

To the Ministry of Finance

Recommendation of 14 August 2008

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1 Introduction

At a meeting held on 4 October 2005, the Council on Ethics for the Government Pension Fund – Global decided to assess whether investments in the company then known as Placer Dome, currently Barrick Gold Corporation, would imply a risk of the Fund contributing to severe environmental damage under the Ethical Guidelines, point 4.4.

As of 31 December 2007 the *Government Pension Fund – Global* held shares worth some NOK 1,274 million in the company.

Barrick Gold is a Canadian mining company, which, in several countries, has been accused of causing extensive environmental degradation. The Council has investigated whether riverine tailings disposal from the Porgera mine in Papua New Guinea generates severe environmental damage, and finds it established that the mining operation at Porgera entails considerable pollution. The Council attributes particular importance to the heavy metals contamination, especially from mercury, produced by the tailings. In the Council's view heavy metals contamination constitutes the biggest threat of severe and long-term environmental damage. The Council also considers it probable that the discharge has a negative impact on the population's life and health, including both the residents of the actual mining area and the tribal peoples who live along the river downstream of the mine.

The environmental damage that riverine disposal may cause are well known, but the company has not implemented any appreciable measures to prevent or reduce this damage. Neither has the company been willing to present data to underpin its allegations that environmental and health damage does not occur.

The Council started its survey of the Porgera mine in the autumn of 2005. In connection with Barrick Gold's acquisition of Placer Dome in 2006, the Council chose to defer further investigations in case the company would stop the riverine tailings disposal or implement other measures to reduce the pollution after the take-over of the mine. So far this has not happened, and the Council therefore decided to continue its assessment of the company in the autumn of 2007.

Through Norges Bank, the Council has made two enquiries to the company. In November 2007, the Council contacted the company requesting it to send the 2006 and 2007 environmental reports for the Porgera mine. The company declined the Council's request in a letter of 30 November 2007¹, presenting its viewpoints on the riverine tailings disposal, to which reference has also been made in this recommendation. On 7 April another letter was written to Barrick, giving the company an opportunity to comment on the Council's draft recommendation, in accordance with the Guidelines, point 4.5. The Council received the company's reply on 14 May 2008.²

In order for there to be a risk that the Pension Fund may contribute to severe environmental damage, there must be a direct connection between the company's operations and the environmental impact. The Council takes as its point of departure that the damage must be extensive, attributing importance to whether the damage causes irreversible or lasting effects

¹ Hereinafter referred to as Barrick's first letter to the Council.

² Barrick's letter is dated 25 April 2008, but was only received on 14 May. This letter is hereinafter referred to as Barrick's second letter to the Council.

and whether it has a considerable negative impact on human life and health. Moreover, an assessment must be made as to what extent the company's acts or omissions have caused the environmental damage, including whether the damage is in breach of national legislation or international standards. It is also significant whether the company has failed to act in order to prevent the damage or has neglected to take measures aimed at significantly reducing the scope of the damage. Last but not least, it must be probable that the company's unacceptable practice will continue in the future. Based on an overall assessment, the Council finds that these conditions have been met in the case at hand.

In accordance with the Ethical Guidelines, point 4.4, the Council has reached the conclusion that there are grounds for recommending that Barrick Gold be excluded from the Government Pension Fund – Global's investment possibilities, due to an unacceptable risk of contribution to ongoing and future environmental damage.

2 Sources

The Council has drawn on a large number of sources to assess the accusations levelled against Barrick's operation of the Porgera mine, including reports from domestic and international NGOs (in Australia, Canada, and Papua New Guinea), surveys and scientific papers related to environmental impacts from the mining operation, as well as other publicly accessible data.

Members of the Council's Secretariat have visited Papua New Guinea and had meetings with representatives from local NGOs, people who are directly affected by the mining operation, and experts with knowledge of the mine.

Barrick does not publish any figures relating to the discharges from the Porgera mine and provides little information in general on the environmental aspects of the operation. The Council has therefore, through Norges Bank, contacted Barrick requesting the environmental reports and discharge data for 2005 and 2006, which, according to Barrick's website, are publicly available. The company declined the Council's request in a letter dated 30 November 2007. At the same time, the company informed the Council about certain aspects of the riverine tailings disposal. Barrick has also commented on the Council's draft recommendation in a letter dated 25 April 2008, but did not present new reports or surveys. The company's viewpoints are cited later in this recommendation.

An important part of the background material has been the report "*Porgera Gold Mine. Review of Riverine Impacts*" from 1996. This study was carried out by *The Commonwealth Scientific & Industrial Research Organization (CSIRO)* at the request of the *Porgera Joint Venture*,³ after the mine had been operative for 5 years. This is still the most comprehensive environmental assessment that has been made of the mining operation to date.⁴ As a matter of fact, Barrick refers the Council to this report. The Council, however, has also had access to more recent material.

³ Barrick has a 95 per cent stake in the Porgera Joint Venture (PJV), which runs the mine; see chapter 5.

⁴ CSIRO 1996: *Review of riverine impacts. Porgera Joint Venture*. In 1995 PJV commissioned the Australian research institute CSIRO to make an environmental impact assessment of the mining operation on the river system downstream of the mine. The survey was comprehensive, covering the health and environmental effects of the discharge, assessing the risk of long-term impact and providing recommendations regarding measures, control and monitoring, as well as further surveys. In this recommendation the report is also referred to as the CSIRO report from 1996. It is on file with the Council.

To assess whether the mine generates ongoing and future environmental damage, the Council has commissioned independent experts in Australia and Norway to analyse the material at hand and the probability that the mining operation may cause severe and long-term environmental harm.

All sources are referred to in the footnotes of this recommendation.

3 The Council's considerations

The Council has assessed whether there is an unacceptable risk that the Government Pension Fund – Global contributes to unethical acts through its ownership in the Canadian mining company Barrick Gold. In particular, the Council has looked into whether Barrick Gold's operation of the Porgera mine in Papua New Guinea causes severe environmental damage.

In previous recommendations, the Council has elaborated on and specified the concept of severe environmental damage.⁵ The Council must make a concrete assessment of what is to be considered *severe environmental damage* in each case, basing itself on an overall evaluation with particular emphasis on whether:

- the damage is significant;
- the damage causes irreversible or long-term effects;
- the damage has considerable negative impact on human life and health;
- the damage is a result of violations of national laws or international norms;
- the company has neglected to act in order to prevent the damage;
- the company has not implemented adequate measures to rectify the damage;
- it is probable that the company's unacceptable practice will continue.

The Council would like to stress that *existing* and *future* violations are the ones covered by the Guidelines. This implies that one must assess whether there is a risk that the company's unacceptable practice will continue in the future. The company's previous actions may give an indication as to how it will behave in the future, and thus form a basis for the assessment of whether there is an *unacceptable risk* that unethical actions will occur henceforth. This also means that proof of future unethical actions is not required – it is sufficient to establish the existence of an unacceptable risk.

The concrete acts and omissions that Barrick Gold is accused of will be assessed with reference to the elements above.

⁵ See the recommendations regarding Freeport McMoRan Inc., DRD Gold Ltd. and Vedanta Resources plc.; available at www.etikkradet.no

4 Accusations of severe environmental damage and other factors

In many countries, Barrick Gold has been accused of causing far-reaching environmental destruction through its mining operations. The Council has investigated the conditions at the Porgera mine in Papua New Guinea where the company makes use of a natural river system to transport and dispose of mine waste. The riverine tailings disposal has taken place over many years, and several international NGOs have for years claimed that the riverine tailings disposal causes extensive and long-term environmental damage in a natural river system.⁶ The Council accounts for its assessment in this recommendation.

Other accusations that the Council has not assessed

The Council has received an enquiry from the Norwegian organization *The Future in Our Hands* requesting an assessment of the *mining pollution from the closed Marcopper mine in the Philippines*, which they claim Barrick is responsible for after the company's acquisition of Placer Dome in 2006. In 2007 a question relating to this matter was also presented to the Minister of Finance during question time in the Norwegian Parliament. This case is recorded briefly below, but the Council has not made any further investigations.

The Marcopper mine is situated on the island of Marinduque in the Philippines, and was operated by Placer Dome from 1975 to 1996, when it was closed.⁷ While the mine was in operation, 200 million tons of tailings were dumped in the shallow waters of Calancan Bay. Two mining accidents, in 1993 and in 1996, further deteriorated the pollution situation. In 1993 a tailings containment dam burst, causing three million tons of tailings to flow into the Mogpog River. Three years later, a drainage tunnel collapsed, and more than four million tons of mining waste spilled into the Boac River and its tributaries. As a result, villages had to be evacuated, and 20 000 people were affected by the accident. Because of the contamination, the Filipino Government declared the area a disaster zone.

Several scientific surveys have been conducted, showing that the mine waste contributes to considerable arsenic and heavy metals pollution.⁸ It is assumed that the tailings in Calancan

⁶ For example the *Mineral Policy Institute* in Australia and *Mining Watch Canada*.

⁷ This case has been examined by various organizations. *The Oxfam Mining Ombudsman* in Australia has conducted field surveys and scientific studies, which are available at <http://www.oxfam.org.au/campaigns/mining/ombudsman/cases/marinduque/>. Much information can also be found on the web pages of the American law firm Diamond McCarthy LLP, which is involved in the lawsuit against Placer Dome/Barrick on behalf of the *Provincial Government of Marinduque*; see <http://www.diamondmccarthy.com/current-events-pom.html>. The *US Geological Survey* has examined the pollution in the area several times and published reports on this at <http://pubs.usgs.gov/of/2001/ofr-01-0441/>. After the tailings disposal from the Marcopper mine into the Makulapnit and Boac Rivers, the UNEP conducted a survey of the environmental damage. The report is available at http://www.reliefweb.int/ocha_ol/programs/rcb/unep4.html.

⁸ USGS 2000: *Preliminary Survey of Marine Contamination from Mining-related Activities on Marinduque Island, Philippines: Porewater Toxicity and Chemistry Results from a Field Trip - October 14-19, 2000*, USGS 2000: *An Overview of Mining-Related Environmental and Human Health Issues, Marinduque Island, Philippines: Observations from a Joint U.S. Geological Survey -- Armed Forces Institute of Pathology Reconnaissance Field Evaluation*, May 12-19, 2000. Both reports are available at <http://pubs.usgs.gov/of/2001/ofr-01-0441/>, A&SR Tingay PTY LTD Environmental Scientists 2004: *Water Quality in the Mogpog River, Marinduque Island, Republic of the Philippines*; see http://www.oxfam.org.au/campaigns/mining/ombudsman/cases/marinduque/docs/scientific_report.pdf, and Regis, Emelina 2005: *Assessment of the effects of Acid Mine Drainage on Mogpog River Ecosystem, Marinduque, Philippines, and Possible Impacts on Human Communities*; see <http://www.oxfam.org.au/campaigns/mining/docs/assessment-of-acid-mine-drainage-mopog-river.pdf>

Bay are at the root of the incidence of lead poisoning among children in the area.⁹ In other affected areas as well, high levels of heavy metals in water and sediments constitute a significant health risk. The pollution has probably destroyed fish resources, cultivated land and drinking water, and thus also the greater part of the local population's livelihood.

Placer Dome sold off the mine in 1997. The Provincial Government of Marinduque, among others,¹⁰ has since sued the company for the damage its mining operation has caused. In connection with Barrick's acquisition of Placer Dome in 2006, the company has by many been regarded as obliged to clean up and compensate for the damage Placer Dome has been instrumental in causing. In 2007, the Marinduque government received the court's ruling that Barrick Gold could also be included as a defendant in this lawsuit. Barrick appealed, and the court granted the motion to dismiss on the grounds that the case was being tried before the wrong court. The case is still pending in the American legal system, however, as the Marinduque Government has filed a motion requesting reconsideration.¹¹

The Council is also aware of the accusations made by the *Norwegian Church Aid (NCA)* regarding *gross human rights violations related to the extension of the mining operation at Bulyanhulu, Tanzania in 1996*. At the time, the mine was owned by the company Sutton Resources, which was bought by Barrick Gold in 1999. Today the mine is owned and run by Barrick Gold. In this context, there have also been allegations that Barrick has under-reported earnings to the Tanzanian authorities and evaded taxation between 1999 and 2003. The NCA raised this issue in a meeting with the Minister of Finance. Barrick contests the allegations. The Council has not assessed this case in any further detail.

Similarly, the Council is aware of international NGOs' accusations against the so-called Pascua Lama project in the Chilean Andes. Chilean authorities have documented that Barrick's prospecting activities in the mountains have caused considerable damage to glaciers in the area, contrary to the requirements for the project.¹² Chilean and international NGOs fear that a future mining operation will cause further destruction to the glaciers, with substantial consequences for the area's water supply and ecosystems.¹³ An environmental commission appointed by the Chilean Parliament is looking into these matters.¹⁴ The Inter-American Human Rights Commission is currently investigating a complaint presented by the Diaguita people that the mining operation will lead to serious human rights violations against the indigenous peoples who live in the area.¹⁵ In July 2007 the Chilean environment minister declared that the project

⁹ Oxfam Mining Ombudsman 2005: *Case Report on Marinduque*, p. 3; available at <http://www.oxfam.org.au/campaigns/mining/ombudsman/cases/marinduque/docs/report.pdf>

¹⁰ <http://www.diamondmccarthy.com/pdf/sac.pdf>

¹¹ Barrick Gold: *Financial Report 2007*, pp. 28-29; available at www.barrick.com

¹² Dirección General de Aguas (The General Water Directorate under the Chilean Ministry for Public Works) 2005: *Informe de Comisión de Servicio a la III Región. Visita a Pascua Lama*. 12.01.2005; on file with the Council.

¹³ Observatorio Latino de Conflictos Ambientales, (OLCA) *Presentación de las organizaciones del Valle del Huasco ante Comisión de Recursos Naturales y Medio Ambiente Cámara de diputados*; available at <http://www.olca.cl/oca/chile/region03/presentacioncomisiondiputados.pdf>. The American Corpwatch <http://www.google syndicated search.com/u/corpwatch?q=Pascua+Lama&is=corpwatch.org>; Mining Watch Canada, <http://www.miningwatch.ca/>, and the Chilean organization Observatorio de Derechos de los Pueblos Indígenas, (ODPI) <http://www.observatorio.cl> have also worked on this case.

¹⁴ EFE, *A exigir comisión investigadora de diputados por Pascua Lama*. 11.07.2007; see <http://www.olca.cl/oca/chile/region03/pascualama265.htm>

¹⁵ Observatorio de Derechos de los Pueblos Indígenas 2005: *Denuncia Comisión Interamericana de Derechos Humanos Comunidad agrícola Diaguita de los Huascoaltinos vs Estado de Chile*. October.

would not be approved until all environmental requirements were met.¹⁶ Barrick informs that the project has been altered to avoid any impact on the glacier, making reference to the company's local support for the project.¹⁷ To the Council's knowledge, the concession has not yet been granted.

Considering the resources at hand, the Council has limited its investigations to the conditions at the Porgera mine as these have provided sufficient grounds for a recommendation on exclusion.

5 The Porgera mine – Papua New Guinea

5.1 Background

Barrick Gold is a Canadian mining company listed on the stock exchanges of Toronto and New York. Following the acquisition of Placer Dome Inc. in 2006, Barrick is now the world's largest gold producer. Currently, the company operates 27 mines – in North America (the USA, Canada, and the Dominican Republic), South America (Peru, Chile, and Argentina), Africa (Tanzania and South Africa), Australia (including Tasmania), and Asia (Papua New Guinea). Moreover, the company engages in exploration activities in several of these countries, as well as in Russia and Pakistan.¹⁸

Barrick owns a 95% share of the *Porgera Joint Venture (PJV)*, which operates the Porgera mine in the Enga province, in Papua New Guinea (PNG).¹⁹ The remaining stake is held by the *Enga Provincial Government and Landowners*. Barrick took over the Porgera mine through the acquisition of Placer Dome in 2006. At the time Placer Dome held a 75 per cent stake in the mine. In 2007, Barrick increased its participation through the purchase of the South African company DRD Gold's (Emperor Mines) 20 per cent share.

The mine site is located in the Porgera Valley, 2 200-2 700 m above sea level, in steep and rugged mountainous terrain covered by rainforest.²⁰ It is situated some 600 km northwest of the capital Port Moresby, and 680 km from the port of Lae, where the gold is shipped. The operation includes both opencast and underground mining.

The mine came on stream in 1990. Daily production was then 1 500 tons of ore (547 500 tons/year).²¹ The mine and the processing plant have since been expanded several times until

[http://www.observatorio.cl/contenidos/datos/docs/20051021152909/Proyecto%20Minero%20Pascua%20Lama_Nancy%20Yáñez%20IMPRESA\[Octubre%202005\].pdf](http://www.observatorio.cl/contenidos/datos/docs/20051021152909/Proyecto%20Minero%20Pascua%20Lama_Nancy%20Yáñez%20IMPRESA[Octubre%202005].pdf)

¹⁶ EFE, *Gobierno condiciona Pascua Lama a cumplir exigencias ambientales*. 02.08.2007

<http://www.olca.cl/oca/chile/region03/pascualama266.htm>

¹⁷ Barrick Gold: Letter to NBIM/Council on Ethics, dated 25 April 2008. In the letter Barrick also refers to its website

<http://www.barrick.com/CorporateResponsibility/KeyTopics/PascuaLama/PascuaLamabrQA/default.aspx>

¹⁸ <http://www.barrick.com/GlobalOperations/default.aspx>

¹⁹ In 2007 DRD Gold sold its share of the Porgera mine to Barrick, which consequently increased its stake from 75 to 95 per cent; see

<http://www.barrick.com/News/PressReleases/2007/BarrickCompletesAcquisitionofAdditionalStakeinPorgera/default.aspx>

²⁰ IIED 2002. Mining for the Future. Appendix 1: *Porgera Riverine Disposal Case Study* p I-5; available at http://www.iied.org/mmsd/mmsd_pdfs/068b_mftf-i.pdf

²¹ Nita, Albert 2002: *Independent Review of the Porgera Mine Impact on the Porgera River and Compensation: 1990-2002*, p. 3, Environmental Science Discipline, University of Papua New Guinea; on file with the Council.

1996 when the mill reached its current capacity of 17 700 tons per day (slightly less than 6.6 million tons of ore per year).²² To the Council's knowledge, there has not been any notable change in the production volume or the amount of tailings since then. In 1999, 15 400 tons of ore were processed per day,²³ which equate to 5.62 million tons a year.²⁴ The Council assumes that the 1999 data may reflect the present situation, provided that the composition of the ore has not changed significantly.

In addition to gold, the ore contains high concentrations of lead, zinc, iron, and sulphur, as well as substantial levels of mercury, cadmium, arsenic, and copper.²⁵ The ore is transported to the mill where it is crushed and ground into a powdery texture, going through several processing stages before the gold is extracted by cyanide leaching. The resulting gold-cyanide compound is placed onto activated carbon, which is added to the leaching tanks. Following the carbon elution, the gold is washed off, recovered by electrolysis, and melted into gold bars.²⁶ After the gold has been extracted, the tailings (the mixture of finely ground ore, leaching chemicals, and water) are neutralized before being discharged through a pipeline directly into the Maiapam River, a small tributary to the Porgera-Laigap-Strickland river system.²⁷

Barrick does not provide any information relating to waste management at the mine, neither with regard to tailings nor waste rock. The company has capacity and licence to dispose of 210 000 tons of *waste rock per day*, amounting to nearly 76 Mtons per year.²⁸ According to the CSIRO report, waste rock is disposed of at three different sites. Erodible waste rock is deposited at two of them, and substantial runoff occurs from these deposit sites into tributaries of the Porgera River. The runoff contributes to further increase the contamination of the water bodies. In 1995 it was estimated that the mining operation would produce 313 million tons of waste rock, but at that time it was also assumed that the mine would close down in 2010.²⁹ Currently predicted volumes are not known to the Council.

The mine's lifespan was originally planned to last until around 2006. Today the mine has reserves for some 10-15 years of operation.³⁰ Barrick itself has great expectations for the Porgera mine and is also considering an expansion: "*Porgera is expected to play a significant role in Barrick's future in this region. As a result, the Company increased its stake to 95%*

²² <http://www.mining-technology.com/projects/porgera/>

²³ See footnote 20, p I-4.

²⁴ In 2006 and 2007, the production was lower than in 1999. According to Barrick, the production in 2006 was affected by remediation work and power cuts, in addition to a 10 day shutdown of operations due to a dispute with landowners. In 2006, the total ore processed was 4.53 million tons, and in the 9 months to 30 September 2007 it was 3.5 million tons. See *Barrick's Fourth Quarter and Year-End Report 2007* p. 23; available at http://www.barrick.com/Theme/Barrick/files/docs_annualquarterly/2007%20Complete%20Year-End%20Results%20v2c.pdf p.23.

²⁵ IIED 2002. Mining for the Future. Appendix 1: *Porgera Riverine Disposal Case Study*, p I-6.

²⁶ CSIRO 1996 report p 2-2, on file with the Council, and <http://www.mining-technology.com/projects/porgera/>

²⁷ The tailings are discharged into the Maiapam River, which is a tributary to the Porgera River, which, in turn, runs into the Lagaip River. The Lagaip is the most important feeder of the Strickland River – a river of several hundred kilometres that passes the east side of Lake Murray before joining the Fly River and running into the Gulf of Papua. The Fly River has the country's largest drainage basin, covering an area of some 79 000 sq km. The drainage basin consists of 6 main parts – Upper, Middle and South Fly, Strickland River and Fly River Delta. See footnote 20, p. I-5 and footnote 71.

²⁸ IIED 2002. Mining for the Future. Appendix 1: *Porgera Riverine Disposal Case Study*, p. I-4.

²⁹ Mineral Policy Institute 1995: *The Porgera Files*, p. 6; available at http://users.nlc.net.au/mpi/reports/porgera_report.html

³⁰ Barrick Gold: Annual Report 2006, p. 130. Based on 7 million ounces of proven and probable reserves.

earlier in 2007 and is currently assessing opportunities for a Stage 6 expansion, which could increase production and extend the mine life.”³¹

The mine has approx. 2 000 employees, the majority of whom come from Porgera and the surrounding areas.

Concession and discharge permit

The *Porgera Mining Development Contract (MDC)* is an agreement between the government and the Porgera Joint Venture partners that specifies the conditions for the mining operation, including annual compensation to be paid to local landowners for the use of their properties – the *Special Mining Lease (SML)*. The SML is in force until 2019 and covers some 2 350 hectares of land, including the mining area itself and corresponding infrastructure.³² There is no expiration date for the MDC, but it is tied to the continuation of the SML.

Applicable as long as the mine is in operation, a concession has been granted by the authorities for the use of and discharge to water.³³ In 1991, PJV was given permission to discharge tailings into the Maiapam River, a tributary of the Porgera River. The government requires that the water quality of the river, measured some 165 km downstream of the discharge point, does not exceed certain limits. These refer to concentrations of cyanide, ammonium, dissolved metals, as well as pH.³⁴ The area from the discharge point to the compliance point (i.e. 165 km) is defined as a mixing zone where no requirements are made regarding discharge or water quality.³⁵

Compensation

According to Barrick the production at the Porgera mine is subject to a two per cent royalty of production payable to the National Government Department of Mining. This royalty is in turn distributed to the Enga Provincial government, the Porgera District Authority, and local landowners.³⁶ In addition, compensation is paid to local landowners who own land in the mining lease area. People living in the immediate downstream vicinity of the mine have received a one-off payment to compensate for loss of alluvial gold and the damage caused by waste disposal.³⁷ It is not clear whether people living in the Lower Strickland have received any compensation for losses connected to the riverine disposal practice.

5.2 Riverine tailings disposal

5.2.1 Sediment load

Tailings have been discharged into the Porgera-Strickland river system since the beginning of the operations in 1990. As each ton of ore contains only a few ounces of gold, the tailings are

³¹ Barrick Gold: 2007 Fourth Quarter & Year-End Mine Statistics, available at http://www.barrick.com/Theme/Barrick/files/docs_annualquarterly/2007%20Complete%20Year-End%20Results%20v2c.pdf

³² <http://www.secinfo.com/d14pb2.v8.html>

³³ See footnote 32.

³⁴ Barrick Gold: Letter to NBIM/Council on Ethics, dated 25 April 2008, annex including excerpts from the discharge permit and the 1996 CSIRO report, p. ES-3.

³⁵ Shearman, Phil 2001: Giving away another river: an analysis of the impacts of the Porgera mine on the Strickland River system. In *Mining in Papua New Guinea: Analysis and Policy Implications*. B.Y. Imbun and P.A. McGavin eds., p. 177.

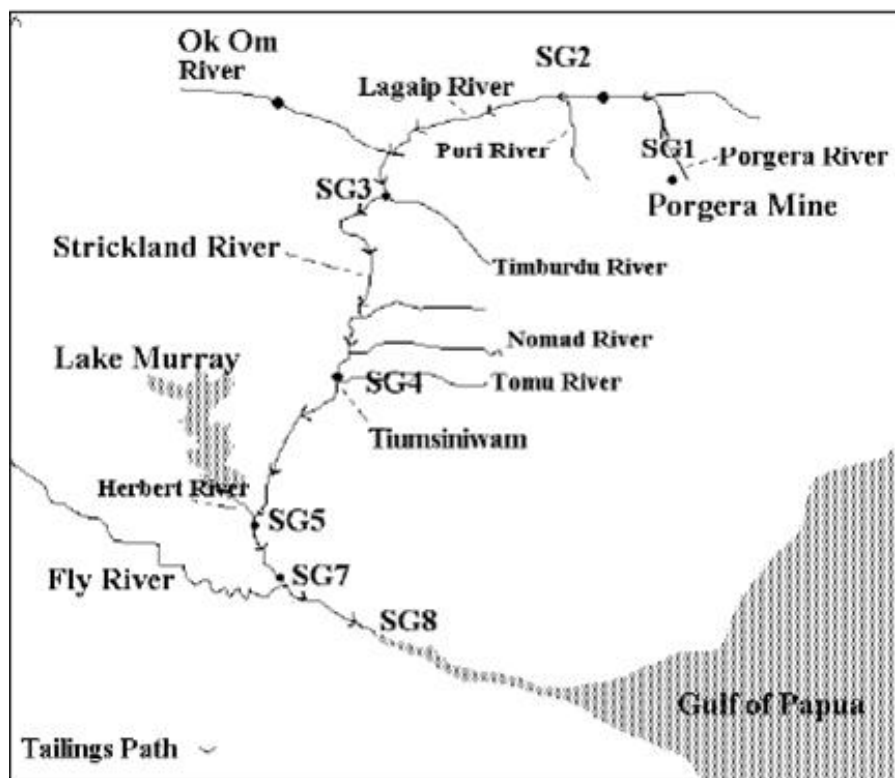
³⁶ Barrick Gold: Annual Report 2006, p 95.

³⁷ IIED 2002. Mining for the Future. Appendix 1: *Porgera Riverine Disposal Case Study*, section 5-1.

nearly equivalent to the amount of processed ore. Consequently, tailings disposal volumes have accompanied the production increase from 1 500 tons a day in 1990 to the current level of some 15 500 tons a day (5 – 6 million tons a year). In addition to the tailings disposal there is substantial runoff from the stockpiles, which further increases the sediment load of the river system. In 1999, PJV estimated this at 10-15 million tons per year.³⁸

Suspended material is transported downstream over a distance of some 1 000 km before reaching the Gulf of Papua. Along the way the concentration of the discharge is diluted as the distance from the mine increases.³⁹ The particles are transported by the river to the Lower Strickland. In the lowlands, which begin some 50 km downstream from compliance point SG3, the Strickland River flows calmly across large flood plains (see figure 1). Here sediments are being deposited along the river banks, in tributaries, and on the alluvial plain.⁴⁰

Figure 1: The Porgera Mine and the Strickland River System⁴¹



³⁸ See footnote Feil! Bokmerke er ikke definert., p I-8, which refers to Porgera Joint Venture 1999 data.

³⁹ Concentrations of total suspended solids in the river water (incl. natural sediments) are diluted as the distance from the mine increases. Levels reported in 1999 were: 13 847 mg/l – 8 km from the mine; 2781 mg/l – 42 km; 1 777 mg/l – 165 km; 1 250 mg/l – 360 km, see footnote Feil! Bokmerke er ikke definert., figure I3, which refers to Porgera Joint Venture 1999 data.

⁴⁰ Apte, S.C. 2001: *Tracing mine derived sediments and assessing their impact downstream of the Porgera Gold mine*. CSIRO report No ET/IR383. Prepared for the Porgera Joint Venture, p. 1; available at <http://www.peakpng.org.pg/docs/Sigreport%20final.pdf>, and Day, Apte, Batley and Skinner 1998: *Strickland River Floodplain Coring Project. Final Report*. Prepared by Ecowise Environmental Ltd, Limnos Environmental Consultants Pty Ltd and CSIRO for the Porgera Joint Venture; on file with the Council.

⁴¹ IIED 2002. *Mining for the Future. Appendix 1: Porgera Riverine Disposal Case Study*, Figure I2. SG refers to monitoring stations along the river.

The additional sediment load of the river system may have both a physical and a chemical impact, affecting the water quality, aquatic organisms, but also human and animal life connected with the river. The physical impact is related to factors such as turbidity (the degree of cloudiness in the water), overbank deposition, and aggradation, whereas the chemical impact has a bearing on the sediment's heavy metals content.

According to PJV data from 1999, the mine produces an annual sediment load of some 15-21 million tons.⁴² The discharge is diluted as it travels downstream. At the SG3 compliance point the mine waste represents approximately 25-33 per cent⁴³ of the Strickland River's total sediment load, and at SG4 (360 km from the mine) the figure is around 15 per cent. This is the annual average. In periods of drought and low flow, the discharge from the mine may constitute a significantly higher percentage, whereas a large influx of natural sediment during flooding may lead to lower concentrations of mine sediments.⁴⁴

It has been alleged that an additional sediment load will not influence the riverine ecosystem because the river system has a naturally high sediment level. Barrick also presents this argument in its letter to the Council: "*The Porgera-Lagaip-Strickland River System is capable of transporting massive sediment loads... In fact, the natural annual variability of sediment discharges from the Strickland system exceeds Porgera's annual discharges.*"

Barrick's reply also implies that the additional load produced by discharges from the mine is unlikely to cause a negative impact because that load is lower than the annual variability of natural sediment loads in the river system. However, while the Strickland River ecosystem has adapted to relatively high sediment loads, the volume of waste discharged by the Porgera mine is an addition to the natural sediment load in the river system. Besides, the tailings discharge occurs on a continuous basis including during low flow conditions. This constitutes a considerable change in natural conditions that in turn may affect riverine biota.⁴⁵

It is well known that aquatic organisms are very vulnerable to high sediment loads, and even small changes in the suspended solids load may have a negative impact on fish, crustaceans and other aquatic organisms. The number of species and their composition may be affected, spawning grounds may be harmed or destroyed, and a decline in the nutrients may lead to depleted fish stocks. Changes in nutrient access may also have an impact on the bird and animal life along the river system. Already in 1995 the local population reported reduced fisheries and the disappearance of turtles and crocodiles (which constituted an important source of income) as a result of the pollution.⁴⁶ However, the lack of data and surveys makes it difficult to verify this.

The physical effects of tailings sedimentation seem to vary in the different parts of the river. According to Barrick, there is temporary aggradation in the upper part of the river. "*The sediment discharges have resulted in significant impacts in the first approximately 20 km of the river.*"⁴⁷ In the lower reaches of the river and on the flood plain, recent studies show that

⁴² See footnote 41, table I2 which refers to PJV 1999 data.

⁴³ 1996 CSIRO report, chapter 4.1-4.2, and Tingay, Alan 2008: *Assessment commissioned by the Council*; on file with the Council.

⁴⁴ Swanson et.al 2008: Sediment load and floodplain deposition rates: Comparison of the Fly and Strickland rivers, Papua New Guinea, in *Journal of Geophysical Research*, vol. 113, section 25.

⁴⁵ Tingay, Alan 2008: *Assessment for the Council*.

⁴⁶ Mineral Policy Institute 1995: *The Porgera Files*, p. 26-27.

⁴⁷ Barrick Gold: Letter to NBIM/Council dated 25 April 08. In its first letter to the Council, of 30.11.07, Barrick states that "*stream aggradation has occurred in the Kaiya and Porgera rivers, which are the smaller rivers that*

sediment from the mine is deposited, but probably not on such a scale that it causes major physical damage.⁴⁸

5.2.2 Discharge of heavy metals

With regard to the Porgera mine, one was aware from the very start that the tailings had high heavy metals content and that the mercury discharges could become a problem. PJV itself stressed this in a presentation of the newly opened mine at a conference in 1992: “*Mercury present in the orebody is considered the priority trace metal because of the potential for bioaccumulation and bioconcentration.*”⁴⁹

In addition to mercury, the tailings also contain high concentrations of arsenic, cadmium, copper, lead, zinc, as well as milling chemicals, including cyanide. Owing to the iron oxide content, the discharges have a distinct red colouring. Heavy metals are hazardous substances, and their discharge represents a considerable environmental problem, not least because they may accumulate in organisms and sediment.

Table 1 below shows the average heavy metals concentration in the tailings for 1999.

*Table 1: Characteristics of tailings discharge, average for 1999*⁵⁰

	Concentration (µg/l)	
	Dissolved	Total
Arsenic	10	50,000
Cadmium	8	1,300
Chromium	5	2,700
Copper	1,200	14,000
Iron	5,500	4,975,000
Lead	3	68,000
Mercury	0.3	300
Nickel	1,300	5,100
Silver	4	900
Zinc	2,200	192,000
Cyanide	CAC*	800
	WAD**	2,300
	Thiocyanate	5,500
Total suspended sediment		2,100,000 (21 %)

* CAC - Cyanide amendable to chlorination

**WAD - Weak acid dissociable cyanide

flow in steep narrow gorges that make up the first approximately 30 km downstream of Porgera. This aggradation will reverse itself after tailings discharges cease and the carrying capacity of these rivers is freed-up to erode the beds of these rivers. Indeed that process is already occurring in some reaches of those rivers.”

⁴⁸ Swanson et.al 2008: Sediment load and flood plain deposition rates: Comparison of the Fly and Strickland rivers, Papua New Guinea, and Aalto et al 2008: Spatial and temporal dynamics of sediment accumulation and exchange along Strickland River flood plains (Papua New Guinea) over decadal-to-centennial timescales; both articles in *Journal of Geophysical Research*, vol. 113.

⁴⁹ Ross, Charles 1991: *Staged Development and Environmental Management of the Porgera Gold Mine, Papua New Guinea*, in Proceedings of the Torres Strait Baseline Study Conference Kewarra Beach, Cairns, Queensland 19 - 23 November 1990, edited by David Lawrence and Tim Cansfield-Smith; available at http://www.gbrmpa.gov.au/corp_site/info_services/publications/workshop_series/ws016/index.html

⁵⁰ IIED 2002. Mining for the Future. Appendix 1: *Porgera Riverine Disposal Case Study*, Table II, which refers to PJV 1999 data.

In an impact assessment, a distinction is normally made between dissolved heavy metals and total heavy metals. Metals dissolved in water may have an acute toxic effect on many aquatic organisms, while total metals have a bearing on long-term effects, as sediment may act as a storage medium for hazardous substances. The metals content in sediment, however, may also have an acute toxic effect on sediment feeders, for instance catfish, which are common in the Strickland River.

The table below presents PJV's own monitoring data for 1999 relating to dissolved and total concentrations of heavy metals in the water at SG3, 165 km downstream from the discharge point. The data are presented as an average for the whole year of 1999. The compliance levels are also stated in the table.

Table 2: Mean Contaminant Levels Recorded by PJV at the Compliance Point SG3 in 1999 and Compliance Levels in the Environmental Permit (right column).⁵¹

	Dissolved (µg/l)	Total (µg/l)	Compliance value (dissolved µg/l)
Arsenic	4	82	50
Cadmium	0.2	3	1
Chromium	1	39	10
Copper	2	84	10
Iron	174	45,500	No compliance
Lead	1,3	254	3
Mercury	0.2	0.7	No compliance
Nickel	4	52	50
Silver	0.8	2	4
Zinc	11	463	50
Ammonia (cyanide)	30		50
Sulphate	34,000		
pH	7.7		7.0-9.0

Barrick informs the Council that the discharge from the mine today still meets the requirements laid down by the authorities, which means that the water quality at the compliance point SG3 shall not exceed the levels referred to in table 2, based on a monthly average.⁵² However, Barrick does not provide any new discharge monitoring data that may substantiate this claim.

Table 2 shows that the government bases its requirements on the concentrations of dissolved metals and not total metal content.⁵³ Dissolved concentrations are relevant to aquatic organisms. In order to assess the risk to humans who use the water for drinking or other purposes and in order to assess the long-term effect on water quality and sediments, it is more relevant to look at total metal content. According to the table, the heavy metals chiefly appear as particulate metal. Besides, it shows that there is no compliance value for mercury.

⁵¹ See footnote 50, Table I4, which refers to PJV 1999 data.

⁵² Barrick Gold: Letter to NBIM/Council, dated 25 April 2008.

⁵³ Dissolved metals represent the metal concentration in the water once the water has been filtered to remove solids. Dissolved metals are thus bioavailable. Total metal content is the sum of particle-bound and dissolved metals. Particulate metal may, however, turn into dissolved metal, depending on pH, organic and particulate material content in the water, the water's hardness, and other factors. It is international practice to require compliance with total concentration levels.

Also relevant to the evaluation of compliance is the fact that the compliance point is located 165 km downstream of the mine. The distance between the mine and the compliance point is referred to as a mixing zone. According to the ANZECC water quality guidelines a mixing zone is an “*an explicitly defined area around an effluent discharge where certain environmental values are not protected*” and furthermore “*Effective discharge controls that consider both the concentration and the total mass of contaminants, combined with in situ dilution and waste treatment, should ensure that the area of a mixing zone is limited and the values of the waterbody as a whole are not jeopardised....If mixing zones are to be applied, then management should ensure that impacts are effectively contained within the mixing zone, that the combined size of these zones is small and, most importantly, that the agreed and designated values and uses of the broader ecosystem are not compromised.*”⁵⁴

In the Council’s opinion, Porgera’s mixing zone does not constitute a mixing zone in the internationally accepted sense of that term. If the above guidelines are used as a basis, mixing zones should not be used for the management of bioaccumulative substances or particulates, nor for discharges that affect the whole river system, as described in more detail below.⁵⁵

Besides, the compliance with discharge requirements is no guarantee that negative environmental effects will not occur. For example, a requirement based on a monthly average may conceal high concentrations in the discharge, which at worst may cause the extinction of all aquatic life. As early as in 1996, CSIRO stated that the concentration of arsenic, zinc and lead had increased 7 to 10 times since 1990 at SG3.⁵⁶ They concluded that “*It is possible to detect an effect of the mine in the enrichment of the TSS⁵⁷ by metals measured at the compliance point, SG3. Particulate metals (As, Pb, Ag, Hg, Ni on a per gram TSS) basis are steadily increasing and may now exceed concentrations that have been shown elsewhere to have a long-term ecosystem effects, particularly when the river is at low flow.*”⁵⁸

The Council has not had access to data that show the current situation. However, according to the assessments commissioned by the Council, there is little reason to believe that it has improved during the past ten years. There is a considerable risk that the water quality has deteriorated while the heavy metals concentration has increased.⁵⁹

5.3 Environmental effects on the flood plain and Lake Murray

The most serious and long-lasting environmental impact seems to be related to the accumulation of arsenic and heavy metals in the sediment in the Lower Strickland River and Lake Murray. The CSIRO report from 1996 warned against the risk of heavy metals producing long-term and negative environmental and health effects. “*Sediments will be deposited both in-*

⁵⁴ ANZECC 2000: *Water quality guidelines*, Chapter 2 a, Framework for applying guidelines, p. 2-17- available at <http://www.mfe.govt.nz/publications/water/anzecc-water-quality-guide-02/anzecc-water-quality-guide-02-pdfs.html>. The Australian and New Zealand Environment and Conservation Council (ANZECC) has established authoritative water quality standards that provide guidelines for the protection of aquatic ecosystems in areas such as the tropics, which are relevant in this case.

⁵⁵ See also Phil Shearman 2001 (footnote 35) and Alan Tingay 2008 (Assessment for the Council), for a discussion on this matter.

⁵⁶ CSIRO 1996 report, p. 4-10.

⁵⁷ CSIRO 1996 report, p. 4-10.

⁵⁸ TSS, total suspended solids, i.e. solid particles suspended in the water.

⁵⁹ Norwegian Institute for Water Research (NIVA) 2008: *The Porgera Mine, Papua New Guinea. Assessment of Environmental Effects*, and Tingay, Alan 2008: *Assessment commissioned by the Council*; both reports on file with the Council.

*and off-river in this environment. ... There is therefore an increasing risk of long-term low-level metal effects from mine-derived sediment in the region.”*⁶⁰

In 1997-98 the *Porgera Joint Venture* commissioned a team of experts from three Australian consultancies to examine the extent of sediment deposition and heavy metals contamination at different locations in the Lower Strickland River.⁶¹ Sediment cores were collected at six key points on the flood plain and in five off-river water bodies. Consistent evidence of enrichment of arsenic, lead and zinc in surface sediments was found at all sites across the flood plain. All five off-river water bodies studied showed elevated levels of arsenic and lead. Two water bodies with short tie channels to the main river also showed higher levels of mercury and zinc in the sediments.⁶² Moreover, the study found that at several sites on the flood plain and in the off-river water bodies, the concentrations of arsenic, nickel, lead and mercury exceeded Australian sediment quality guidelines.⁶³ The study concluded that: *“The delivery of sediment into the ORWBs [Off River Water Bodies] has the potential to affect the aquatic ecology of the Strickland floodplain system. The Strickland has relatively few ORWBs [] and as such, any loss of habitat caused by mine-derived sediment deposition may have a more important impact.”*⁶⁴

In May 2001, another CSIRO study was published.⁶⁵ The study, aimed at finding tracer metals to track the deposition of tailings in the river, confirmed that heavy metal enriched tailings were being deposited in the lower reaches of the river, in overbank depositions, and in off-river water bodies. The study found that silver, arsenic, cadmium, zinc, and lead were all present in the sediments in far higher concentrations than in rivers not affected by the tailings.

In 2003, the results from this study were applied in a new survey of sedimentation processes on the flood plain. Lead and silver found in the tailings were used as indicators and measured in sediments on the flood plain. The survey confirmed previous findings that heavy metal enriched tailings are sedimented across the greater part of the alluvial plain. In general, the highest lead concentrations were found in surface sediments and at a distance of 5-100 m from the riverbank, but with local variations. Sediments from the mine were traced more than 1 km from the main river. The survey also showed that heavy metal concentrations can increase significantly during periods of drought or low flow and decrease during periods of high flow.⁶⁶ Some of the highest values were found in an ox-bow lake linked to the main river. *“All core samples to a depth of 40 cm [] were contaminated out of a distance of 0.5 km. Elevated metal concentrations were found to depths of 7 cm over 3 km from the tie channel inlet”*⁶⁷ Sediment samples from the Momboi River, which is a tributary to the Strickland River and empties into Lake Murray *“revealed that mine-derived sediment was present through the entire system.”*⁶⁸

⁶⁰ CSIRO 1996 report, p ES-9.

⁶¹ Day, G.M., S.C. Apte, G.E. Batley and J. Skinner 1998: *Strickland River Coring Project. Final Report*. Prepared by Ecowise Environmental Ltd. Limnos Environmental Consultants Pty Ltd and CSIRO for the Porgera Joint Venture; on file with the Council.

⁶² See footnote 61, p. I, 34.

⁶³ See footnote 61, pp I, 51-52.

⁶⁴ See footnote 61, p 52.

⁶⁵ Apte, S.C. 2001: *Tracing mine derived sediments and assessing their impact downstream of the Porgera Gold mine*. CSIRO report No ET/IR383. Prepared for the Porgera Joint Venture, p. 13.

⁶⁶ Swanson et.al 2008: Sediment load and floodplain deposition rates: Comparison of the Fly and Strickland Rivers, Papua New Guinea, in *Journal of Geophysical Research*, vol. 113, chapter 4.

⁶⁷ See footnote 66, section 38.

⁶⁸ See footnote 66, section 38.

In its first letter to the Council, Barrick claims that the heavy metal content in the sediments does not have any serious negative effects on the river system: “*In sum, there are no irreversible significant and adverse chemical impacts on this river system.*” In its second letter to the Council, Barrick does not broach this issue other than confirming that “*Studies have identified elevated metals indicative of mine-derived sediment at locations on the floodplain.*”

The Council takes as its point of departure that all surveys it has had access to show an unambiguous trend of elevated heavy metal concentrations in the sediments. What effects this actually has on the natural environment and on the people who live in the area do not seem to have been examined. The Council therefore does not find Barrick’s statements credible.

It is well known that sediments can function as a repository for hazardous substances where the metals may be released over time and be absorbed by the food chain. Whether this actually will happen is a complex issue that depends on various factors.⁶⁹ Barrick’s first letter to the Council states that it is not likely that metals will be released because limestone, which occurs naturally around Porgera, will act as a buffer against acidification and thus prevent the leaching of metals: “*The water chemistry of the system accordingly reflects high buffering capacity and pH. As a result, rather than being mobilized, the metals that are contained in the solid fraction remain there and much of dissolved metal fraction adsorbs onto sediments.*”

This seems to be a simplification of a very complex issue. Even if the tailings are alkaline, it is well known that an element like arsenic is relatively easily released. Cadmium and zinc are also known to be mobile in an aquatic environment, something that is evident from the investigations initiated by PJV itself.⁷⁰ Moreover, weathering processes may increase in the presence of oxygen and when the river is at low flow, thereby affecting the metal release. In this context it is natural to refer to the experience from the Ok Tedi mine in Papua New Guinea.⁷¹ In the past, Ok Tedi Mining Limited also claimed that the presence of large quantities of natural limestone would effectively limit the mobility of heavy metals in the Fly River system, which receives tailings from its mine. It is now known that this is not the case, and it has been documented that during periods of low flow heavy metals are released from sediments on levees and islands down to Suki Creek 600 km downstream of the mine.⁷²

The Council has not had access to surveys regarding the uptake of arsenic and heavy metals into the food chain or other effects on humans and the natural environment in the area. PJV’s sustainability reports from 1999 to 2003⁷³ show that PJV has performed sediment analyses, as well as initiated other studies related to environmental impacts of sediments. It is not clear which of these studies have been made public.

⁶⁹ Such as the water’s acidity, hardness and organic and particulate material content.

⁷⁰ See footnote 65, p. 7.

⁷¹ PNG’s largest copper mine, the Ok Tedi mine, is located in the mountains near the border with Indonesia. This mine also discharges tailings directly into a river system – *the Fly River*. The Strickland River joins the Fly River before emptying into the Papua Gulf. This implies that the discharges from the Porgera and Ok Tedi mines flow together in the lower reaches of the Fly River, which continues through the delta and out to sea (see figure 1). See Tingay, Alan 2007: *The Ok Tedi mine Papua New Guinea. A summary of Environmental and Health Issues*; on file with the Council.

⁷² Tingay, Alan 2008: *Assessment commissioned by the Council*; on file with the Council. In its second letter to the Council, Barrick claims that the conditions of the Strickland River cannot be compared with those of the Fly River. The surveys referred to by the company (see footnote 667) that describe this focus on physical differences related to sediment volume and aggradation, which do not necessarily have a bearing on the mobilization of heavy metals in the sediments.

⁷³ The reports are available at <http://www.peakpng.org.pg/reports.html>

5.3.1 Mercury pollution

High mercury concentrations in the entire river system and in the Lake Murray area is not only an important environmental problem, but also a major health issue for local people.

The mine waste from Porgera has significantly elevated mercury concentrations. According to a survey from 2001, the mercury concentration in the mine tailings is 2400 ng/g (dry weight), whereas the mercury concentration in natural sediments from the uncontaminated tributaries is <100 ng/g.⁷⁴ As the mine waste is dumped into the Porgera-Strickland river system, mercury is transported downstream – with potential negative impact on aquatic biota and human health.

Particulate mercury, such as it occurs in the tailings, can be converted, or methylated, by micro-organisms into methylmercury, a fat-soluble substance that is absorbed by plants and animals. Being highly toxic, methylmercury bioaccumulates in organisms and biomagnifies in the food chain, thus inflicting the greatest harm on organisms in the highest trophic levels.⁷⁵ Although both inorganic and organic forms of mercury can be taken up by aquatic organisms, methylmercury bioaccumulates much more readily than inorganic mercury, and most of the mercury found in fish is methylmercury.

Mercury compounds are highly toxic to many aquatic organisms and mammals, and may produce chronic toxic effects even in very small concentrations. Mercury may cause contact allergy, kidney failure and damage to the central nervous system. Foetuses and small children are more vulnerable than adults. Methylmercury may lead to brain damage and disrupt the motor and mental development. Fish consumption is the main source of human methylmercury intake.

Lake Murray is the largest lake in Papua New Guinea, with a surface area of about 647 km² at high water and an average depth varying between 4–10 m, depending on climatic conditions. The main tributary rivers flow into Lake Murray from the north, and the lake usually drains via the Herbert River in the south, which flows into the Strickland River. However, under certain hydrological conditions, such as flooding, the water flow from the Herbert River may reverse, resulting in water entering Lake Murray from the Strickland River. Flow reversal events vary in duration from a few hours to two weeks, with a cumulative total of some 95 days a year.⁷⁶ The CSIRO report from 1996 estimated that about 150 000 tons per year of mine-derived sediments are transported to the lake, which may account for 20 per cent of the total sediment transported to the lake from the Strickland River.⁷⁷

The human inhabitants around the lake have some of the highest recorded concentrations of mercury for people not occupationally exposed to mercury. This is attributed to consumption of

⁷⁴ See footnote 65, Appendix, survey 1, and NIVA 2008: *The Porgera Mine, Papua New Guinea. Assessment of Environmental Effect*, p. 8.

⁷⁵ Bioaccumulation refers to how pollutants enter a food chain. Biomagnification occurs when pollutants concentrate as they move from one trophic level in the food chain to the next. It generally refers to the sequence of processes that result in higher concentrations in organisms at higher levels in the food chain (at higher trophic levels). These processes result in an organism having higher concentrations of a substance than is present in the organism's food.

⁷⁶ Bowles, K.C. Apte, S.C., Maher, W.A and McNamara, J. 2002: Mercury speciation in waters and sediments of Lake Murray, Papua New Guinea, in *Marine and Freshwater Research* 53 (4), p. 826.

⁷⁷ CSIRO 1996 report, p. 5-2.

locally caught fish, which has naturally high mercury concentrations, often exceeding the World Health Organisation's recommended limit (0.5 mg/kg).⁷⁸

The ecosystem of Lake Murray is susceptible to mercury contamination as a result of biomagnification of methylmercury in the food chain.⁷⁹ A study on the mercury concentrations in the waters and sediments of Lake Murray and the surrounding rivers showed that mercury concentrations in sediments from the southern end of the lake were elevated compared to the northern and central part of the lake.⁸⁰ The mercury concentration in the southern part of the lake was comparable to mercury concentrations in suspended sediments from the Herbert and Strickland Rivers. The reason for this is that mercury is transported by suspended sediments from the Strickland River to the southern part of Lake Murray.

Measurements of the concentration of methylmercury showed levels more than ten times higher in the surface sediments of the southern part of Lake Murray than in suspended sediments from the Strickland River. The considerable differences indicate that mercury methylation occurs in recently deposited sediments.⁸¹

In its second letter to the Council, Barrick claims that the Council's presentation of these results from Bowles et al (2002)⁸² is misleading.⁸³ Barrick highlights one sentence in the Bowles article that says the deposition of fluvial sediments alone cannot explain the concentrations of methyl mercury in the southern end of the lake: "*This large concentration difference indicates that the deposition of fluvial sediments alone cannot account for the observed MeHg concentrations in the bottom sediments.*"⁸⁴ Furthermore, Barrick states that the conclusion of the article "*is supportive of the fact that it is primarily the unique food chain in Lake Murray that results in the mercury levels of inhabitants, not mine-derived sediments.*"

Based on analyses obtained by the Council, Barrick does not provide new arguments for the assessment. In the article, Bowles et al (2002) use precisely the differences in concentration between fluvial sediments (particulate river material) and in sediments in the south end of the lake to support their argument that the methylation occurs in the sediment transported by the Strickland River.⁸⁵ The suspended sediments in the Strickland River present high mercury content, but show lower methylmercury levels than the sediments in the lake. This is

⁷⁸ Bowles, K.C. Apte, S.C., Maher, W., Kawei, M. and Smith, R. 2001: Bioaccumulation and biomagnification of mercury in Lake Murray, Papua New Guinea, in *Canadian Journal of Fisheries and Aquatic Sciences Volume 58, Number 5, May 2001*, p. 895. More than 23% of the collected piscivorous fish showed mercury concentrations above 0.5 mg/kg.

⁷⁹ See footnote 78 and footnote 76. The ecosystem of Lake Murray is susceptible to Hg contamination due to biomagnification of monomethyl mercury (MeHg) in the planktonic based food web, comprising four trophic levels: phytoplankton, zooplankton, planktivorous and piscivorous (fish-eating) fish.

⁸⁰ See footnote 76 and NIVA 2008: *The Porgera Mine, Papua New Guinea. Assessment of Environmental Effect*. According to Bowles et.al 2002, the mercury concentrations in sediments from the south end of the lake were 177 ± 57 ng/. Levels in the northern and central part of the lake were 70 ± 27 ng/g and 89 ± 48 ng/g respectively. The mercury concentration in the southern part of the lake was 142 ± 32 ng/g.

⁸¹ See footnote 76 and NIVA 2008: *The Porgera Mine, Papua New Guinea. Assessment of Environmental Effect*. According to Bowles et.al 2002, the concentration of monomethyl mercury was 0.84 ± 0.39 ng/g in surface sediments of the southern part of Lake Murray and 0.07 ng/g in suspended sediments from the Strickland River.

⁸² Bowles, K.C. Apte, S.C., Maher, W.A and McNamara, J. 2002: Mercury speciation in waters and sediments of Lake Murray, Papua New Guinea, in *Marine and Freshwater Research 53 (4)*, p. 831.

⁸³ Barrick Gold: Letter to NBIM/Council on Ethics, dated 25 April 2008.

⁸⁴ See footnote 82.

⁸⁵ NIVA 19 May 2008: Electronic correspondence between the Council's Secretariat and Tingay, Alan; 27 May 2008: Letter to the Council. Both are on file with the Council.

understandable as methylation rarely occurs in an oxygen-rich riverine environment, but rather happens after the sediments have been deposited in an oxygen-poor/free reductive environment near the bottom of the lake.⁸⁶

According to the Council's assessment, there is little doubt that large quantities of mercury pollutants are transported by the Strickland River into Lake Murray, causing the sediments in the southern part of the lake to have an elevated (total) mercury content. There does not seem to be any doubt that after the sedimentation significant methylation of the imported mercury occurs, transforming it into a more bioavailable form, which has a great potential for accumulation in food chains.

The mercury levels in fish and human residents in the area near Lake Murray were elevated even before the development of the Porgera mine. This demonstrates that the natural background levels of mercury are high, but also that the lake's ecosystem is vulnerable to mercury pollution. In an aquatic system with already naturally elevated mercury concentrations, such as Lake Murray, any further anthropogenic supplement of mercury to the system is unfavourable and should be avoided.⁸⁷

5.3.2 Health and social effects associated with the tailings disposal

In 2000, Porgera had an estimated population of 10 000 Ipili (the original local landowners) and 12 000 migrants, people who have immigrated to the valley after the mining operations started.⁸⁸ The population has probably increased in the last years, mostly by people who have been attracted by business and employment opportunities in the area.

There are a number of villages within or adjacent to the mining lease area, some of them in close vicinity to the waste rock dumps and the area where the tailings are discharged. Villagers here are often in direct physical contact with the mine waste.⁸⁹ There are well-trodden paths traversing the unsecured deposit sites, and many of the locals look for gold in the tailings, waste rock piles, or the open pit itself.⁹⁰ In some villages, vegetables are grown in the immediate vicinity of the tailings. People are undoubtedly exposed to arsenic, heavy metals and other harmful substances found in the tailings, which may inflict serious and long-term health effects.

The houses in these villages lack running water, and people fetch water from nearby creeks or collect rainwater. Former sources of drinking water have been covered by tailings and are spoilt. Villagers are deeply concerned about the water quality and fear that the water is contaminated by the tailings. Moreover, smoke and gas from the processing plant, dust from the opencast mine and the gravel roads add to the pollution of both air and water.

It appears that local residents have no access to information regarding the content of hazardous substances in the tailings, air emissions and air quality, or the quality of the drinking water.

⁸⁶ NIVA 2008: Electronic correspondence with the Council's Secretariat of 19 May.

⁸⁷ NIVA 2008: *The Porgera Mine, Papua New Guinea. Assessment of Environmental Effect*, p. 9.

⁸⁸ http://www.mineral.gov.pg/GreenPaper/WP2_4.htm

⁸⁹ First-hand observations by the Council's Secretariat.

⁹⁰ The locals' gold mining is considered illegal, as it occurs on PJV's property and because the gold, in principle, is owned by PJV. Locals claim that they practiced alluvial gold mining before the mine operation began, and that it was a legal and important source of income. The main reasons why they continue to mine illegally is poverty and lack of land for subsistence farming. Illegal mining is a controversial issue that the Council has not researched further.

People believe that the tailings and the emissions contain toxic substances, and are worried about possible health impacts. However, they do not know which hazardous substances these are or the possible harmful effects they may cause in the long term. To the Council's knowledge, no systematic investigations have been carried out in order to evaluate the long-term health hazards faced by the local population because of mine-derived pollution and waste. Many of the villagers complain that Barrick does little to address their concerns.⁹¹

In 1995, the Australian NGO, the Mineral Policy Institute, estimated that some 7 000 people lived between the discharge point and the compliance point 165 km downstream of the mine, in other words the part of the river where the water is most polluted.⁹² PJV has disputed this estimate and claims that only about 2 000 people live in this area.⁹³ The Council does not know how many people currently live downstream of the mine and are affected by the discharges.

In the CSIRO report from 1996, the population's health risk in the mixing zone was assessed as low.⁹⁴ The reason for this, according to the report, was that the villagers did not live near the river and therefore had limited exposure to the water. There is no information available to assess whether this reflects the present situation. Experience from other mines in PNG shows that significant changes in local communities and people's way of life can occur in the proximity of mine sites, influencing people's exposure to the contaminants in the water.⁹⁵ This may be the case here as well. In the Council's opinion, this is a matter of concern, given the high concentrations of arsenic and heavy metals in the water.

The aforementioned CSIRO report concluded that the potential health risk associated with the discharges most probably would be limited to the inhabitants of the Lower Strickland River and the lower middle half of the Lake Murray region.⁹⁶ This is where the population was considered to be most susceptible to metal contamination, particularly through fish consumption. At the same time, the report draws attention to the need for detailed risk assessments: "*Risk assessments are needed for all people living downstream from the mine including the people living along the erodible dump along the Kogai River, and extending to villagers living along the Porgera, Lagaip and Strickland Rivers, Lake Murray, and the Fly River delta.*"⁹⁷ Barrick, on the other hand, claims that "*health risk assessments and medical assessments of downriver populations have been conducted and interim reports are posted from time-to-time. We do not believe that there is evidence of health risks to the downstream populations.*" In this context, the company refers to the website of the Porgera Environmental Advisory Komiti (PEAK).⁹⁸

⁹¹ The Council has not assessed the issue of compensation or the security guards' alleged human rights abuses.

⁹² Mineral Policy Institute 1995: *The Porgera Files*, p 10.

⁹³ IIED 2002. Mining for the Future. Appendix 1: *Porgera Riverine Disposal Case Study*, p I-15

⁹⁴ CSIRO report from 1996, p. ES-6.

⁹⁵ Tingay, Alan 2008: *Assessment commissioned by the Council*, and Tingay, Alan 2007: *The OK Tedi Mine Papua New Guinea. A summary of Environmental and Health Issues*.

⁹⁶ CSIRO 1996 report, p 3-15.

⁹⁷ CSIRO 1996 report, p 3-17.

⁹⁸ Placer Dome established in 1997 a "multi-stakeholder committee called PEAK (Porgera Environmental Advisory Komiti) to oversee the implementation of the CSIRO recommendations." The respected leader of the Foundation for People and Community Development in Papua New Guinea was appointed to chair the committee. In 2001, he withdrew from PEAK because, in his view, Placer Dome did little to implement the CSIRO's recommendation and because he felt that he was used in the company's CSR propaganda. According to his letter to the company: "*Placer has now had four years to carry out these studies and implement their recommendations, yet nothing has changed from the situation in 1996 when the CSIRO report was started.*"

The Council has accessed the PEAK website, but has not been able to find any significant reports on health risks associated with the Porgera mine, except the CSIRO report from 1996 (which was not available) and a study by Taufa et al. (2001).⁹⁹ The latter is a limited health assessment of a small sample of residents in nine villages above SG3. Other available reports comprise brief accounts of field visits to villages and dietary surveys. The PEAK site also refers to a Community Health Study, but this is not available.

In the Council's view, the CSIRO recommendation regarding a comprehensive and detailed assessment of health risks encompassing the whole riverine population does not seem to have been carried out. Neither does the Council consider the other studies referred to by the company to provide a scientific basis for claiming that health risks do not occur.

There is no information available on the social impacts either. On the whole, the population downstream of the mine is engaged in subsistence farming, fishing and hunting. The CSIRO report from 1996 states that people living on the flood plain make extensive use of aquatic food supplies as well as growing food crops on the riverbank, which may be affected by the tailings.¹⁰⁰ The Council has not been able to find any updated information on how this situation has developed. However, there is reason to believe that the tailings disposal have had and will continue to have an adverse impact on the local population's economic base in addition to potential health effects. In the Council's opinion, these possible effects should have been investigated to provide a better understanding of what consequences the mining operation entails.

6 Barrick's response to the Council

As previously mentioned, the Council has, via Norges Bank, made two enquiries to Barrick Gold. The first was a request of access to the company's environmental reports for the Porgera mine, a matter referred to in more detail in chapter 2. The other enquiry gave the company an opportunity to comment on the Council's draft recommendation, as prescribed by the Guidelines. The draft recommendation was sent to Barrick on 7 April 2008 with a deadline for reply on 4 May. On 24 April the company contacted Norges Bank, via e-mail, requesting a postponement of the deadline until 9 May, which was granted. The Council received a letter from Barrick on 14 May 2008. The letter is dated 25 April 2008.

In this letter, Barrick dismisses the Council's draft recommendation, which, according to the company, "*mixes allegations, data, unattributed hearsay and other information into single sentences and paragraphs. In addition it alleges that certain conditions exist without any geographic context. Accordingly, it is difficult to dissect the document, separate the facts from the errors and respond to the individual points.*" Moreover, the company sustains that the Council does not take into sufficient consideration that the discharges from the Porgera mine are minor, that they are released into a massive river system, and that they are not comparable

http://www.miningwatch.ca/cms/index.php?/porgera_placer_dome/Bun_resignation_ltr . PEAK's website is available at <http://www.peakpng.org.pg/>

⁹⁹ Taufa et.al. 2001: *The investigation of the "mysterious disease" and deaths in The Strickland Gorge areas of Southern Highlands and the West Sepik provinces of Papua New Guinea*. April 2001, available at

http://www.peakpng.org.pg/docs/Medical_Survey_Lake_Kopiago.pdf

¹⁰⁰ CSIRO 1996 report, p. ES 9.

with the discharges from Freeport's Grasberg mine.¹⁰¹ Barrick also thinks that the Council is against riverine tailings disposal on principle. *"It therefore appears that addressing each and every allegation would be of no consequence. Instead of attempting to do so, our response is limited to a few comments that we believe demonstrate that the [Council's] report is not fair and balanced."*

Barrick focuses chiefly on three factors in its letter to the Council – that the physical effects of sediment deposition on the flood plain is negligible, that the Council's assessments of the risk related to mercury contamination is misleading, and that the company is in the process of evaluating alternatives to riverine tailings disposal.

As is shown in chapter 5.2 and in the draft recommendation that has been sent to Barrick, the Council does not have information indicating that the physical impact of the sediment deposition poses a major environmental risk. On the other hand, the Council has been concerned with the heavy metal contamination caused by the discharges. An account of this is given here (section 5.2.2 and 5.3) and in the document that Barrick received for comments. In the Council's view, this is what constitutes the biggest threat of severe and long-term environmental damage. The Council deems it unfortunate that the company does not address the issue in its reply to the Council. Even if Barrick acknowledges that elevated levels of heavy metals have been detected in the sediments on the flood plain, the company does not discuss what potential risks this implies nor does it provide any indications that this is an issue of concern.

As mentioned above, Barrick is of the opinion that the Council's presentation gives a misleading impression with regard to the mercury contamination of Lake Murray. The company claims that the Council has omitted relevant information from the publications on which its assessment is based,¹⁰² and that this is done to strengthen the Council's argument about the mine's contribution to the mercury pollution.¹⁰³ In light of the company's objections, the Council has reviewed the material and asked for expert opinion from the Norwegian Institute for Water Research, among others. Based on this, the Council finds that the conclusion remains valid (as has also been clarified in section 5.3.1) and that Barrick's reply does not bring new arguments to the case.¹⁰⁴ In this context, the Council also refers to Bowles' conclusion (from 2002): *"Intermittent inputs of turbid water from the Strickland River inject particulates and filterable MeHg into the southern end of Lake Murray. This has resulted in the formation of a depositional footprint that contains higher concentrations of particulate mercury and other elements compared with the rest of the lake."*¹⁰⁵

Finally, Barrick informs that the company is in the process of evaluating alternatives to riverine tailings disposal, including the building of a dam and the possibility of returning tailings to the mine. *"We are considering all of the technical considerations outlined in the new IFC Guidelines and more, specifically, social issues such as relocation and the impact on alluvial miners, who [] work the tailings stream."* According to its web pages, the company has *"engaged a team of experts to study and assess options to improve, reduce or eliminate the*

¹⁰¹ See the Council on Ethics' recommendation to exclude Freeport McMoRan of 15 February 2006, at www.etikkradet.no.

¹⁰² Among others: Bowles, K.C. et al 2002: Mercury speciation in waters and sediments of Lake Murray, Papua New Guinea, in *Marine and Freshwater Research* 53 (4).

¹⁰³ Barrick Gold: Letter to NBIM/Council on Ethics, dated 25 April 2008.

¹⁰⁴ NIVA 2008: Electronic correspondence with the Council's Secretariat of 19 May

¹⁰⁵ See footnote 102, Abstract, p. 825.

*discharge of riverine tailings. Environmental, social, technical, and regulatory considerations will drive selection of the preferred tailings management methodology.”*¹⁰⁶ This assessment is to be concluded by the end of 2008. However, the company does not give any concrete indications that it actually will stop the riverine disposal. In its letter to the Council, Barrick also gives the impression that riverine tailings disposal must be accepted if other disposal methods prove difficult.

Lastly, the Council would like to point out that neither in its second reply to the Council does Barrick provide any substantial information on the mining operation. The company continues to make reference to the CSIRO report from 1996, in addition to a few technical reports, which the Council already has found out about on its own. It is still unclear whether this represents all the company’s research on the mining operation’s environmental impact. The Council finds that this lack of transparency contributes to weaken the credibility of Barrick’s claims that the environmental impact of the mine is insignificant.

7 The Council’s assessment

Based on the documentation at hand, the Council has assessed whether there is an unacceptable risk that the Fund, through its ownership in Barrick Gold, may contribute to severe environmental damage under the Ethical Guidelines, point 4.4.

The first element in the assessment refers to the *scale of the damage and to what extent it causes irreversible effects*. In this context, the Council has investigated Barrick’s mining operation at Porgera, basing its assessment on the information provided in chapter 5.

The Council deems it highly probable that the riverine tailings disposal causes severe environmental damage. The amount of tailings discharge is substantial and contains a number of hazardous substances, including arsenic and heavy metals, which are deposited over a very long river distance. Already in 1996 the effects of the mining operation were detected in the Lower Strickland River, in the Herbert River, and at the outlet of Lake Murray (see section 5.2 and 5.3). The Council attaches particular importance to the risk of bioaccumulation and biomagnification of heavy metals, especially mercury, in the environment. Research findings from 1996 gave clear indications that these processes were under way, something that has also been confirmed by more recent studies. It is hardly probable that these effects have abated with time, and neither will they cease after the mining operation has closed down. If the heavy metals in the sediments are mobilized, it will be almost impossible to stop the process in this river system, which means that the local population will have to deal with the contamination for decades. Based on the information at hand, the Council finds it probable that the riverine disposal from the Porgera mine may lead to considerable and lasting environmental damage.

The Council also finds that the pollution from the mining operations at Porgera may have substantial effects on *human life and health*. The practice of riverine disposal seems to increase the local population’s exposure to heavy metals, including mercury. This has taken place and will continue to take place over a long period of time, posing a significant risk of severe and long-term health effects. It is particularly serious as the population groups in the area already are subject to naturally elevated background levels of mercury, and additional exposure may have extremely severe health effects (see section 5.3.1). The lack of systematic health surveys

¹⁰⁶ <http://www.barrick.com/CorporateResponsibility/Environment/WasteRockTailings/default.aspx>

means that there is no information available as to how the mining operation affects the health conditions among the inhabitants of the mining area and downstream from the mine. In the Council's view, the worries local residents in the mining area have for their future health are well founded, given the high values of arsenic and heavy metals found in the discharge, and which are also detectable in water and sediment.

The third element in the assessment is whether the environmental damage is a result of *violations of national laws or international norms*. Barrick claims to comply with official discharge requirements. The Council finds that in practice this is impossible to assess as long as it is not documented through monitoring data. In this context, the Council would like to note that the waste management rules the company has to obey in PNG are significantly laxer than those applicable in the company's home country, Canada, where riverine disposal is prohibited. Weak environmental requirements, which, moreover, are scarcely enforced, imply that there is no system in place to prompt the reduction of mine-related damage. This contributes to further increase the risk of severe environmental damage.

Today Papua New Guinea and Indonesia are, as far as the Council knows, the only countries that allow riverine tailings disposal. In Europe the mining industry has to act in accordance with a new directive for extractive industries from 2008, with stringent environmental requirements.¹⁰⁷ The World Bank no longer finances projects that make use of riverine tailings disposal, neither does the *International Finance Corporation* accept riverine disposal.¹⁰⁸ The World Bank's "*The Extractive Industries Review*" (EIR) from 2003¹⁰⁹ and the international project "*Mining, Minerals and Sustainable Development*" (MMSD)¹¹⁰ also advise against riverine tailings disposal because of the environmental damage this implies. The EIR states that "*Scientific evidence clearly demonstrates that this method of waste disposal causes severe damage to water bodies and surrounding environments... In practice, this technology is being phased out due to recognition of its negative consequences.*"¹¹¹

¹⁰⁷ Directive 2006/21/EC of The European Parliament and of the Council of 15 March 2006 on the Management of Waste from Extractive Industries and Amending Directive 2004/35/EC; available at <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:102:0015:0033:EN:PDF>

¹⁰⁸ IFC 2007: *Environmental, Health and Safety Guidelines for Mining* where the IFC declares that riverine tailings disposal is not considered good international practice (p.7); available at [http://www.ifc.org/ifcext/enviro.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_Mining/\\$FILE/Final+-+Mining.pdf](http://www.ifc.org/ifcext/enviro.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_Mining/$FILE/Final+-+Mining.pdf)

¹⁰⁹ "*The Extractive Industries Review was launched by the World Bank Group to discuss its future role in the extractive industries with concerned stakeholders. The aim of this independent review was to produce a set of recommendations that will guide involvement of the World Bank Group in the oil, gas and mining sectors.*" Information and reports available at www.worldbank.org

¹¹⁰ "*Mining, Minerals and Sustainable Development (MMSD) was an independent two-year process of consultation and research with the objective of understanding how to maximise the contribution of the mining and minerals sector to sustainable development at the global, national, regional and local levels. MMSD was a project of the International Institute for Environment and Development (IIED) commissioned by the World Business Council for Sustainable Development (WBCSD)*" Information and reports available at <http://www.iied.org/mmsd/>

¹¹¹ EIR 2004: *Striking a Better Balance - The World Bank Group and Extractive Industries: The Final Report of the Extractive Industries Review*, p 33; available at <http://siteresources.worldbank.org/INTOGMC/Resources/finaeirmanagementresponse.pdf>. In this context, it may also be mentioned that the world's largest mining company, BHP Billiton, has declared that it does not wish to make use of riverine tailings disposal in new projects. The background for this is the extensive environmental damage that the riverine disposal has caused at the OK Tedi mine in Papua New Guinea, which BHP owned jointly with the Papua New Guinean state until 2002; see www.bhpbilliton.com

The Council therefore stresses that internationally riverine disposal is considered an unacceptable disposal method for mine waste, due to the environmental damage it provokes. On these grounds the Council assesses Barrick's practice in Papua New Guinea as clearly in breach of international norms.

It is also the Council's task to assess whether the company has *neglected to act in order to prevent the damage, or whether adequate measures have been implemented to rectify the damage*. Two years have passed since Barrick acquired the Porgera mine, but no significant changes in mine waste management seem to have been effected. Even if the company states that it considers the possibility of other tailings disposal measures, it has not given any concrete indications that it will actually abandon riverine disposal.

The Council is not aware that the company has initiated comprehensive environmental and health assessments to obtain updated knowledge on the environmental and health status of the local population and future risks related to this. Considering the pollution in question, this is particularly serious. The Council assumes that such studies will be necessary to be able to implement measures aimed at mitigating a severe pollution situation downstream of the mine.

In its letters to the Council, the company has hardly touched on the impact of heavy metals. In the Council's view, the company attempts to give the impression that the environmental effects of the mining operation are insignificant and without lasting consequences. At the same time, the company does not strive for transparency in this respect. The fact that Barrick does not wish to disclose its environmental reports, but continues to refer to the CSIRO environmental review from 1996 rather than publishing contemporary data, suggests that the management is not willing to substantiate its claims with concrete data. In the Council's view, the company's statements that the discharges do not have long-term harmful effects are therefore not convincing. The Council also finds it regrettable that the population who is affected by the discharges does not have access to information on the pollution and what health and environmental effects it may cause.

The Council takes as its point of departure that Barrick has not implemented any significant measures aimed at reducing the damage caused by the mining operation and fails to substantiate its claims that the mining operation does not produce severe environmental damage in the short or long term. The Council finds that the lack of environmental measures and transparency relating to environmental information increases the risk of the Fund's contributing to severe environmental damage.

Finally, the Council must evaluate whether *the company's unacceptable practice may be expected to continue in the future*. In the last quarterly report for 2007, Barrick informs that the company plans to expand the mine and extend its lifespan. The authorities have granted a concession for discharge into water for as long as the mine is in operation. Riverine disposal is practiced by several mining companies in PNG, and the Council has no indications that the government will order Barrick to use other disposal methods. The discharge of tailings into a natural river is a very cheap waste disposal method in terms of both infrastructure and maintenance. Even if Barrick states that other disposal methods are being studied, the Council assumes that it will take many years before the company voluntarily builds a new, and probably very costly, waste disposal site.

Based on the above, the Council deems it probable that the company's unacceptable practice will continue.

8 Conclusion

In light of the documentation at hand, the Council finds that Barrick's operation of the Porgera mine entails an unacceptable risk of extensive and irreversible damage to the natural environment. According to the Council's assessment, the company's riverine disposal practice is in breach of international norms. In the Council's view, the company's assertions that its operations do not cause long-term and irreversible environmental damage carry little credibility. This is reinforced by the lack of openness and transparency in the company's environmental reporting. Considering the intentions presented by the company with regard to production expansion, the Council finds reason to believe that the company's unacceptable practice will continue in the future.

9 Recommendation

After this assessment of the gist of the accusations against Barrick Gold Corporation and in light of the Ethical Guidelines, point 4.4, the Council will recommend that the company be excluded from the investment universe of the *Government Pension Fund - Global* due to an unacceptable risk of contributing to ongoing and future severe environmental damage.

Gro Nystuen
Chair
(sign.)

Andreas Føllesdal
(sign.)

Anne Lill Gade
(sign.)

Ola Mestad
(sign.)

Bjørn Østbø
(sign.)