Mine waste disposal at sea: how can we assess impacts to inform regulation?

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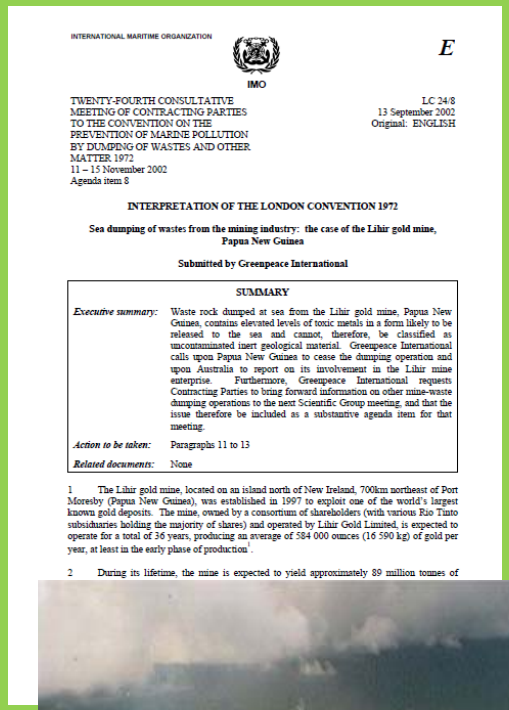
2002: sea dumping of mine wastes – the case of the Lihir gold mine, PNG



INTERNATIONAL MARITIME ORGANIZATION

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TWENTY-FOURTH CONSULTATIVE MEETING OF CONTRACTING PARTIES TO THE CONVENTION ON THE PREVENTION OF MARINE POLLUTION BY DUMPING OF WASTES AND OTHER MATTER 1972
11 – 15 November 2002
Agenda item 8

LC 24/8
13 September 2002
Original: ENGLISH

INTERPRETATION OF THE LONDON CONVENTION 1972

Sea dumping of wastes from the mining industry: the case of the Lihir gold mine, Papua New Guinea

Submitted by Greenpeace International

SUMMARY

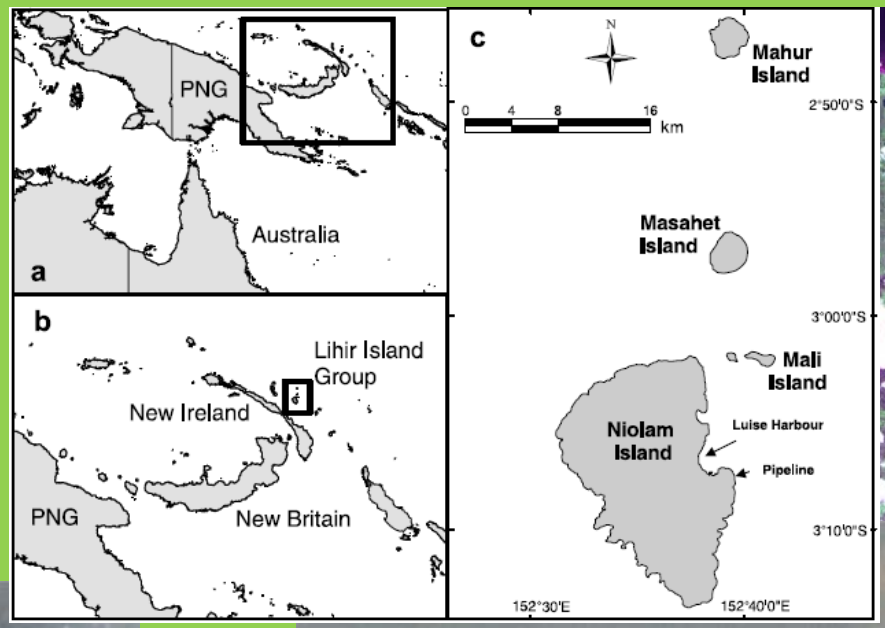
Executive summary: Waste rock dumped at sea from the Lihir gold mine, Papua New Guinea, contains elevated levels of toxic metals in a form likely to be released to the sea and cannot, therefore, be classified as uncontaminated inert geological material. Greenpeace International calls upon Papua New Guinea to cease the dumping operation and upon Australia to report on its involvement in the Lihir mine enterprise. Furthermore, Greenpeace International requests Contracting Parties to bring forward information on other mine-waste dumping operations to the next Scientific Group meeting, and that the issue therefore be included as a substantive agenda item for that meeting.

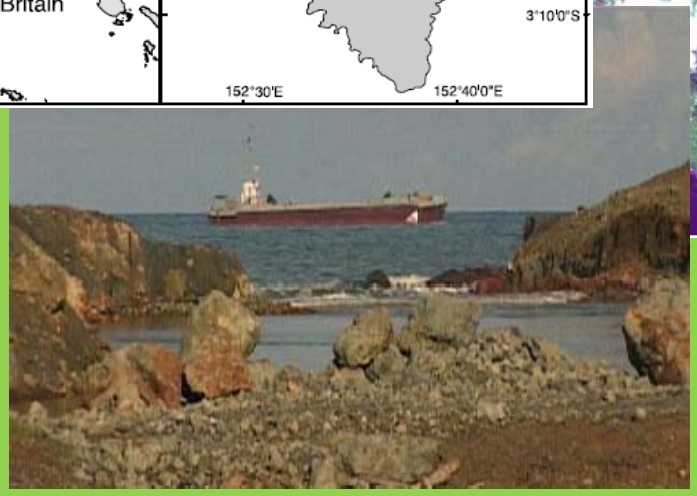
Action to be taken: Paragraphs 11 to 13

Related documents: None

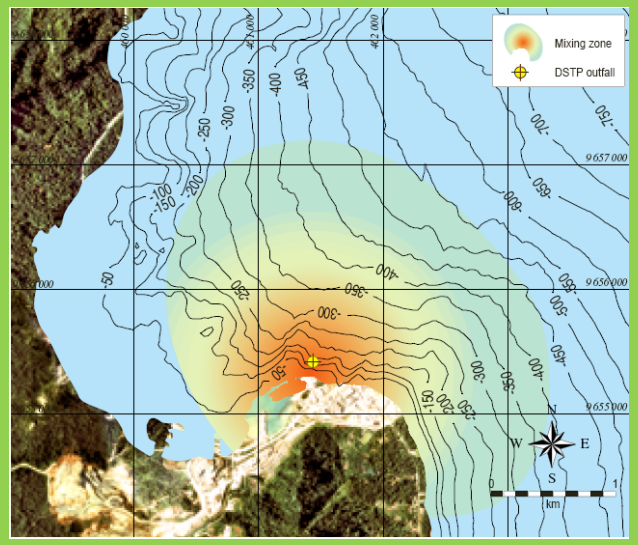
1 The Lihir gold mine, located on an island north of New Ireland, 700km northeast of Port Moresby (Papua New Guinea), was established in 1997 to exploit one of the world's largest known gold deposits. The mine, owned by a consortium of shareholders (with various Rio Tinto subsidiaries holding the majority of shares) and operated by Lihir Gold Limited, is expected to operate for a total of 36 years, producing an average of 584 000 ounces (16 590 kg) of gold per year, at least in the early phase of production'.

2 During its lifetime, the mine is expected to yield approximately 89 million tonnes of

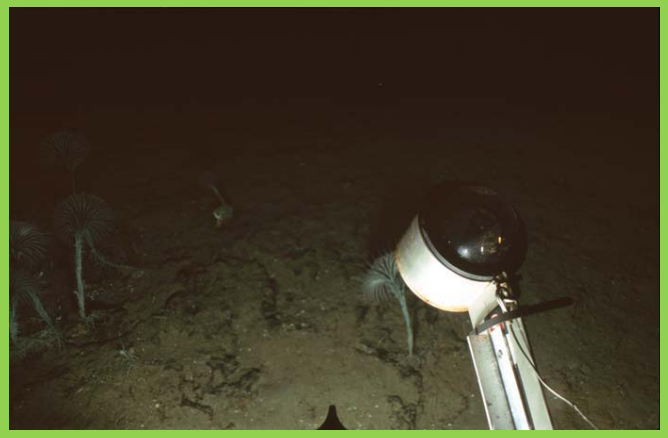




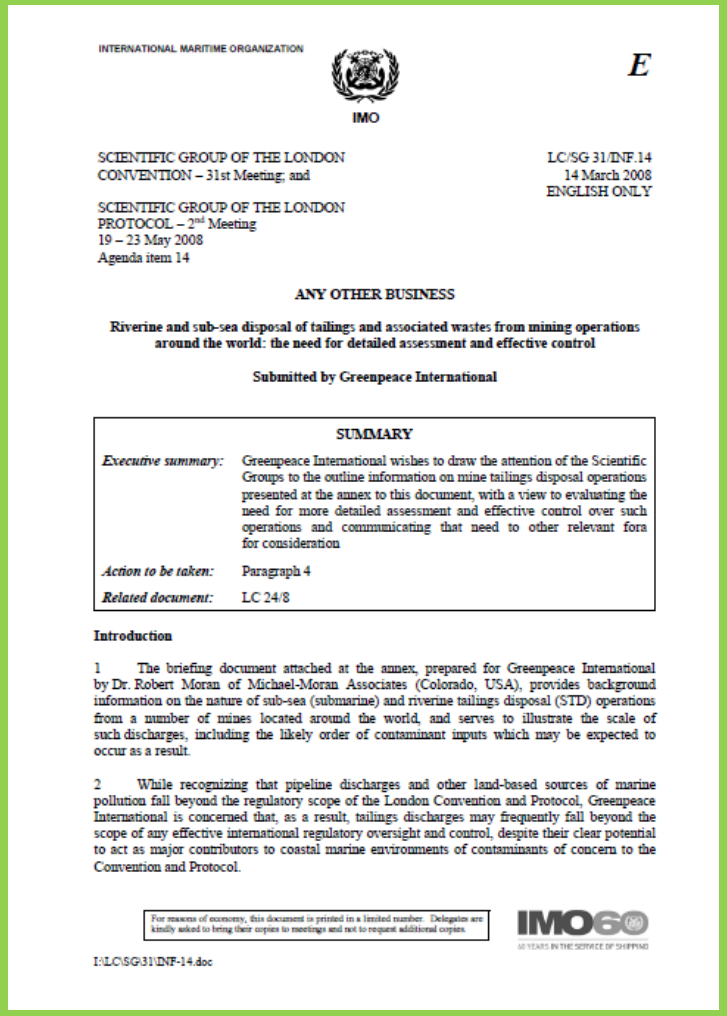
Sub-sea tailings discharges from the Lihir gold mine, PNG – a bigger issue?



- 3.5-4.5 M t per year
- 34 °C
- pH 2.3
- Composition otherwise poorly described
- Estimated 10-30% dispersed as subsurface plumes



2008: an overview of subsea and riverine tailings disposal



INTERNATIONAL MARITIME ORGANIZATION

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SCIENTIFIC GROUP OF THE LONDON CONVENTION – 31st Meeting; and

SCIENTIFIC GROUP OF THE LONDON PROTOCOL – 2nd Meeting
19 – 23 May 2008
Agenda item 14

LC/SG 31/INF.14
14 March 2008
ENGLISH ONLY

ANY OTHER BUSINESS

Riverine and sub-sea disposal of tailings and associated wastes from mining operations around the world: the need for detailed assessment and effective control

Submitted by Greenpeace International

SUMMARY

Executive summary:	Greenpeace International wishes to draw the attention of the Scientific Groups to the outline information on mine tailings disposal operations presented at the annex to this document, with a view to evaluating the need for more detailed assessment and effective control over such operations and communicating that need to other relevant fora for consideration
Action to be taken:	Paragraph 4
Related document:	LC 24/8

Introduction

1 The briefing document attached at the annex, prepared for Greenpeace International by Dr. Robert Moran of Michael-Moran Associates (Colorado, USA), provides background information on the nature of sub-sea (submarine) and riverine tailings disposal (STD) operations from a number of mines located around the world, and serves to illustrate the scale of such discharges, including the likely order of contaminant inputs which may be expected to occur as a result.

2 While recognizing that pipeline discharges and other land-based sources of marine pollution fall beyond the regulatory scope of the London Convention and Protocol, Greenpeace International is concerned that, as a result, tailings discharges may frequently fall beyond the scope of any effective international regulatory oversight and control, despite their clear potential to act as major contributors to coastal marine environments of contaminants of concern to the Convention and Protocol.

For reasons of economy, this document is printed in a limited number. Delegates are kindly asked to bring their copies to meetings and not to request additional copies.

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"While recognizing that pipeline discharges and other land-based sources of marine pollution fall beyond the regulatory scope of the London Convention and Protocol, Greenpeace International is concerned that, as a result, tailings discharges may frequently fall beyond the scope of any effective international regulatory oversight and control, despite their clear potential to act as major contributors to coastal marine environments of contaminants of concern to the Convention and Protocol".

(sub-)marine mine tailings disposal: an overlooked problem?

- Billions of tonnes per year generated by mines globally, initially disposed to impoundments
- Thereafter frequently disposed of to sea, either directly by pipeline or to rivers near the coast
- Tailings can be rich in metals and other naturally occurring and man-made contaminants
- Are known to be chemically reactive and to act as a source of bioavailable metals

Typical composition of discharged mine tailings

- natural rock
- added process chemicals
- explosives residues
- fuels/oils and greases/antifreeze
- wastes from water treatment, sewage facilities and laboratories
- residues from miscellaneous maintenance operations, including herbicides and other pesticides, road de-icing compounds, etc.

Some typical operations

Currently Operating	Status	Tailings Disposed [tons per day, TPD]	Ore/Plant
Cayeli Bakir, Turkey	1994 – present	2,000	Cu-Zn mill flotation
Lihir, PNG	1997 – present	3,500 (est. 89 M tons, total)	Au mill, CN
Batu Hijau, Indonesia	1999 – present	160,000	Cu-Au mill
Huasco Iron, Chile	1994 – present	3,000	Fe ore, pelletizing
Currently Proposed	Status	Tailings Disposed [tons per day, TPD]	Ore / Plant
Petaquilla, Panama	?	90,000	Cu-Au
Ramu, PNG	?	14,000	Ni-Co laterite (autoclave leach)
Tampakan, Philippines	?	50,000	Cu-Au
Namosi, Fiji	?	100,000	Cu-Au

Some typical operations

Recently Closed	Status	Tailings Disposed [tons per day, TPD]	Ore/Plant
Misima, PNG	1990 – 2004	20,000	CN, autoclave
Minahasa, Indonesia	1996 – 2004	2,000—3,000 (2.8 M tons, total)	Au mill, roast, CN
Island Copper, BC, Canada	1971 – 1995	30,000—60,000	Cu-Mo-Au flotation
Kitsault Moly, BC, Canada	1980 – 1982	20,000	Mo flotation
Atlas, Cebu, Philippines	1971 – 1994	70,000—100,000	Cu flotation
Riverine/Coastal Marine	Status	Tailings Disposed [tons per day, TPD]	Ore/Plant
Toquepala-Cuajone, Peru	≈1960 – 1997	100,000	Cu-Mo-Se flot.
(production continues; new tailings impounded 1997; effluent continues to ocean)			
Marcopper, Marinduque, Phil.	1975 – 1991	(200 M tons total)	Cu-Au
Grasberg, Indonesia	1972 – present	238,000 avg. (est. 3.0 Billion tons during life of mine)	Cu-Au

Concentration ranges for eight metals or metalloids in tailings from four copper mines in Arizona, USA [Pond *et al.* (2005)]

Tailings element	Tailings Conc. Range (mg/kg or ppm)	
	Min.	Max.
Fe	19300	27300
Cu	650	1190
Zn	13	160
Cr	7.1	13
Ni	11	15
Se	1.5	2.9
As	1.7	6.2
Pb	3	16

Newmont Minahasa Raya gold mine: the case of Buyat Bay, Indonesia

- Operational from 1996-2004
- Discharging 2000 t tailings per day approximately 1km from shore and at depth of 82m (around 4 M t over 8 years)
- EIA suggested tailings would be isolated beneath thermocline at 50-70m
- In practice, tailings dispersed throughout Buyat Bay, smothering corals and sea grasses
- At some locations, seabed raised by over 10m

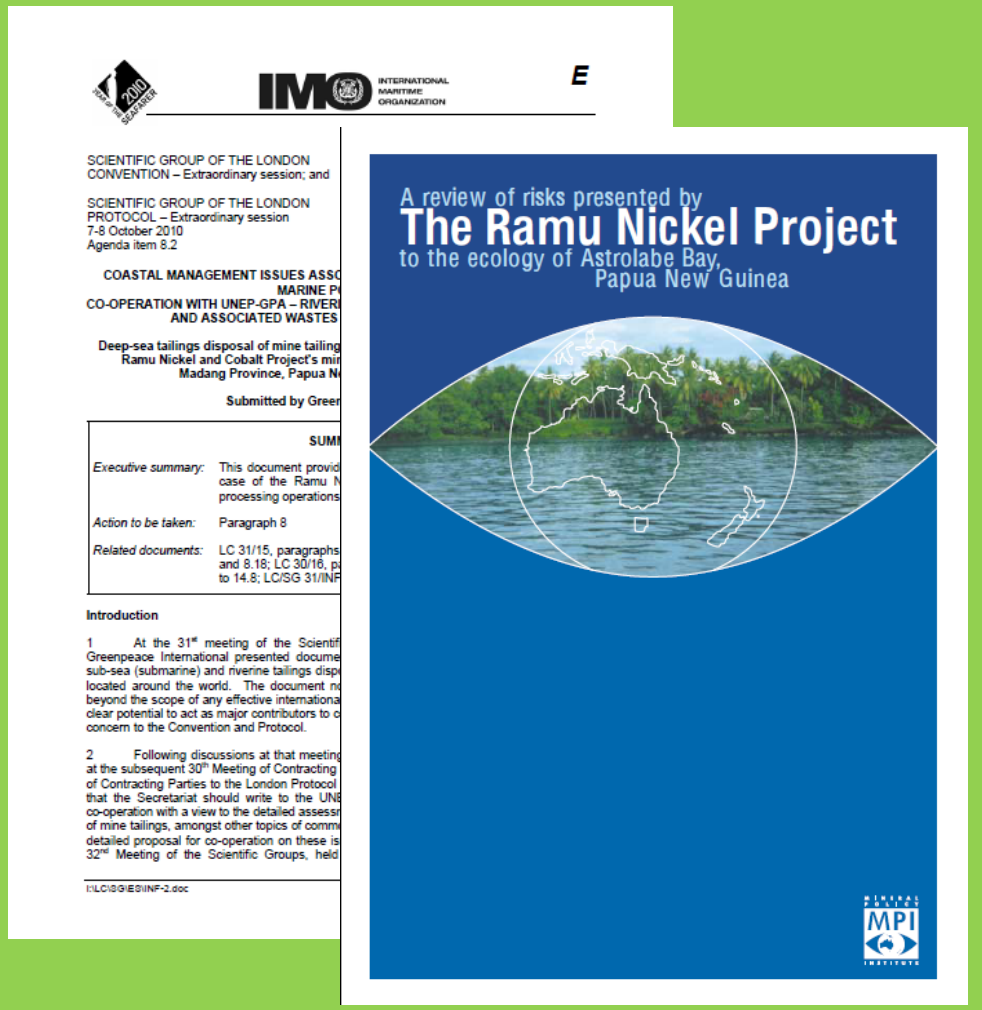
Newmont Batu Hijau copper & gold mine, Indonesia

- Discharges 160 000 t per day, 2.9 km from shore at depth of 108 m (50 M to per year)
- Assumption is that tailings sink 4000m to Java Trench
- Verification of fate of tailings limited, and their chemical composition unclear
- Heavy reliance on studies conducted by the company and published only in summary – local authorities lack funds and expertise

Other cases of subsea tailings disposal

- **Island Copper** (Canada) – 1971-95 – predictions of water column stability and tailings settlement proved incorrect
- **Kitsault** (Canada) – 1981-82 – 4 M t to Alice Arm fjord – 14km^2 seafloor impacted, 7km^2 severely – several resuspension event
- **Cayeli Bakir** (Turkey) – discharge below 250m to Black Sea – studies suggest plume separation and rise through water column are likely
- **Atlas Copper** (Philippines) – discharge at 30m with aim for tailings deposits to reach 350m – in practice, some tailings washed back to 12m depth

Ramu Nickel, Indonesia

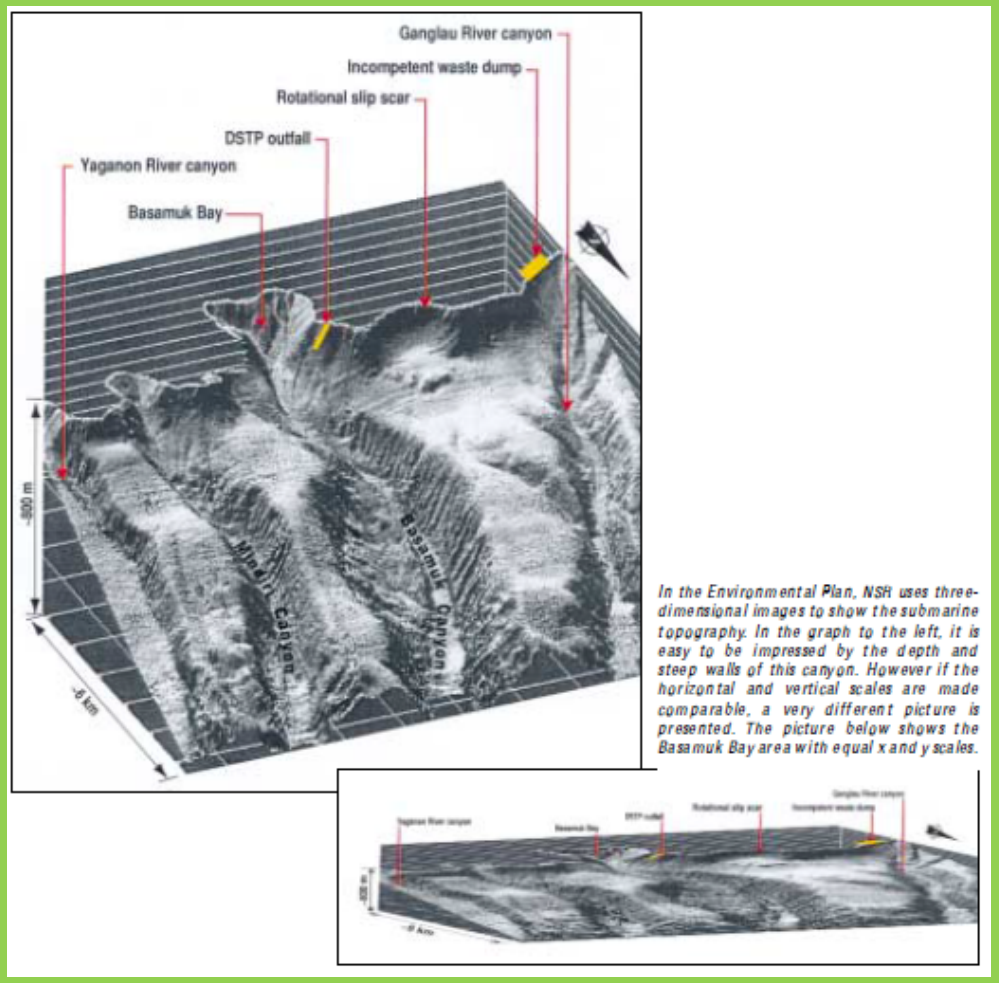


Ramu Nickel: assessment by Scottish Association for Marine Science (SAMS)

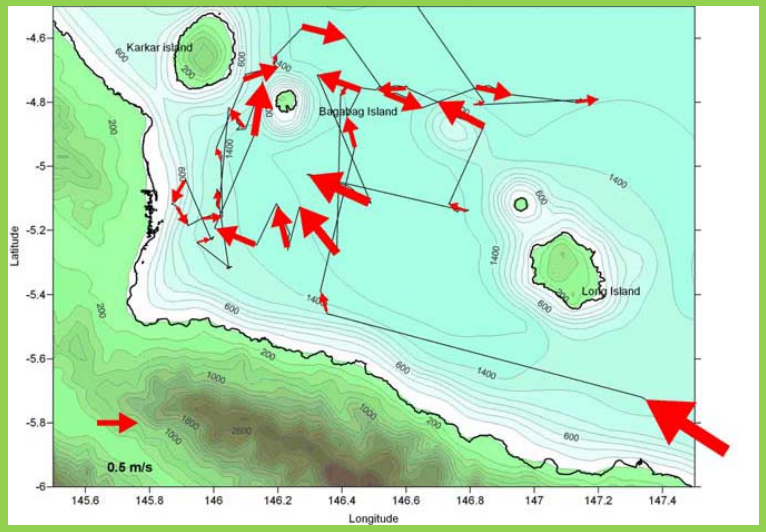
Potential impacts include:

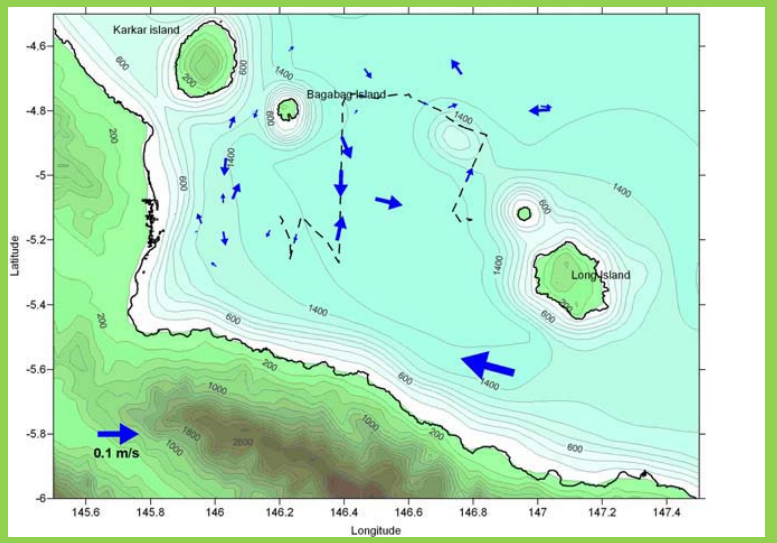
- Local decreases in primary productivity as a result of increased turbidity
- Local acute toxicity of dissolved metals, particulate metals, process chemicals
- Chronic/sublethal effects of metals on organisms
- Metal bioaccumulation leading to increased trophic transfer of metals
- Habitat alteration (e.g. increased turbidity, smothering of coral reefs)
- Changes in species composition/abundance
- Changes in biodiversity
- Reduction in food availability
- Effect of fine particles on organisms: e.g. clogging of gills and feeding mechanisms
- Local effects of increased turbidity on organisms that utilise bioluminescence
- Increased productivity due to iron or other nutrient availability.

Ramu Nickel: bathymetry and currents



In the Environmental Plan, NSR uses three-dimensional images to show the submarine topography. In the graph to the left, it is easy to be impressed by the depth and steep walls of this canyon. However if the horizontal and vertical scales are made comparable, a very different picture is presented. The picture below shows the Basamuk Bay area with equal x and y scales.





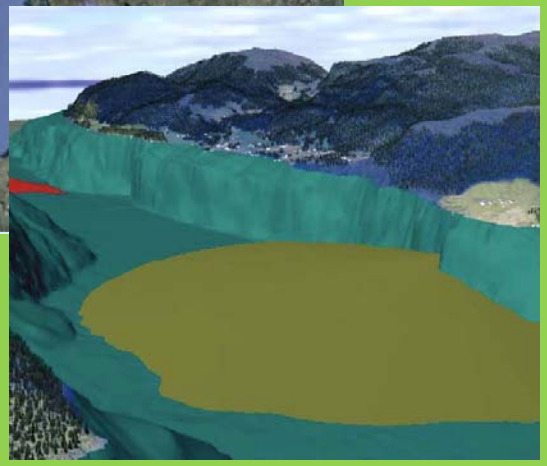
Ramu Nickel: court ruling (April 2012)

- likely that the tailings would smother benthic organisms over a wide area of the ocean floor (at least 150 km2), which would inevitably alter the ecology of that part of the ocean;
- very likely that the tailings would be toxic to marine organisms; and
- real danger that the tailings would not settle on the ocean floor but be subject to significant upwelling, which meant that substantial quantities of tailings would be transported towards the PNG mainland.

Ramu Nickel and SAMS: the broader context

- 2010 SAMS study, despite being limited in time and extent, identified numerous specific and generic concerns regarding deep sea tailings placement (DSTP)
- Nonetheless, report also proposed guidelines for decision-making on DSTP – yet to be further developed
- Study was conducted under the Mining Sector Support Programme in PNG, with overarching objective *"to increase foreign investment in PNG.'s mineral sector, with special emphasis on mineral exploration expenditures".*

Marine tailings disposal in Norway



Sydvaranger Gruve AS – existing iron ore mine – 4 M t tailings per year to fjord (200m depth) – no increase in turbidity (but only to 15m depth)

Nordic Mining - proposed rutile (TiOx) mine at Engebø – tailings expected to cover 4.4km^2 to depths up to 150m

Comparison of Førdefjord and Bøkfjord projects

	FØRDEFJORD	BØKFJORD
Company	Nordic Mining	Sydvaranger Gruve AS
Environmental status of the fjord	Close to pristine	Impacted by mine tailings and chemicals "strongly modified water mass"
Conservation status of the fjord	(National salmon fjord)	National salmon fjord
Mine tailings	Ca 3 mill tons per year. Application of 2008	4 mill tons per year (permit of 2008) Application of 2009 up to 9 mill tons
Chemicals	Magnafloc 10 tons per year Application of 2008	Magnafloc 35 tons per year (permit of 2008) Lilaflot 500 tons a year Application of 2009
Depth of disposal	Deeper than 100 m Purpose: avoid impact in the uppermost layers of the fjord	Around 25 m Strong tidal currents Fine fraction effectively spread to a large area
Other	Shock waves from detonations can disturb or harm fish	
Risk assessment	Yes. Summary report based on many special reports	No. But environmental status report on the benthos and sediments

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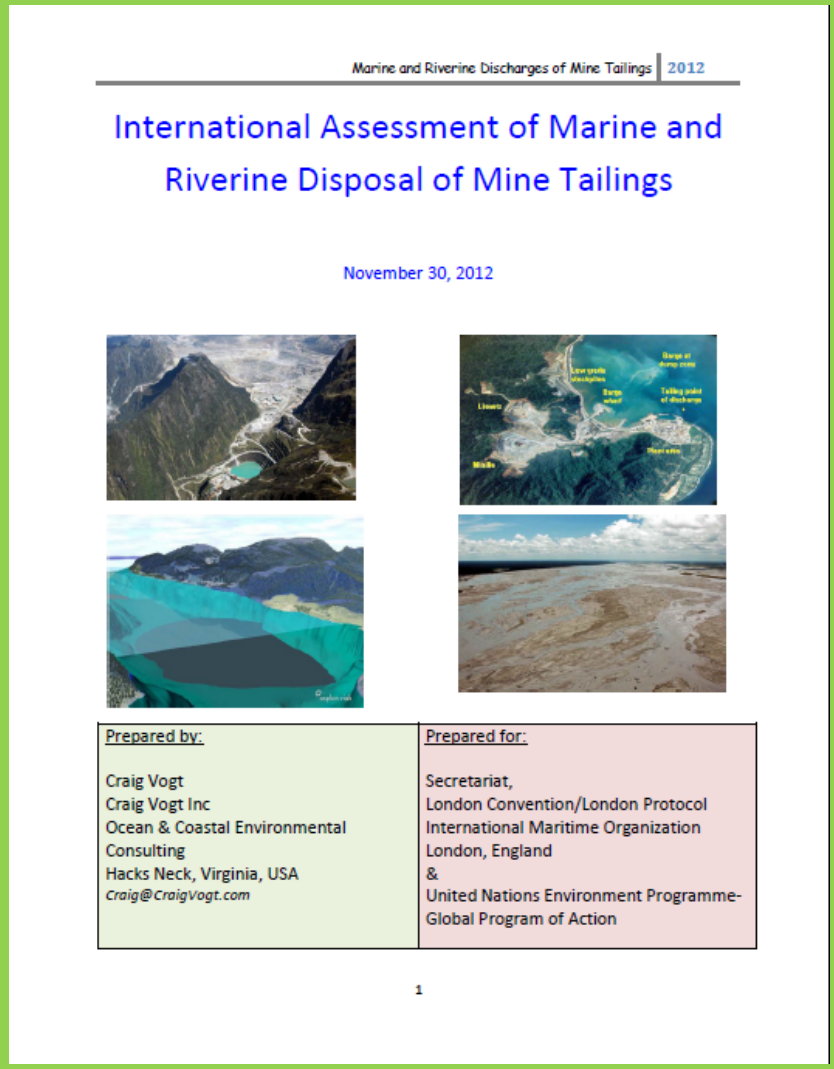
November 2012: first global overview



Marine and Riverine Discharges of Mine Tailings | 2012

International Assessment of Marine and Riverine Disposal of Mine Tailings

November 30, 2012

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Prepared for:

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International Maritime Organization
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United Nations Environment Programme-Global Program of Action

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LC-SG 36 (Buenos Aires, May 2013) agreed that:

- there was a need for international guidance/ codes of conduct on marine disposal of mine wastes in order to protect the marine environment.
- it is not clear which organisation(s) should develop such guidance.
- the Secretariat should contact UNEP, UNIDO, UNDP and others to gather further information
- information available should be examined for scope & consistency with the objectives of the LC-LP.
- all countries should carefully evaluate all proposals for STD/DSTP, to evaluate alternatives, and to avoid, where possible, the use of such operations and...ensure any impacts are minimised and monitored.

Mine waste disposal at sea: next steps

- Studies to date have shown:
  - Many examples of STD (or DSTP) past, present and future
  - All have the potential for substantial impacts on marine fauna, perhaps severe and widespread
  - Some evidence for accumulation of metals and for persistent impacts on benthic community structure (recovery generally only partial)
  - There are few independent studies and assessments of impacts so far
  - There is therefore an urgent need for a truly independent expert review and assessment of the practice and its impacts in order to inform regulation

Mine waste disposal at sea: next steps

- Independent review and advice could include:
  - Focused effort on discovery, collation and critical interpretation of available data on impacts and critical review of impact assessments to date
  - Development of guidance on necessary design of baseline studies and of monitoring programmes for ongoing or past activities
  - Advice to feed in to policy processes on the wisdom and acceptability of STD/DSTP

Mine waste disposal at sea: next steps

- The tailings and associated wastes discharged from pipelines in STD/DSTP programmes would not be acceptable for dumping at sea from a vessel, even at the exact same locations
- If STD/DSTP is only option available for mine tailings disposal, then development of mine should be reconsidered
- It would be unwise to propose any guidelines which could inadvertently facilitate more STD/DSTP