th till 13th June 2011 after extensive review of information and a four day orientation visit by members of the team who had not previously visited the site.

The 2011 external environmental management audit was carried out with the primary purpose of evaluating PTFI's compliance with the national environmental law, environmental related government regulations and environmental standards. The audit also considered the adequacy of PTFI's environmental management strategies to achieve best and feasible environmental management practices and the effectiveness of PTFI's environmental management system in the actual implementation toward continuous improvement.

The approach used during the audit was by taking into account two critical aspects which will have a significant influence on PTFI mining activities. The first is the passing of Law Nr. 32/2009 concerning Environmental Protection and Management, which introduces a wide range of new concepts and legal frameworks into environmental protection and management. The second aspect is PTFI's internal condition in relation to the decommissioning of Grasberg open pit in 2016 and the

transition to underground mines as the backbone of ore production. During this transitional period, the current mine plan shows a decrease in daily ore production to 150,000 ton/day with rehandle of ore stockpile and increase gradually to current production rates begining 2020 onwards.

The audit focused on 6 strategic environmental issues which were defined and selected based on interest and perception of stakeholders, including the national government, the provincial government, district governments, and the community (including local communities). The issues are:

1. Tailings management
2. Waste rock management
3. Biodiversity
4. Waste management
5. Water quality and quantity
6. Air quality

This External Environmental Audit did not address social, economic nor cultural issues.

Key results form the audit are summarized below. Detailed assessments, explanations, and reccomendations are provided in the body of the main report.

TAILINGS MANAGEMENT

Tailings management continues to improve significantly since the previous 2008 External Environmental Audit (2008 Audit).

A ModADA (modified Ajkwa Deposition Area) hydraulic study conducted pursuant to Ministerial Decree Nr. 431/2008 has identified the downstream zone as being more effective for tailings retention because of its low gradient. Moreover, the presence of *Phragmites karka* in the zone can function as a biological filter. Construction of deflection channels will improve tailings retention in this area.

Efforts to protect and conserve water resources within the ModADA have been improved since the 2008 Audit. These efforts include the management of seepage water emitting through the base of the East and West levees, the design and trial testing of

various scour protection measures, continued management of potentially ARD-generating sediment through limestone blending, and ongoing efforts to reduce flow velocities within the ModADA to promote settling. From a long-term perspective, water resources have been positively impacted by construction of the Ajkwa Diversion which efficiently separates the Ajkwa River, which is not impacted by mining activity, from the Otomona River, which transports mine tailings.

A study of the effects of the tailings deposition area on groundwater flows and quality in Timika was recommended in the 2008 Audit. Several additional monitoring wells and piezometers were built, primarily near the West Levee. Conceptual mass transport model and sulfate monitoring results suggest that the Ajkwa River and Kwamki Lakes are hydraulically connected to the seepage from the ModADA and are intercepting these water flows. These transport models, however, are based on two-dimensional (2D) analysis and need to be confirmed with more data through the installation of additional groundwater monitoring wells to determine groundwater gradients, flow velocities and travel times and the groundwater flux. The conceptual mass model indicates a future potential for impacts to the Timika groundwater water system from the tailings deposition area. A deeper understanding of groundwater conditions in Timika would provide confirmation of current conditions. In the future, there is a potential for problems to emerge concerning the quality and quantity of groundwater in localized areas, where local population practices and waste management are likely to contaminate shallow groundwater. In this respect, the development of a groundwater monitoring system in Timika is recommended, together with the Timika local authorities, in order to have a more detailed understanding of local groundwater hydraulic (gradient and flux) and quality conditions (whether shallow groundwater or deep aquifer). Additionally, the transport model developed needs to be continually verified with the latest data and transformed into a 3D model integrating the local conditions found in Timika.

OVERBURDEN MANAGEMENT

In terms of preparations for the transition to underground of operations at the Grasberg open pit, overburden stockpile (OBS) management is a strategic issue to be constantly

evaluated to ensure it is aligned with the established mine closure plan. Several key issues were reviewed, focusing on the aspects of stability and ARD management.

Geotechnical stability aspect

Stockpile slope stability is an important matter that should be addressed in overburden stockpile operations, specifically in Lower Wanagon. There should be assurance that overburden stockpiles will remain stable in the long run after mine closure. Some issues associated with OBS slope stability include the following:

- The current mixing practice should be carefully reviewed, as it could weaken the entire overburden material in the stockpile.
- It is recommended to review of the slope stability monitoring system towards better identifying early signs of slippage. This is important to ensure long-term stockpile slope stability after mine closure.

Another issue that needs to be further addressed is the subsidence in Grasberg Block Cave, which will be mined once activity at the Grasberg open pit ceases. Construction or mining preparation has begun at Grasberg Block Cave and the targeted production level is expected to be achieved in 2022. Simulation conducted by CNI in March 2011 indicates the subsidence trajectory could spread to portions of the Carstenz OBS. Potential impacts from subsidence include: slippage at the former pit and the toe of the Carstenz OBS, slippage at the Carstenz/Bali OBSs that could lead to rock exposure and potential acid generation, and slippage at reclaimed stockpile areas. As such it is recommended to continue reviewing the subsidence site and the potential impacts generated. Risk analysis of various simulated scenarios is needed.

ARD Control

ARD control practices through overburden management have demonstrated good performance as indicated by the quality of seepage from Lower Wanagon monitored at stations ENV-01 and #57 in Banti. The measurement parameter for the mixing of various overburden types is ANC/NAG ratio, targeted to a minimum ratio of 15 to 1, to ensure the Lower Wanagon OBS in non-acid forming. This practice, in addition to placement of non-potentially acid-generating rock in the lowermost (downstream)

stockpile and proper drainage system design, needs further development to ensure OBS stability in ARD control, primarily in the long term after mine closure.

Additionally, in order to monitor the possibility of overburden stockpiles in the Bali dump area impacting areas outside the COW (contract of work) area, additional monitoring wells need to be built to the east of Bali dump area, in the direction of Meren Lakes.

Reclamation in overburden stockpile areas

Observations during the audit indicated some difficulty in revegetating OBS slopes. Some of this may be related to available equipment or deal with steep slopes. Therefore, final slope configuration should consider requirements for revegetation success and its effect on slope stability.

BIODIVERSITY

The success of *Deschampsia klossi* and *Phragmites karka* as pioneer species is highly significant since it is a combination of revegetation efforts with local species and a long-term experiment. It is a common practice in open pit mining to use fast growing plant species for reclamation in poor soil condition but most of these species are exotic and can turn out to be less adaptive or even invasive.

The success of limestone reject use as a growing medium is an innovative technique for revegetation in highland areas with extreme conditions. It provides a solution to the main problem in overburden revegetation, which is to improve the physical condition of substrate.

Reclamation model and experiments on the effect of tailings on the vegetation and livestock were initially aimed to investigate the potential for toxicity from tailings constituents to organisms. These experiments were later developed into cultivation experiments for various commodities, both agricultural crops, cattle and fisheries. This information will be used in the design of the future post mining land use of the tailings deposition area.

Special studies, such as maximum sustainable yield for various crops, should be continued and intensified because they could be used to determine the environmental carrying capacity of the impacted area. This is important for decision making on the sustainable use of biological resources considering the socio-economic aspects as well.

Based on the data and experience gathered to date in support of the importance of awareness of biodiversity resources conservation, PTFI should consider expanding use of their data and experience into a model in order to increase awareness of natural resource conservation to all stakeholders.

The use of rivers to transport tailings introduces significantly large volumes of sediment (mostly derived from natural rock) continuously over long periods of time, possibly even changing completely the ecosystem structures and functions of the river. Although sediment mitigation in river water bodies transporting tailings is virtually impossible in the highlands area due to rapid currents and river rock structures, in ModADA this could possibly be engineered using pioneer *Phragmites* as a 'natural filter'. Thus, the application of phytoremediation techniques for sediment mitigation should be further researched to be applied as part of the ecological engineering approach for wetlands management.

A unique feature of the Papuan highland ecosystem is the presence of a glacier atop Carstenz (the Carstenz equatorial glacier), which is adjacent to the PTFI COW area. This glacier, together with the integrity of the Papua highland ecosystems (Grasberg and Carstenz), could serve as an indicator of climate change. Therefore, by taking actions in order to reduce emissions and maintenance of standing vegetation which will maintain carbon stocks, PTFI could provide an example of the implementation of good environmental management practices in relation to climate change. On the basis of available data and experience gained to date, PTFI could benefit from the accumulation and integration of this information into a management model for forest areas that could be included in national and global schemes (CDM, REDD+, etc.), bearing in mind that PTFI holds a permit to exploit mineral resources that also involves the obligation to manage vast forests until 2041.

WASTE MANAGEMENT

Prevailing law on waste management requires PTFI to provide facilities for the segregation and separation of waste. Segregation facilities should have the capacity to separate hazardous waste originating from non-mining activities such as households, from non-hazardous waste; organic waste (food waste, garden waste, etc.) from inert waste; and recyclable trash or waste such as plastics, scrap iron, from non-recyclable inert waste.

PTFI has 10 domestic wastewater treatment centers distributed from Grasberg to Portsite. Routine monitoring of influents/effluents is carried out in a consistent manner. From a compliance point of view, all requirements appeared to be fulfilled. However, there is neither SOP implemented nor regular evaluations carried out at these facilities to assess if the system at the STPs is functioning optimally.

An SOP needs to be available to direct routine monitoring and evaluation of the STPs (sewage treatment plant), in particular organic loading, MLVSS, DO, sludge age, hydraulic loading, weir loading so that system performance can be monitored on a regular basis. Additionally, as has been done on the LTP (leachate treatment plant), it would be better for system improvement if PTFI also monitored inlet-outlet quality periodically for NO_3, NO_2, PO_4, in addition to routine parameters such as BOD and COD. Modification of aeration at STPs could be implemented, but should be based on clear understanding of the process unit mechanism. Failure to supply oxygen for degrading bacteria at the STP could cause the STP to fail to function. Without this SOP, there could be a tendency to modify performance, for instance by altering aeration time to become intermittent. If this is not handled judiciously with a good comprehension of the system, the result could be counterproductive.

Maintenance workshops in many areas have continuously met quality standards prescribed for discharges from oil-water separators by the permit (set at a maximum of 50 mg/l). However, there were no written improvement programs available during the audit to reduce oil content in workshop activities, in order to meet management commitments towards continuous improvement as set forth in PTFI's environmental

policy. This could be handled by the ISO 14001 Environmental Management System action plans.

Segregation of hazardous waste from PTFI primary activity is being implemented appropriately. At all activities visited, including hospitals, segregation of hazardous waste has been implemented effectively. Hazardous waste normally found in PTFI primary activities is segregated into at least 4 categories: (a) lead-acid battery (b) used rag oily waste, (c) used filters, (d) absorbents. However, hazardous waste not resulting from primary activities, such as used batteries, ink cartridges, spray cans and e-waste generally produced from administrative work, as well as similar waste from residential areas, was still being combined with inert waste such as plastics and scrap iron, and dumped in the inert landfill. Electrical equipment commonly part of human activities (such as ACs and refrigerators) that are no longer used and therefore discarded as waste are categorized as hazardous waste according to the Indonesian regulations.

In the treatment of domestic waste, PTFI is currently promoting efforts to reduce waste generation through 3R activities, whether household composting or trial segregation of used cooking oil and drink cans. In the near future, PTFI will also introduce plastic shredders to increase plastic recycling efforts. But to date most of these types of dry waste are deposited in landfills. This audit has no additional systematic recycling effort to recommend in this instance.

For monitoring of potential pollution of groundwater in the area of the inert land-fills, installation of monitoring wells is recommended. Monitoring wells are already located at the wet-waste landfill at MP38.

Even though the quantity of leachate being treated is about 15% of the design capacity of the unit, to further reduce the quantity of leachate produced, PTFI should minimize the entry of external water into the landfill area, particularly into wet-waste landfill. Preventive measures could be developed to reduce external water.

PTFI has proved a consistency in the compliance with applicable regulations and internal procedures for various environmental impacts such as in the identification, collection, storage and internal transfer of hazardous waste. However, PTFI should start the application of its commitment to pollution prevention in order to reduce waste

generation. A relevant case in this sense is the reduction of oil concentration in effluents with reference to more stringent standards and the reduction of hazardous waste from laboratories.

As such PTFI efforts to improve its wet landfill at MP38, specifically through collection and conversion of CH_4 into CO_2, either through flaring or utilization, could represent a contribution to the reduction of greenhouse gases. This biogas capturing system could be combined with the surface impermeable layer. A gravel media might be needed to facilitate biogas capture, which could be channeled to a simple, locally-made flaring system.

WATER QUALITY & QUANTITY

Storm water management

Compared with conditions encountered during the 2008 Audit, there have been significant improvements regarding stormwater management at the Grasberg mine site and the mill area. There is a stormwater management plan for the concentrate Dewatering Plant, but progress on implementing the plan has been slow.

Grasberg open pit

To manage sediment from erosion in the Grasberg mine area, the drainage system is equipped with control boxes that capture erosion sediment washed into the drain. In 2008 the total capacity of control boxes was merely 17,617 tons, with mud-scraping scheduled every 4 days that removed 4,404 tons of mud per day. In 2011, even though the number of control boxes decreased from 13 to 12, the total control box capacity increased significantly to 34,612 tons. With mud-scraping scheduled every 4 days, the total volume of mud scraped per day totals 8,653 tons.

Improving erosion sediment control performance is one way to minimize non-tailings sediment entry into the ModADA tailings retention area. Erosion-sediment control performance is also monitored through regular flow-rate and TSS measurements at Mahaka flume and HEAT Road. PTFI operates the drainage system around the Grasberg open pit to control the runoff water flows.

Concentrating Plant

Drainage system and facilities in the concentrating plant have been upgraded, including drainage improvements and concrete surfacing in almost all open areas including the road.

Concentrate Dewatering Plant (DWP)

Almost the entire DWP area is covered with a concrete floor equipped with sediment traps, especially those areas prone to concentrate spills. At the time of the audit visit, work was still in progress, in particular in the supporting facility area.

Quality control of water from overburden stockpiles

Overburden placement at the Wanagon stockpile, conducted in accordance with the SOP for control of acid rock drainage formation by controlling ANC/NAG ratio has demonstrated good control of pH in Wanagon River. The results of pH monitoring at monitoring station #57 in Banti showed pH values generally above 7.5.

One water quality parameter which still needs addressing is TSS, as illustrated by the time period between March and April 2011. Although station #57 is not a compliance point, significant increases in TSS resulting from slippage at the stockpile indicates a need for increased and continual monitoring and control of slope stability.

AIR QUALITY

Air emissions from underground mobile sources were monitored and spot checks of air quality in working areas are made on a frequent and statutory basis (weekly where diesel equipment is operated – Decree of Minister of Mines & Energy Nr. 555/1995, Chapter VIII, Part 8, Article 370 (12)). These checks are used to verify and document concentrations of various gases are below the threshold levels. Emissions from outdoor mobile sources also need to be included in a formal environmental management system program.

The use of large quantities of equipment in support of PTFI operations means large-scale consumption of natural resources in the form of fuel and oil. Reduction of this

consumption would reflect PTFI's commitment towards conservation of natural resources.

Overall, PTFI has demonstrated the ability to meet the various requirements specified in the AMDAL and permits for consumption of used oil as fuel. However, in the spirit of meeting commitments associated with pollution prevention management and continuous improvement, PTFI needs to begin shifting its management concept regarding emissions towards reduction of emissions at the source, including ensuring year-long process stability, as startups and shutdowns or abnormal operations increase the release of emissions into the atmosphere. Improvement is recommended to determine upper and lower limits based on the objectives to ensure sustainability of operations. A higher frequency of operations working within this range translates into lower amount of pollutant emissions. The auditors recommend statistical analysis of operating data to support process control decisions. In this way, PTFI can implement preventive measures that will also be in accordance with the EMS scheme.

REGULATORY ASPECTS

In terms of use and utilization of Aghawagon–Otomona–Ajkwa–Minajerwi Rivers for tailings dispostion, PTFI has obtained permits from the Irian Jaya (now Papua) Governor through the Letter from Irian Jaya Governor Number 540/154/SET dated 4 January 1995 regarding Utilization Permit of Ajkwa River for Mining Waste (Tailings) Transportation, Letter from Irian Jaya Governor Number 540/2102/SET dated 20 June 1996 regarding Utilization Permit of Aghawagon–Otomona–Ajkwa–Minajerwi Rivers for Mining Waste (Tailings) Transportation and from the Mimika Regent through Decree of Mimika Regent Nr. 4 of 2005 regarding Stipulation on Use and Utilization of Aghawagon-Otomona, Ajkwa, and Minjerwi Rivers in Mimika Regency. All of the foregoing are Environmental Permits, Thus, the use and utilization of Aghawagon, Otomona, Ajkwa, and Minajerwi Rivers is legitimate because PTFI has obtained the appropriate permits from Governor of Papua and the Mimika Regent.

Article 20 paragraph 3 of Law 32/2009 further directs that PTFI may dispose of wastes to an environmental media, in this case to Aghawagon – Otomona – Ajkwa – Minajerwi Rivers, provided that it has fulfilled the environmental quality standards and has also

obtained a permit from the authorized official. This is in line with the meaning of Environmental Pollution provided in Article 1 point 14, in which we conclude waste disposal to an environmental media only constitutes environmental pollution if following the disposition the environmental media exceeds the quality standards. In other words, as long as waste disposal complies with the determined quality standards, then there is no pollution.

In the context of PTFI's tailings management, PTFI is subject to the AMDAL, the provincial level and regent level permits mentioned above and the water quality standards issued by Ministry of Environment (MoE/KLH) under Kepmen LH 431 of 2008 which specifically applies to PTFI. The quality standards that must be complied by PTFI have been provided in the Dictum Four point 5 of Kepmen LH 431. The technical data analyzed pursuant to this audit demonstrate that PTFI's tailings disposition has satisfied the quality standards provided in Kepmen LH 431/2008 during the period of 2008 through the time of the field visit of the audit, which was on June 6-13, 2011.

As analyzed in PTFI's AMDAL document, parts of fine particles will flow into Arafura Sea, and if it is not managed properly it will potentially violate the sea water quality standards. Kepmen LH 431/2008 also has anticipated the condition. Dictum Four point 7 clearly provides that PTFI is subject to Sea Water Quality Standards as referred to in Attachment III of the Decree of Minister of Environment Nr. 51 of 2004 regarding Sea Water Quality Standards. The technical data analyzed in this audit demonstrate that PTFI has complied with the sea water quality standards during the period of 2008-2010.

Decree of Minister of Environment Number 431 of 2008 regarding Requirement of PTFI Tailings Management in Modified Ajkwa Deposition Area (ModADA) in Mimika Regency, Papua Province (Kepmen LH 431/2008) stipulates requirements and obligations of tailings management which apply to PTFI if it will place tailings into ModADA located in Mimika Baru District, Mimika Regency, Papua Province. The Audit Team found that the report documents were submitted to the institutions mentioned in DICTUM FIVE number 10 of Kepmen LH 431 of 2008.

Until the issuance of the environmental permit as provided in Law 32/2009, based on the above details, it is concluded that Kepmen LH 431 of 2008 is a permit for PTFI to manage the tailings in ModADA. Any environmental permit that will be awarded to PTFI in the future, on top of the current environmental permit, shall be determined after considering all studies required in DICTUM SIX of Kepmen LH 431/2008, including study on 5-yearly tailings utilization plan for infrastructure development of Papua and Eastern Indonesia Zone.

MISCELLANEOUS

Laboratory

The laboratories at Concentrating Division and Timika have calibrated all measurement instruments, both external and internal. However there was no objective evidence that acceptance criteria were defined to determine whether or not calibration is acceptable. These criteria are crucial to decide whether or not equipment needs to be repaired. Such practice would ensure the maintenance of high accuracy during instrument calibration.

Port site/Dredging

KPI (PT Kuala Pelabuhan Indonesia), PTFI's subcontractor for port operation, performs port maintenance through regular dredging. Impacts on the sea are visible in the form of increased turbidity, fuel or oil contamination, and impacts from dredged material on land. PTFI does not address this issue in its environmental risks assessment to support the existing pollution control or EMS planning. There is no objective evidence that dredging activity refers to the PTFI management system and standards as the activity does not include a risks analysis, SOP, necessary controls, and performance monitoring before and after dredging. Dredging operations should be included in the EMS process.

Housekeeping

Housekeeping issues were observed in a number of locations during the audit tour. Specifically, housekeeping issues were observed in the concentrator mill area and in the concentrate dewatering plant (DWP) (drums were placed onto soil ground in project

area, dust fall in dryer area). Therefore, proper housekeeping is recommended in all PTFI facilities.