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References to Main Report and Appendices A-C, H-J

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- Angel, M.; Thiel, H.; Angel, M.V.; Foell, E.J.; Rice, A.L. and Schriever, G. (1997) *Environmental Risks from Large-scale Ecological Research in the Deep Sea: A Desk Study*. Report for the Commission of the European Communities Directorate-General for Science, Research and Development: Brussels.
- Angel, M (2000) *Quality Status Report 2000*. OSPAR Commission: London.
- Anon (1996) A Review of Mine Tailings Disposal Practice at Ergo. *Mining World*. February 1996.
- ANZMEC (2000) Strategic Framework for Mine Closure. Australia and New Zealand Minerals and Energy Council & Minerals Council of Australia. 22p.
- AWPA (1995) *West Papua Information Kit*. Australia West Papua Association: Sydney. Available at <http://www.cs.utexas.edu/users/cline/papua/> (Accessed April, 2002).
- Banks, G. and Ballard, C. (ed) (1997) *The Ok Tedi Settlement: Issues, Outcomes and Implications*, National Centre for Development Studies & Resource Management in Asia-Pacific.
- BHP (1999) BHP and Ok Tedi. Discussion Paper. October 1999. BHP: Australia. 20p.
- Blanchard et al. (2001) A Chemical and Ecotoxicological Assessment of Marine Tailings Disposal. *Tailings and Mine Waste '01. Proc. 8th Int. Conf.* Fort Collins, Colorado, 15–18 January, 2001. A.A. Balkema: Rotterdam, Netherlands.
- Buhupe, A. (1998) *Benefiting from a Mining Project: The Case of Ok Tedi Mine in Mitigating Social Impacts, Compensating Communities and Improving Community Services*.
- Chamber of Minerals and Energy (1999) *Mine Closure Guideline for Mineral Operations in Western Australia* November, 1999. Chamber of Minerals and Energy of Western Australia.
- Chatterjee, P. (1996) *A Copper Mine of Death, or Misplaced Blame?* International Press Service, February 1996.
- Clark, A.L.; Naito K. and Clark J.C. (2000) Legal Framework for Mine Closure. In: Khanna, T. (Ed.) *Mine Closure and Sustainable Development*. Proceedings of a Workshop organised by the World Bank and the Metal Mining Agency of Japan, Washington, March 2000. Mining Journal Books Ltd.: London. pp.93–115.
- Clarke, G. (1996) *Ok Tedi: Mining, Development and the Environment. A Case Study for Senior Geography Students*. Education package.
- CSIRO (1996) *Porgera Joint Venture, Review of Riverine Impacts*. December. CSIRO Environmental Projects Office, Dickson, ACT, Australia.
- Dalton, R.; Abrahams, L. and Morkel, G. (Eds.) (1998) *Jutas Statutes Of South Africa: Agriculture, Fisheries, Forests & Water: Property*, Vol. 6. 8th Edition.
- Dames & Moore (1996) *PTFI Environmental Audit Report*, March 25, 42p.
- Davies, M.P. and Rice, S. (2002) Dry Stack Filtered Tailings. *Mining Environmental Management*, January 2002.
- Dietrich, W.E., Day, G. and Parker, G. (1999) The Fly River, Papua New Guinea: Inferences about river dynamics, floodplain sedimentation and fate of sediment. In: Miller, J. and Gapla, A. (Eds.) *Varieties in Fluvial Form*. John Wiley. pp.345–376.
- Dines, H.G. (1956) *Metalliferous Mining Region of Southwest England*. Vols I and II. HMSO: London.
- Ellis, D.V.; Poling, G.W. and Baer, R.L. (1995) Submarine tailings disposal (STD) for mines: an introduction. *Marine Georesources and Geotechnology*, **13**: 3–18.
- Ellis, D.V. & Robertson, J.D. (1999) Environmental Impacts of Mining Activities, Emphasis on Mitigation and Remedial Measures. In: Azcue, J.M. (ed.) *Underwater Placement of Mine Tailings: Case Examples and Principles*. Chapter 9, pp 123–141.

- Environment Australia (1997) *Managing Sulphidic Mine Wastes and Acid Drainage; Best Practice Environmental Management in Mining*. Environment Australia. 84p.
- Environment Australia (1998) *Dust Control. Best Practice Environmental Management in Mining*. Department of the Environment, Australia. 73p.
- FCX (1999) *Annual Report*. Freeport-McMoRan Copper & Gold Inc.
- FCX (2000a) *Annual Report*. Freeport-McMoRan Copper & Gold Inc.
- FCX (2000b) *Economic, Social And Environmental Report. Part II, Social Change & Development*. Freeport-McMoRan Copper & Gold Inc. Available at <http://www.fcx.com/esp/2000WTSD.htm>.
- FCX (2000c) *Amungme, Kamoro and Freeport Indonesia Announce Agreement; Initial Cooperative Projects Launched*, News Release. August 18.
- Fleming, A.W.; Handley, G.A.; Williams, K.L.; Hills, A.L. and Corbett, G.J. (1986) Porgera Gold Deposit, Papua New Guinea, *Economic Geology and the Bulletin of the Society of Economic Geologists*, **81**: 660–680.
- Gardner, G. and Sampat, P. (1998) *Mind over Matter: Recasting the Role of Materials in Our Lives*. Worldwatch Paper 144. Worldwatch Institute: Washington DC.
- Garnett, R.H.T. and Ellis, D.V. (1995) Tailings Disposal at a Marine Placer Mining Operation by WestGold, Alaska. *Marine Georesources and Geotechnology*, **13**(1&2), pp.41–57.
- Golder Associates (1994) *Tailings and River Management Plan Options Executive Summary*, Submitted by Golder Associates to PT Freeport Indonesia, November 1994.
- Harkinson, R. (1999) *"Incompatible with our environmental values". What 's next for Ok Tedi?* Interview with Stuart Kirsch, Minewatch: London.
- Hettler, J.; Irion, G. and Lehmann, B. (1997) Environmental Impact of Mining Waste Disposal on a Tropical Lowland River System: A Case Study on the Ok Tedi Mine, Papua New Guinea. *Mineralium Deposita*, **32**: 280–291.
- ICOLD (2001) *Bulletin 121*. International Commission on Large Dams.
- Jewell, R.J.; Fourie, A.B. and Lord, E.R. (Eds.) (2000) *Paste and Thickened Tailings – A Guide*. ACG: Perth.
- Jones, S. and Gwyther, D. (2000) Deep Sea Tailings Placement (DSTP). *Australian Journal of Mining*, December 2000, pp.38–42.
- Jones, S. and Jones, M. (2001) *Overview of Deep Sea Tailing Placement January 2001 Update*, NSR Environmental Consultants Pty Ltd, Victoria, Australia for BHP Minerals.
- Kalgoorie (2001) *Kalgoorie Consolidated Gold Mines Annual Report*. Section 9.3.1. Available at http://www.kalgold.com.au/aer/er98_sec09_3_1.html. (Accessed April 2002.)
- Kennedy, D.; Chatterjee, P.; Moody, R. (1998) *Risky Business. The Grasberg Gold Mine, Project Underground*, Berkeley CA (US). Available at <http://www.moles.org>.
- KPMG (2000) *Mining: A Survey of Global Reporting Trends*, 83p.
- Lapakko, K.A. (1990) Regulatory mine waste characterization: A parallel to economic resource evaluation. In: Proc. Western Regional Symposium on Mining and Mineral Processing Wastes, F. Doyle (ed.), Soc. for Mining, Metallurgy, and Exploration, Inc., Littleton, CO, US. pp.31–39.
- Lapakko, K.A. and Wessels, J.N. (1995) Release of acid from hydrothermal quartz-carbonate hosted gold-mine tailings. In *Sudbury '95, Conference on Mining and the Environment*, Sudbury, Ontario, May 28th - June 1st, 1995. p.139–148.
- Lapakko, K.A. (2002). Metal Mine Rock and Waste Characterization Tools: An Overview. Acid Drainage Technology Initiative – Metal Mining Sector. Available at <http://www.mackay.unr.edu/adti>. (Appendix F of *Mining for the Future*.)

- le Roux (2000) Paper in: Khanna, T. (Ed.) *Mine Closure and Sustainable Development*. Proceedings of a Workshop organised by the World Bank and the Metal Mining Agency of Japan, Washington, March 2000. Mining Journal Books Ltd.: London.
- Lyon, J.S., Hilliard, T.J. & Bethell, T.N. (1993) *Burden of Gilt* - Mineral Policy Center, 68p.
- MacDonald, G.D. and Clark A.L. (1994) Geological and geochemical zoning of the Grasberg Igneous Complex, Irian Jaya, Indonesia. *Journal of Geochemical Exploration*, **50**: 143–178.
- McCauley, S. (1999) Pollutant Release and Transfer Registers: International Developments. *ICME Newsletter* (International Council on Metals in the Environment: Ottawa). Vol. 7, No. 4. 8p.
- Miller, G. (1998) *Use of Financial Surety for Environmental Purposes*. International Council on Metals and the Environment: Ottawa.
- Mineral Policy Institute (1995) *A Report on the Environmental and Social Impacts of the Porgera mine, Papua New Guinea*. MPI: Sydney, Australia. December 1995.
- Minerals Council of Australia (2000) National Education Program - Ok Tedi. - 16/11/2000. Available at http://www.minerals.org.au/pages/page8_158.asp
- Minewatch (1996) *Minewatch Report on Dames & Moore Audit, Project Underground*. September 2, 1996. Available at <http://www.moles.org/ProjectUnderground/motherlode/freeport/minewatch.html>. (Accessed April 2002.)
- MiningWatch Canada (2001) *Chairperson Quits Over River Pollution at Placer Dome's Porgera Mine in Papua New Guinea*, with Mineral Policy Center (US) and Mineral Policy Institute Australia, June 15.
- Montgomery Watson (1999) *External Environmental Audit, PT Freeport Indonesia Operations Irian Jaya, Indonesia*. Steamboat Springs, CO, US, December.
- Moody, R. (2001) *Into the Unknown Regions The hazards of STD (Submarine Tailings Disposal)*. SSC and International Books (London and Utrecht). 64p.
- Moran, R. (2000) Cyanide in Mining: the chemistry, toxicity and analysis of mining-related waters. In: *CDG/Wits Training Workshop in Environmental Technology Assessment in South Africa: Cyanide Technology in Mining*, 21–15 February 2000, Carl Duisberg Gesellschaft e.V. Publ. 40p.
- Mudder, T.I. (1999) Cyanide, Science and Society. *ICME Newsletter* (International Council on Metals in the Environment: Ottawa). Vol. 7, No. 2. 8p.
- Murray, L., Thompson, M., Voigt, K. & Jeffrey, J. (2000), *Mine Waste Management at Ok Tedi Mine Papua New Guinea; A Case History, Tailings & Mine Waste*, AA Balkema.
- National Rivers Authority (1994) *Abandoned Mines and the Water Environment*. Water Quality Series No.14. London, 46p.
- Newton, D.; Wissink, D.; Francis, T. and Buhupe, A. (1999), *Mine Closure Planning with the Integration of Community Based Projects to Establish Sustainable Development Activities Surrounding the Ok Tedi Mine Western Province, Papua New Guinea*, Annual Environmental Workshop - Minerals Council of Australia, pp194
- Nordstrom, D.K. (1982) Aqueous pyrite oxidation and the consequent formation of secondary iron minerals. In: J.A. Kittrick, D.S. Fanning, and L.R. Hossner (eds.) *Acid Sulfate Weathering*. *Soil Sci. Soc. America Spec. Pub.* **10**: 37–56.
- North Fly Rubber Limited (2001) *Managing Director's Report, 2000*.
- OTML (1986) *Sixth Supplemental Agreement Environmental Study Terms of Reference*
- OTML (2000) *Historical Statistics At Year Ending December 2000*
- OTML (2002) *Ok Tedi Ready to Continue Without BHP Billiton*. Media Statement.

- OTML PRG (2000) *Comments On Key Issues and Review Comments On the Final Human and Ecological Risk Assessment Documents April 2000*; Ok Tedi Mining Peer Review Group; Website; http://mpi.org.au/oktedi/prg_final_report_print.html 16/11/2000
- Ortman, D.E. and Subra, W. (2000) *Review of Freeport Audit*, (Review of Montgomery Watson Environmental Audit and Dames and Moore Environmental Audit), <http://www.scn.org/earth/wum/>
- Phelps, R.W. (2000) *Moving a Mountain a Day – Grasberg Grows Six-fold*, Engineering and Mining Journal, **201**: 22–28.
- Pioneer Technical Services, (1994) *Abandoned Hard Rock Mine Priority Sites, Abandoned and Inactive Mines Scoring System (AIMSS)*, Report to Montana department of State Lands, Abandoned Mines Reclamation Bureau, December.
- PJV (1999a) *PJV Environmental Monitoring Annual Report January–December 1999*, Porgera Joint Venture Environment Department, Report NO. PJV/ENV-1/00
- PJV (1999b) *Porgera mine 1999 Sustainability Report*, Placer Dome Asia Pacific
- PJV (2001) Placer Dome website. Available at <http://www.placerdome.com>
- Poling, G.W. (1995) Mining/ Milling Processes and Tailings Generation, *Mining Georesources and Geotechnology Journal*, **13**: 19–31.
- PricewaterhouseCoopers (1999) *Financial Reporting in the Mining Industry for the 21st Century*, 136p.
- Rea, M. (2000), Riverine Tailings Disposal; A Methodology Well Past its Use By Date. *GroundWork Journal*, No. 4, Vol.3. Australian Minerals and Energy Environment Foundation: Prahran, Victoria, Australia.
- RFK (1999) *RFK Center and Amnesty International–USA Critique US Mining Company Freeport McMoRan’s Social and human Rights Policy*, Robert F. Kennedy Memorial Center for Human Rights. Available at: <http://www.rfkmemorial.org/center/Freeport.htm>, accessed May 5.
- Richards, D.G. (2001) Risk review and corporate assurance in tailings management in Rio Tinto. In: *Workshop on Mine Waste Management Brussels*, 5th July 2000. Les Techniques de l’Industrie Minerale No. 9, March 2001. pp.95-97.
- Robertson, A.; Mac, G., Shaw, S.C. (1999) Multiple Account Analysis for Tailings Site Selection. In: *Proc. Sudbury '99 Conf., Mining and the Environment II*, Vol. 3, pp.883–891.
- Robinsky, E.I. (1979) Tailings Disposal by the Central Thickened Discharge Method for Improved Economy and Environmental Control. In: Argall, G. (ed). *Proc. 2nd Int. Tailings Symp.*, Miller Freeman, San Francisco, pp.75–95.
- Sassoon, M. (2000) *Environmental Aspects of Mine Closure in Mine Closure and Sustainable Development*. In: Khanna, T. (Ed.) *Mine Closure and Sustainable Development*. Proceedings of a Workshop organised by the World Bank and the Metal Mining Agency of Japan, Washington, March 2000. Mining Journal Books Ltd.: London.
- Slight, M.G. (2000) Waihi Gold Mine's community story, 2000 New Zealand Minerals & Mining Conference Proceedings, 29 - 31 October, 7pp. Available at http://www.marthamine.co.nz/com_story.html (accessed April 2002).
- SRK Consulting and SENES Consultants Limited (2002) *Acidic Drainage Research and Technology Gap Analysis*, Prepared for MEND 3, Natural Resources Canada, The Mining Association of Canada and Environment Canada, February 2002.
- Strachan, C. (2002) Review of tailings dam incident data, *Mining Environmental Management, Tailings Management Guide*, Jan, pp 7–9.

- Tasmanian Geological Survey (1998) *Strategy – The Rehabilitation of Abandoned Mining Lands*. Mineral Resources Tasmania, Department of Infrastructure, Energy and Resources, Record 1998/07.
- Taylor, G. (1998) *Acid Drainage: Sources, Impacts and Responses in Groundwork; A Special Feature Acid Drainage*, No. 1, Vol 2, September 1998, pp.4–7.
- Thiel, H.; Angel, M.V.; Foell, E.J; Rice, A.L.; and Schriever, G. (1997) *Environmental risks from large-scale ecological research in the Deep Sea: A Desk Study*. Report for the Commission of the European Communities Directorate-General for Science, Research and Development.
- ToBI (1999) *Scraping Bottom: Freeport McMoRan in Irian Jaya*, Taskforce on Business and Industry, <http://isforum.org/tobi/reports/minding/freeportmcmoran.htm>
- UNEP (2000) *Abandoned Mine Sites: Problems, Issues and Options*, Industry and Environment, Vol. 23, Special Issue on Mining and Sustainable Development II, pp.36–38.
- USGAO (1996) *Federal Land Management – Information on Efforts to Inventory Abandoned Hard Rock Mines*, Report to the Ranking Minority Member, Committee on Resources, House of Representatives. United States General Account Office.
- van Kooten, G.C. and Bulte; E.H. (2000) *The Economics of Nature*, Blackwell Publishers, 512p.
- van Zyl, D.J.A (2000), *Remediation methods, performance and design; Hard Rock – Part 1* in Acid Mine Drainage Technical Workshop in St. Louis, MO.
- Vick, S.G. (2000) Tailings Dam Safety - Implications for the Dam Safety Community, Tailing Dams 2000, Association of State Dam Safety Officials, US Committee on Large Dams, March 28 - 30, Las Vegas, pp 1–20.
- Wilson, W.; Williams, D. and van Zyl, D. (2001) Co-disposal of tailings and waste rock. *Geotechnical News*. BiTech Publishers: Vancouver, Canada.
- Wissink, D. (2000) *The Ok Tedi Development Foundation*. Mining and Petroleum Investment Conference. Papua New Guinea Chamber of Mines and Petroleum.
- WOM Geological Associates Inc. (2000) *Abandoned Mines in Canada*, Prepared for MiningWatch Canada: Ottawa, Canada. 14p.
- World Bank (2000) Technical Note sent to The Papua New Guinea Government.
- Younger, P.L. (2001) Mine Water Pollution in Scotland: Nature, Extent and Preventative Strategies. *Science of the Total Environment*, **265**: 309–326.