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MINING

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EXECUTIVE SUMMARY

1. Asia and the Pacific are endowed with rich mineral resources. For example, Asian region accounts for 82.5% of the world mine production of antimony, 23.8% of gold, 41.3% of molybdenum, 29.1% of nickel, 79.1% of tin, and 42.3% of zinc. Oceania contributes 33% to the world bauxite production, and 14% to the gold production.

2. Regional economic growth has increased the demand for minerals, and for energy. At the same time climate action is being promoted by many stakeholders. These factors have contributed to the following trends: increased investment in nuclear energy and related demand for uranium; increased demand for Rare Earth Elements and other rare metals to support clean technologies.

3. At the same time several factors require the mining industry to become more environmentally and socially responsible. Public awareness has grown, anti-mining campaigns have become quite powerful, and institutional investors increasingly aware of the links between economic performance, risk, and environmental responsibility. The banning of exports of metallic mercury and certain mercury compounds by the European Parliament and the Council of the European Union[1] also reflects a trend that will impact on

[1] The European Parliament and the Council of the European Union (2008) Regulation (EC) No 1102/2008 of the European Parliament and of the Council of 22 October 2008 on the banning of exports of metallic mercury and certain mercury compounds and mixtures and the safe storage of metallic mercury.

the regional mining industry.

4. While new trends emerge, there are persistent challenges related to artisanal gold mining and associated mercury contamination in South and Southeast Asia; radioactive waste management issues related to mining in Central Asia.

5. Regional frameworks to support the development of new mining policies have been established by ASEAN and APEC. There is evidence that Governments have taken steps to promote responsible mining. The extractive industry has taken steps to establish management systems and policy frameworks to comply with global standards. UN agencies, NGOs and Community based organizations are also important players in the region.

6. Good practice examples from the region include: Japan's "Eco-Town Program" promotes interconnections between industry, society, community, tradition, culture and the nature and holds the promise of the sustainable society; and Mongolia's "Responsible Mining Initiative for Sustainable Development".

7. However there still seems to be mismatch between growing societal expectations on government/mining firms' good practice and their practices. At the same time, strong consideration should be given to measures to 1) reducing the demand for minerals via sustainable and consumption and 3R (Reduce, Reuse, Recycle) practices.

8. Policy priorities that address this gap include: strengthened cooperation with international initiatives, reciprocal trade formula, investment framework that are supportive of responsible mining,

promotion of information exchange, capacity building, land-use planning, support to improve the health and safety record of artisanal/small-scale mining, indigenous and women's issues, risk management, technological development to support 3R practices such as urban mining and eco-industrial development.

I. SETTING THE SCENE

1. Agenda 21 and JPOI

9. Although the Agenda 21 was publicized in 1992, policy concerns related to the sustainable development of minerals and metals have been either addressed in a piecemeal manner through a variety of regional and sector-specific bodies, or in a forum that may not bring together people with the appropriate knowledge and expertise. This is reflected in the fact that Agenda 21 lacks clear focus on minerals and metals.

10. The eighth session of the CSD in 2000 listed "minerals, metals and rehabilitation in the context of sustainable development" as a priority area for future work (Paragraph 4, Decision 8/3). CSD Decision 8/3 also urged "Governments, the international community and other relevant actors ... to examine the social, economic, and environmental impacts of minerals extraction and metals production...". Accordingly the World Summit on Sustainable Development in 2002 recognized the contribution of the mining and metals sector to sustainable development and identified it as a subject worthy of further consideration by governments.

11. This report reviews the progress towards environmental and social sustainability of the extractive

industry in Asia and the Pacific in preparation for the CSD 18/19 Asia-Pacific RIM, and with specific reference to paragraph 46 of the **JPOI.**

46. Mining, minerals and metals are important to the economic and social development of many countries. Minerals are essential for modern living. Enhancing the contribution of mining, minerals and metals to sustainable development includes actions at all levels to:

(a) Support efforts to address the environmental, economic, health and social impacts and benefits of mining, minerals and metals throughout their life cycle, including workers' health and safety, and use a range of partnerships, furthering existing activities at the national and internatio nal levels among interested Governments, intergovernmental organizations, mining companies and workers and other stakeholders to promote transparency and accountability for sustainable mining and minerals development;

(b) Enhance the participation of stakeholders, including local and indigenous communities and women, to play an active role in minerals, metals and mining development throughout the life cycles of mining operations, including after closure for rehabilitation purposes, in accordance with natio nal regulations and taking into account significant transboundary impacts;

(c) Foster sustainable mining practices through the provision of financial, technical and capacity-building support to developing countries and countries with economies in transition for the mining and processing of minerals, including small scale mining, and, where possible and appropriate, improve value-added processing, upgrade scientific and technological information

and reclaim and rehabilitate degraded sites.

2. Mineral production and supply in Asia-Pacific region

12. In addition to being a key driver of global economic growth, the region is a significant producer and user of minerals and metals. Many countries believe that they can derive important economic and social benefits from mineral development, trade and use; and that the extractive industry can effectively be an engine for promoting employment, economic growth, and national development.

13. The region is endowed with rich mineral and energy resources. For example, as of March 2009, the Asian region accounts for 28.5% of the world bauxite production, 82.5% of the world mine production of antimony, 19.8% of copper, 23.8% of gold, 53.4% of lead, 41.3% of molybdenum, 29.1% of nickel, 79.1% of tin, and 42.3% of zinc.[2] The Pacific contributes 33% to the world bauxite production, and 14% to the gold production.[3] With respect to uranium, as of 2008, Australia is a major producer of uranium with the share 19.2% of the world production, followed by Kazakhstan with 19.4% and Uzbekistan of 5.3%.New Bauxite mining projects are being envisaged or have been initiated.[4]

2 "Asia's nuclear energy growth", World Nuclear Association website 2009 at http://www.world-nuclear. org/info/inf47.html.

3 World Bureau Metal Statistics (2009) World Metal Statistics, July 2009, vol.62, no. 7, Ware, Herts, UK.

4 "Vedanta's India bauxite mining to begin by October", Reuters website, 10 July 2009, at ttp://www.reuters.com/article/rbssMiningMetalsSpecialty/idUSCOL47748020090710.

Table 1 - Mine production (tonnes) in the world, Asia and Oceania for the period Jan-May 2009

Commodity	World total	Asia	Oceania
Bauxite*	49,025,400	13,965,900	16,179,000
Antimony*	28,627	23,625	1,200
Copper	6,250,000	1045,000	415,700
Gold	899.7	216.4	127.0
Lead	3,413,100	1,758,400	95,200
Molybdenum	88,500	33,800	-
Nickel	584,200	169,300	100,800
Silver	8044.3	1432.8	610.9
Tin	125,200	95,900	-
Zinc	4,376,800	1,633,400	496,600

*Period for Jan-Mar. 2009.

Source - World Bureau of Metal Statistics, 2009

14. The rapid increase in domestic demand has lead China to curb export of ore/metals and to increase exporting tariff rate. In June 2009, the United States of America has requested World Trade Organization (WTO) dispute settlement consultations with the China regarding China's export restraints on numerous important raw materials[5].

5 "Ambassador Kirk announces WTO case against China over export restraints on raw materials", US Trade Representative website at http://www.ustr.gov/about-us/press-office/blog/ambassador-kirk-announces-wto-case- against-china-over -export-restraints-r, June 23 2009.

15. For the moment, the scale of investment, legalization, exploration, exploitation, extraction, supply and the economic impact have not allowed the industry to meet the demand in the region. Despite its importance for economic growth, the mineral sector has not contributed significantly to the GDP in the region except in a very few countries.[6] (Table 2).

3. Climate change and mining

16. The extractive industry is not exempt from the list of stakeholders who should reduce greenhouse gas (GHG) emissions. In recognition of this, investments are being made in research on clean-coal technology, carbon dioxide capture, and near-zero emission coal power plants.

17. But there are still significant GHG emissions associated with the transportation, processing and use of the products. The industry has set emission targets according to the guidelines like Greenhouse Gas Protocol but more effort is necessary to deliver on the societal expectations: industry leaders have concluded that they "did not meet … 2003 to 2008 greenhouse gas emissions target, with a 3.8 per cent increase in emissions per tonne of product, compared to a four per cent reduction target."[7]

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6 An example of the said distribution can be seen in Murao, S., Furuno, M. and Uchida, A. (1991) Geology of indium deposits: a review, Mining Geology 41, 1-13.

K., McCallum, R., Schultz, A. and Ball, A. (2007) Mineral exploration in APEC Economies: a framework for investment, APEC Energy Working Group, Report no. APEC #207-RE-01.10, Australian Bureau of Agriculture and Resource Economics, Canberra, 2007.

7 Rio Tinto (2008) 2008 Annual Report and Financial Statements, Rio Tinto website at http://www.riotinto.com/annualreport2008/performance/sustainable_dev/environmental_stewardship/greenhouse/index.html.

Table 2. Key economic indicators for selected countries in Asia and the Pacific.

Country	Area ('000 sq km)	Population (Million)	GDP/person (USD)	Mining sector contribution to GDP (%)
Australia	7,692	20.7	36,546	5.1
China	9,561	1314.1	2,001	5.6
Indonesia	1,905	222.1	1,640	2.0
Japan	378	127.7	34,188	0.1
Malaysia	330	26.4	5,718	0.8
Philippines	300	87.0	1,345	1.6
Thailand	513	65.8	3,136	0.3
Viet Nam	332	84.4	723	1.1

Source: Penney et al. (2007)

18. Partly due to the climate change negotiations and partly due to energy demand, a number of countries in East and South Asia are planning and building new power reactors to meet their increasing demands for electricity although anti-nuclear groups are lobbying to prevent the expansion of nuclear energy in Asia and, in particular, to prevent the spread of nuclear energy to countries which do not yet have nuclear power plants.[8]

19. According to the World Nuclear Association, (1) Asia is the only region in the world where electricity generating capacity and specifically nuclear power is growing significantly; (2) as of 2008 there

8 For example, see the "Asian Nukes Campaign" by Citizens' Nuclear Information Center at http://www.cnic.jp/english/topics/international/asianuke.html

are over 111 nuclear power reactors in operation, 21 under construction and plans to build about a further 150 in East and Southeast Asia and (3) the greatest growth in nuclear generation is expected in China, Japan, South Korea and India.

20. But scientific research is still needed on the uranium cycle to understand whether there is a sufficient supply of uranium and the environmental implications of its use and management. Nuclear wastes, both operational and decommissioning, remain a major, and there is a clear need to address the question of their safe disposal. The on-going research and development on thorium reactors is another factor that is likely to affect future trends.

21. The climate change and the demand for greener technology, influences the mining of REE (Rare Earth Elements: a group of rare metals with similar chemical features) and rare metals. This is because many clean technologies rely on rare metals. The demand for rare metals is expanding rapidly, but their limited occurrence and production is making the market unstable.[9] From geological point of view, the Asia-Pacific region is one of the strategic areas for the production and supply of rare metals.

22. REE are indispensable to manufacture energy efficient brushless motors for air conditioners and other home appliances. A hybrid car being sold successfully by a Japanese company uses various kinds of REE-bearing parts. For example, each electric motor requires 1 kg of neodymium, and each battery uses 10 to 15 kg of lanthanum. The manufacturer plans to sell 100,000 cars in the United States alone for 2009, and

9 An example of the said distribution can be seen in Murao, S., Furuno, M. and Uchida, A. (1991) Geology of indium deposits: a review, Mining Geology 41, 1-13.

180,000 next year. The company forecasts sales of 1 million units per year starting in 2010[10]. Another example is indium (In) which is used for the In-Ga thin film of solar panels, liquid crystal display of computers and so on. It is recovered as by-product of some (not all) types of zinc deposits, and more than half of the world production of the refined indium is from China.[11]

23. From 2003 onwards, more than 90% of the world production came China. There have been frequent shortages in the supply of selected REE over the last 2-3 years. The growth in apparent global demand for processed REE has been 9-12% per year,[12] driven largely by average annual growth rates in China and by the needs mentioned above.

24. The banning of exports of metallic mercury and certain mercury compounds by the European Parliament and the Council of the European Union is likely to influence the region and it seems necessary for the Governments of the Asian and Pacific Region to prepare for the impacts of this decision.

4. Environmental and social issues

25. In the Asia-Pacific region, artisanal/small-scale mining (ASM) is a type of mineral recovery and processing that is well- established and incorporated in the local economy. It should be noted that rush-type

10 "As hybrid cars gobble rare metals, shortage looms" REUTERS UK website, September 1, 2009 at http://uk.reuters.com/article/idUKN01180144.

11 "Indium", Mineral Commodities Production and Trade Statistics by index mundi at http://www. indexmundi.com/en/commodities/minerals/indium/indium_t2.html.

12 Roskill Information Services, Ltd. (2007) The Economics of Rare Earths and Yttrium, 13th edition. http://www.indexmundi.com/en/commodities/ minerals/indium/ indium_t2.html.

mining and traditional mining should be distinguished[13] although these two are sometimes coexisting in mining communities. For indigenous tribes of long mining tradition, ASM is a part of the culture, and their way of mineral recovery is not harmful to the environment.

26. However it is asserted that the gold mining is globally the second-worst source of mercury pollution, after the burning of fossil fuels and the continued use of mercury threatens people all over the world since mercury is a global air pollutant.[14] In Asia and the Pacific, artisanal gold mining is associated with mercury contamination.[15]

27. Due to the high uranium potential, in Central Asia, there are several radioactive waste storage facilities that have negative impact on the population's health and the environment. These risks are multiplied by the risk of natural disasters and natural-anthropogenic cataclysms.[16]

28. Public awareness about the issues surrounding mineral development has increased rapidly since the early 1990s, with governments and mining companies coming under increasing pressure to be accountable

13 Liyo, N.S. (2002) Traditional versus gold-rush-type small-scale mining, In: Small-Scale Mining in Asia, Observations Towards A Solution of the Issue, 55-56, Mining Journal Books, London.

14 Blacksmith Institute (2008) The World's Worst Pollution Problems, 72 pp.

15 Since no reliable statistics exists, information is found sporadic and it is quite difficult to draw a comprehensive picture. For example, Li, P. et al. (2009) described mercury pollution in Asia but lacks information for India, Myanmar, Lao Peoples Republic, Papua New Guinea and Vietnam. Li, P., Feng, X. B., Qiu, G. L., Shang, L. H. and Li, Z. G. (2009) Mercury pollution in Asia: a review of the contaminated sites, Journal of Hazardous Materials 168, 591-601.

16 "Uranium tailings in Central Asia", UN in Kyrgyzstan website 2009 at http://www.un.org.kg/en/ un-in-kyrgyzstan/what-we-do/uranium-tailings-in-central-asia.

for pollution and violation of people's rights.

29. The rights of indigenous groups are a critical and high-profile issue in Asia and the Pacific with indigenous communities becoming increasingly vocal. For example, the Mukti-Paani Declaration says "while our rights to livelihood, movement and self-determination are being systematically violated the 'rights' of commodity, capital and multinational corporations are instead being established. This is not acceptable to us"[17].

30. Local communities and indigenous groups are not isolated and are not separated from international society. Community-based organizations (CBO) are key players in local development issues, and because of information and communication technology (ICT) development, CBOs are often supported by international NGOs. Anti-mining campaigns are increasingly forceful and globally networked.

II. Commitment to Mining

30. Governments and inter-governmental bodies are formulating schemes for responsible mineral development while some international NGOs are critically monitoring development program of mineral resources.

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17 Participants of the Second SAARC People's Forum (2000) Open Letter to Mr. Navinpatnaik, Chief Minister, Orissa, India, at http://www.tradeobservatory.org/ library.cfm?refID=24811.

1. Global initiatives

31. At the global level, the following initiatives and partnerships can be shown as examples in harmony with the Agenda 21 and JPOI that have been forged and maintained by international alliance. The following are examples of global initiatives and partnerships for mining:

- Communities And Small-Scale Mining (CASM)
- Mines Ministries of the Americas Conference (CAMMA)
- EU Mercury Strategy
- Extractive Industry Review (EIR)
- Extractive Industry Transparency Initiative (EITI)
- Green Gold
- Green Lead TM Initiative
- Inter Governmental Forum on Mining, Minerals and Sustainable Development
- International Cyanide Management Code for the Manufacture, Transport and Use of Cyanide in the Production of Gold
- Kimberley Process Certification Scheme (KPCS)
- An international plan to launch an international treaty of mercury

2. Asia-Pacific

The following frameworks are observed to be working in accordance to the Agenda 21 and JPOI.

(1) ASEAN

32. The ASEAN leaders in the Fifth ASEAN Summit in 1995 approved the Program of Action for ASEAN Cooperation in Minerals 1996-1998. The ASEAN leaders also identified, in broad terms, the objectives of ASEAN cooperation for this sector. The ASEAN leaders also specifically approved the establishment of a database to be operationalized immediately.

33. The ASEAN Federation of Mining Associations (AFMMA) is working to materialize the policy in ASEAN region. It is a private non-stock and non-profit organization for advancing the goal of ASEAN. It was formed in 1984 and the Constitution was signed in 1985.

(2) APEC

34. APEC's Group of Experts on Mineral and Energy Exploration and Development (GEMEED) was leading the region for the education and training of officials and engineers for better understanding on responsible mining. GEMEED was formed in 1996 with the following Objectives; articulate, coordinate and promote minerals issues within APEC; supply information about development potential and opportunities; promoting adequate access to markets for mining products; promote linkages between minerals and energy; enhance the contribution of mineral and energy resources to sustainable development; identify, develop and promote synergies with other regional and multilateral fora.

35. In 2004, APEC countries established the "APEC Ministers Responsible for Mining (MRM)" to improve practices and to realize more sustainable development in mining. MRM provides ministers with the opportunity to discuss the challenges arising for both producer and consumer economies from the increasing demand for minerals and metals globally, and the development of new technologies and applications which

require new material.

(3) SAARC

36. The South Asian Association for Regional Cooperation (SAARC) was established in 1985 and has been a platform for the peoples of South Asia to work together in a spirit of friendship, trust and understanding. It aims to accelerate the process of economic and social development in Member States. The primary objective is to improve the "quality of life" of the peoples of the region irrespective of the difference in political systems, religion or culture in order to foster socio-economic co-operation.

(4) CASM

37. CASM has supported and promoted the development of ASM projects and approaches, by individuals, communities and institutions, that will directly or indirectly contribute to the reduction of poverty. In Asia-Pacific, its regional group, CASM Asia-Pacific and CASM China exist and work for the regional issues.

(5) NGOs and NPOs

38. Many civil groups are skeptical to mining in Asia and the Pacific. Some international groups are capable to monitor the environment, to conduct scientific research or to review the governance of governments and publish the reports. Major complaint is that mineral development potentially threatens the health and livelihoods of citizens; flaws are found in plans, e.g. lacking free and prior informed consent; and governmental agencies are neither transparent nor accountable enough.

III. Review of implementation

39. Governments and inter-governmental bodies are formulating schemes for responsible mineral development while strengthening the extractive industry; while a wide range of international NGOs are monitoring the performance of mineral programs in the region.[18] Actions by these stakeholders are reviewed, and special attention is paid to two critical issues in mining in this region: artisanal and small-scale mining and social issues related to mining.

1. Global initiatives

40. At the global level, several initiatives and partnerships serve as examples of strategies that generally support the implementation of Agenda 21 and the JPOI. Asian and Pacific countries are members of several of these, as shown in Table 4. These include Communities And Small-Scale Mining (CASM)[19], Mines Ministries of the Americas Conference (CAMMA), EU Mercury Strategy, Extractive Industry Review (EIR), Extractive Industry Transparency Initiative (EITI), Green Gold, Green Lead TM Initiative, Global Reporting Initiative[20] Inter Governmental Forum on Mining, Minerals and Sustainable Development International Cyanide Management Code for the Manufacture, Transport and Use of Cyanide in the Production of Gold, Kimberley Process Certification Scheme (KPCS)[21] and an international plan to

18 For example, the Asian NGO Coalition for Agrarian Reform and Rural Development (ANGOC) are analyzing mining issues to find directions to better promote the agralian reform.

19 See their website at http://www.artisanalmining.org/ and http://casm-asia.ccop.or.th/

20 http://www.globalreporting.org/Home

21 http://www.kimberleyprocess.com/

22

Table 4 International mining-related initiatives and Asia-Pacific participation

Initiative	Asia-Pacific participation
Extractive Industry Transparency Initiative (EITI) The Extractive Industries Transparency Initiative (EITI) is a coalition of governments, companies, civil society groups, investors and international organizations and supports improved governance in resource rich countries through the full publication and verification of company payments and government revenues from oil, gas and mining.	Kazakhstan, Kyrgyz Republic, Mongolia and Timor-Leste are "candidate countries" of EITI. In addition, a China - Liberia contract is known for the provision that commits the mining company to join the Liberia Extractive Industry Transparency Initiative (LEITI)[23].
Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development In February 2005, the Forum came into effect when twenty-five national governments had confirmed their membership. It aims at promoting the implementation of the JPOI.	India, Kazakhstan, Kyrgyzstan, Mongolia, PNG, Philippines, and Russian Federation.
The Kimberley Process is a joint governments, industry and civil society initiative to stem the flow of conflict diamonds.	Australia, Bangladesh, China, India, Indonesia, Japan, Republic of Korea, Lao People's Democratic Republic, Malaysia, New Zealand, Russian

22 "Governments unanimous on 2009 start to mercury treaty talks", Environment News Service website, 20 February 2009, at http://www.ens-newswire.com/ens/feb2009/ 2009-02-20-01.asp.

23 Global Witness and Green Advocates (2009) Recommendations for future concession contract negotiations and for the considerationof the China-Union contract by the Linerian legislature, Joint Memorandum at "http://www.globalwitness.org/ media_library_detail.php/ 719/en/ global_witness_and_green_advocates_ publish_analysi", 8p.

	Federation, Singapore, Sri Lanka, Thailand, Turkey, and Viet Nam.
The Global Reporting Initiative (GRI) The Global Reporting Initiative (GRI) is a network-based organization that has pioneered the development of the world's most widely used sustainability reporting framework and is committed to its continuous improvement and application worldwide. Its framework sets out the principles and indicators that organizations can use to measure and report their economic, environmental, and social performance.	In 2002 only nine companies posted the report but in 2008 fifty two submitted it. Many are transnationals and nearly twenty have operations or exploration sites in Asia.

2. **ASEAN**

41. ASEAN initiatives on mining have accelerated since 1995 with the development of the Vientiane Program of Action for ASEAN Cooperation in Minerals 1996-1998. The ASEAN Federation of Mining Associations (AFMMA), collaborates on the implementation of the ASEAN mining agenda. While the ASEAN Ministerial Meeting on Minerals (AMMin), established as a gathering of ministers and mining agencies and first held in 2005, as well as the ASEAN Senior Officials Meeting on Minerals (ASOMM) have met on multiple occasions. The "ASEAN Minerals Cooperation Action Plan 2005-2010 realizes the policy agenda under the Vientiane Action Programme and Ministerial Understanding on ASEAN Cooperation in Minerals through four working groups on (1) minerals information and database, (2) trade and investment in minerals, (3) sustainable mineral development and (4) capacity building in minerals. Priority projects endorsed by these forums include mine safety and health; reverse logistics management for sustainable minerals and metals circulation; and harmonizing mining and protection of natural heritages.

The Seventh ASOMM in 2005 decided that ASOMM+3 Consultations would be established with ASOMM members and China, Japan and Korea in order to strengthen the cooperation between ASEAN and the three nations. The inauguration meeting was held in 2007 in Myanmar. Several workshops have been held, including on minerals/metals recovery and recycling.

42. AFMMA co-sponsored the AMMin in 2008 and coordinated with the senior officials in drafting the Manila Declaration on Intensifying ASEAN Minerals Cooperation. It is regarded a success story that they utilized an existing organization. AFMMA also formed the Private Sector Forum on Cooperation in Minerals in ASEAN. This forum is expected to bring out strategic policies of mutual interest to the member countries as well as issues and concerns that will be considered and acted upon by the mining ministers.

1. International Cooperation under APEC Framework

43. Asian and Pacific countries also cooperate under the framework of APEC with capacity building events covering: environmental management (1997), best practice, life cycle assessment, mine closure (1998), LCA and small-scale mining (1999), international dialogues on sustainable development (2001), transparency (2002) and community engagement (2003).

Table 5 - Policy directions to intensify cooperation in the ASEAN minerals sector.

1. ENSURE continuous development and utilization of the mineral resources of the ASEAN Member States to enhance the sustainability of the resources and maximize the benefits to the community and the national economy, providing the necessary safety net and shield from global financial and

economic turmoil;

2. ACCELERATE cooperation to work towards the facilitation and enhancement of trade and investments in minerals through harmonization of mineral policies, incentives and taxation, standardization of mineral resource information, and systematized flow and exchange of resource and trade information;

3. ENCOURAGE cooperation to develop policy guidelines and standards for ASEAN Best Mining Practices to promote environmentally and socially sustainable mineral development in the ASEAN region;

4. STRENGTHEN the development of institutional and human capacity building in the geological and minerals sector to ensure and adequately address the current needs and future demands of the ASEAN minerals industry and economy;

5. PROMOTE a platform for dialogue in which the private sector and ASEAN Dialogue Partners can more effectively and efficiently collaborate in mutually beneficial minerals cooperation activities in support of the building up of the ASEAN Community;

FOSTER concerted cooperation and joint approaches in international and regional forum in minerals such as in Asia Pacific Economic Cooperation (APEC) activities and the forthcoming United Nations Committee on Sustainable Development's Meeting in 2010, among others.

Source - Manila Declaration on Intensifying ASEAN Minerals Cooperation."Manila Declaration on Intensifying ASEAN Minerals Cooperation", Second ASEAN Ministerial Meeting on Minerals, Manila, 16 October 2008.

44. In the third APEC MRM meeting (2007), the participating ministers agreed to work on breaking down the barriers to greater trade and investment in the minerals and metals sector, and they agreed to "10 APEC Mining Policy Principles",[24] committing to stewardship of the industry and to delivering important business improvements in mining. It is also noteworthy that participation and employment of indigenous communities in mining was encouraged. In order to discuss challenges according to these 10 Principles, APEC decided to hold "Mining Task Force (MTF)". MTF was once proposed as "Mining Working Group (MWG)" of APEC but after the deliberation under the Russian chairmanship, at the 19th APEC Ministers Meeting in 2007, it was decided to be set up as task force for two years (2007-2009), with two groups within APEC, i.e., the Group of Experts on Mineral and Energy Exploration and Development (GEMEED) and Non-Ferrous Metals Dialogue (NFMD) as the foundation.

3. South Asian Association for Regional Cooperation (SAARC)

45. The Colombo Declaration of the 10th SAARC Summit clearly declares that Heads of State or Government will remain committed to "promote mutual trust and understanding". They have also recognized the fact that "the aim of promoting peace, stability and amity and accelerated socio-economic

24 Source – Joint Statement, Third Meeting of APEC Ministers Responsible for Mining

nd

[25] was marked by conflict related to the issue tribal groups wish to express their concern over mining in their area.

4. United Nations

46. The UN organizations are important actors in the region. ILO's International Programme on the Elimination of Child Labour (IPEC) has successfully reduced the number of child labor through the Minors out of Mining program.[26] [27] Uranium-related issues were addressed by the "the High-Level International Forum "Uranium Tailings: Local Problems, Regional Consequences, Global Solution" which took place in Geneva on 29 June 2009. The meeting was organized by the initiative of the Government of the Kyrgyz Republic and supported by the countries of Central Asian region and UNDP country offices in Central Asia.

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25 ILO-IPEC (2003), In Search for the Pot of Gold, 127p.

26 ILO-IPEC (2003), In Search for the Pot of Gold, 127p.

27 ILO- IPEC (2006), Minors Out of Mining, 14p.

28 Joint Declaration of the delegations of the Republic of Kazakhstan, the Kyrgyz Republic, the Republic of Tajikistan, the Republic of Uzbekistan, UN system Agencies, IAEA, OSCE, European Community, EBRD and EurAsEC - participants of the International High Level Forum, High Level International Forum Uranium Tailings in Central Asia: Local Problems, Regional Consequences, Global Solution, Geneva, Palace of Nations, 29 June 2009.

47. The Forum resulted in a Joint Declaration[28]. The Declaration urges the international community to continue to support the countries of Central Asia in addressing problems of uranium tailings sites and highlighted the importance of regional cooperation in the following priority directions: strengthening legislative framework; remediation of the tailings; development and implementation of specific programs and projects aimed towards improving monitoring, capacity building and public awareness; implementation of measures to prevent access of the population to contaminated materials; implementation of medical-humanitarian measures to improve the quality of life and standard of living of the population living within areas affected by tailings disposal.

48. One such initiative to contribute to economic development and overall livelihood improvement in the Asia-Pacific region is the Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP). This body promotes "capacity building, technology transfer, exchange of information and institutional linkages for sustainable resource development, management of geo-information, geo-hazard mitigation and protection of the environment".[29]

5. Government action

49. In some countries the current laws on mineral management are weak and have a number of gaps, e.g., a lack of provisions for those displaced by mining operations. In other countries, legislation, even the most recent initiatives, has been said to lack clarity in terms of the support to investment, provincial government authority and responsibility, and responsibilities of mining operators. Sometimes the legal

[29] See http://www.ccop.or.th/news.asp?no=4 for more information

framework for how companies are being given “mining concessions” is not clear. It is not clear how these concessions should be granted, how they can be used, who awards and administers them, and how they relate to mining licenses.[30] [31]

50. Free, prior, and informed consent (FPIC)[32] is recognized as a key principle in order to ensure that states/companies and indigenous peoples agree to recognize each other’s existence and rights, as far as possible, in an equitable and amicable framework. However, communities often allege that they have been ill-informed and intimidated. An often cited example of a process in which there is a lack of FPIC relates to the granting of mining licenses.

51. Other concerns are lack of enforcement of existing law, lack of institutional capacity to coordinate mineral business, and lack of access to information. The growing in demand from investors and the increased number of licenses issued has not been matched by an equivalent increase in institutional capacity of the Government. There are significant institutional and capacity gaps within the government agencies responsible for coordination, contracting and monitoring of the extractive industry sector.

52. Civil society and local communities have expressed concern about military involvement at mining sites.

30 Global Witness (2009) Country for sale – how Cambodia’s elite has captured the country’s extractive industries, Global Witness Publishing Inc., Washington, DC, 83pp.

31 Kachin Development Networking Group (2007) Valley of Darkness: Gold Mining and Militarization in Burma's Hugawng Valley, 77pp.

32 Marcus Colchester and Fergus MacKay (2004) In search of the middle ground, indigenous peoples, collective representation and the right to free, prior and informed consent, paper presented to the 10th Conference of the International Association for the Study of Common Property, Oaxaca, August 2004, Forest Peoples Programme, 32pp.

53. In Asia-Pacific region, exclusive ASM laws are not common although some states are striving to enact such laws[33]. It is not usually incorporated in mining and environmental laws either.

54. Funding is also an important issue. Governments are providing funds for research and development (R and D) to academic institutions in some countries. Various scales of grants and funds are available in the region and a significant body of research is being conducted by institutes/universities on economic geology, exploration technology, ore recovery, processing, smelting, environmental protection/reclamation, 3R (reduce, reuse, recycle), risk management, and public relationships.

6. Mining firms

55. In recent years, mining companies have taken proactive steps to address environmental and social issues by establishing internal management systems and policy frameworks which promote consistent practice and compliance with global standards. Companies are formulating community friendly policies based on such experiences. International initiatives such as GRI22 and the sharing of lessons learned among companies are pushing the trend forward.

56. For example, a mining company operating a gold-and-copper mine in Lao People's Democratic Republic established a community trust fund for the community benefits such as environmental care

33 A draft law of Mongolia to regularize ASM can be downloaded at the Sustainable Artisanal Mining project website at http://www.sam.mn/images/documents/assm%20law%20of%20mongolia%20draft%20april%2021.pdf.

[34]. In 2007, nearly 92% of the stockholders of a mining company with operations in the region, voted in favor of a resolution committing the company to conduct a review and evaluation of its policies and practices relating to the relationships with local communities[35]. The report admitted that the company has made mistakes in its engagement with communities but it also pointed to the opportunity to build credibility and generate trust among stakeholders.[36] While the review above looks at actions by specific stakeholders, special attention must be paid to two critical issues in Asia and the Pacific: Artisanal and small-Scale Mining.

Artisanal and Small-Scale Mining

57. "The World's Worst Pollution Problems" published by Blacksmith Institute ranks the ASM worst of the environmental issues in 2008[37]. In the region, some nations like Mongolia[38] have successfully controlled, or legislate against ASM but some nations have not, and ASM remains a serious issue in the region.

34 Inthavong, S. (2005) Lao mining boom 2005. In: The Survey on the Present Situation of Mining Industry in the ASEAN countries and Philippines, vol. 1, Proceedings of the 6th Asia-Pacific Mining Conference and Exhibition, Makati, 11-13 October 2005, Edited by the Chamber of Mines of the Philippines, 2005.

35 "Beyond the Mine", Newmount website at http://www.beyondthemine.com/2007/?pid=470.

36 Newmont Mining Corporation (2009) Community Relationship Review, March 2009.

37 Blacksmith Institute (208) The World's Worst Pollution Problems, 72 pp.

38 Swiss Agency for Development and Cooperation in Mongolia (2009) ONSITE INSIGHTS, May 2009 - No. 37.

58. ASM workers are in some places marginalized, and women and children are especially vulnerable. In one conference, women mineworkers narrated their stories of exploitation at the hands of mining contractors while working in the stone, granite and other quarries. They not only face economic injustice and indebtedness, but are sexually abused, face alcoholism, violence and forced into prostitution.

59. Communities and Small Scale Mining (CASM)[39] has supported and promoted the development of ASM projects and approaches, by individuals, communities and institutions that will directly or indirectly contribute to the reduction of poverty. In Asia-Pacific, its regional group, CASM Asia-Pacific, CASM China and CASM-Pakistan exist and work for the regional issues. However the financial foundation for these groups is not solid. CASM Asia-Pacific has contributed to the region by holding seminars on advanced chemical analysis, risk assessment and community development tools in terms of ASM.[40]

60. Successful community programs have been established in the framework of larger projects. With respect to mercury contamination, the Global Mercury Partnership[41], a UNIDO and UNEP initiative, aims at reducing mercury in ASM gold mining by 50% in 2015. Its projects and activities are well-recognized in the region.

61. A best practice can be found in the Sustainable Artisanal Mining (SAM)

39 See their website at http://www.artisanalmining.org/ and http://casm-asia.ccop.or.th/.

40 See two books from the Mining Journal Books: Small-scale mining in Asia, Observations Towards a Solution of the Issue (2002) and Risk Communication Between Mineral Developers and Local Communities (2003).

41 Swiss Agency for Development and Cooperation in Mongolia (2009) ONSITE INSIGHTS, May 2009 - No. 37.

62. Project in Mongolia[42] where miners organized themselves into partnerships, and jointly formed an umbrella organization. They established their own rules of operation and behavior in their designated areas and addressed such issues as extraction rights, extraction technology, land rehabilitation and labor safety. The mine closure plan of a mine operating in Papua New Guinea, emphasized providing assistance to the community to cope with the changed economic conditions once the mine was shut.[43]

63. Another success story is found at a town in the Philippines where the contract mining project has 14 contractors working on 18 contract areas within a company's mining claims. The contractors, many of them retrenched personnel and former workers, employ small-scale miners who operate what are called "on-vein" tunnels. Each contractor employs as many as 70 to 100 workers, many of them skilled miners.[44]

Social issues

64. Social issues are progressively forming an integral part of the sustainable development agenda in the minerals sector. There is growing acceptance by mining companies that mining projects have economic, social and environmental impacts on the community and there may be significant business advantages associated with early community engagement.

42 http://www.globalmercuryproject.org/

43 Crispin, G. (2003) Environmental management in small scale mining in PNG, J. Cleaner Production 11, 175-183.

44 INQUIRERnet (2007) "Responsible mining program takes root" at http://business.inquirer.net/ money/features/view/20070624-73057/Responsible_mining_program_takes_root.

65. In spite of such progress, there still seems to be mismatch between growing societal expectations on mining firms' good practice and their willingness, or capacity, to deliver on these expectations.

66. The relationship between the military and mining in some places has drawn international attention.[45] [46]Corruption has been associated with mining, accusations by civil society include the lack of transparency of allocation of rights to exploit oil and mineral resources. Civil society has led campaigns against mining. A global campaign has aimed to have all international financial institutions stop funding for oil and mining projects and targeted the supply side or early stage of the mining/metal life cycle.[47] Another international campaign has tried to reduce demand for gold, particularly gold jewelry.[48] These campaigns are examples of global issues and debates that governments could address through a global forum and mining associations, both domestic and international.

67. Governments and financial institutions, including development banks are increasingly accountable for ensuring that there is stakeholder consultation regarding all kinds of environmentally sensitive

45 "Treasury targets financial networks of key supporters of the Burmese Junta" at US Department of Treasury website 15 January 2009 at http://www.treas.gov/press/releases/hp1355.htm.

46 Their allegation can be seen as an article "Ivanhoe's Burma Mine resumes production, mine valued at zero making money" in Canadian Friends of Burma website 2 June 2009 at http://www.cfob.org/news/ IvanhoeMinesResumeProduction.html.

47 Hands off; why international financial institutions must stop drilling, piping and digging" at http://www.foei.org/publications/pdfs/handsoff.pdf

48 An NGO EARTHWORKS's "No dirty gold campaign" is gaining more attention. See http://www.nodirtygold.org/about_us.cfm.

investments, and civil groups often are given the chance to influence investments.[49] Investments can also be made more environmentally and socially responsible when investors exert pressure. In 2006, a pension fund blacklisted a mining company in the region over its disposal of waste residue into the local river system. Investors contested that the company's waste management practices were illegal in many other countries where it operated[50]. Another fund challenged the same company on its human rights practices[51] and the company appears to have responded positively and transparently.[52]

68. A typical fall of investment affected by adverse factors mentioned in this report is recorded in the Philippines. Although the Government intends to revitalize mining, only two billion USD has flowed into the mining industry since 2004 when the Supreme Court cleared a law allowing foreigners to own 100 percent of large-scale mining projects.[53] This investment contrasts with the initial estimates of the Government, which estimated the cost of the revitalization programs from 2004 to2010 to be one trillion

49 Minutes can be downloaded from http://www.jacses.org/sdap/mof/gijiroku/.

50 "Freeport investors voice environmental fears over goldmine" by Jonathan Wootliff, The Jakarta Post website 2 June 2009 at http://www.thejakartapost.com/news/2009/06/02/ freeport-investors-voice- environmental-fears-over-goldmine.html.

51 "NYC Pension Funds concerned about Freeport McMoran's activities in Indonesia", Office of the New York City Comptroller's Office website at http://www.comptroller.nyc.gov/ press/2005_releases/PR05-08-091.shtm.

52 The document showing the policy change of the company is found at http://www.comptroller.nyc.gov/press/pdfs/pr05-02-018__Freeport-Corp.pdf.

53 Japan Oil, Gas and Metals National Corporation (2009) JOGMEC News Flush Vol. 16, No.2.

USD.[54]

69. A regional group of eminent experts, Asia-Pacific Forum for Environment and Development (APFED), has been operating since 2001. It aims to address critical issues facing Asia and the Pacific region and to propose new models for equitable and sustainable development of the region[55]. They encourage the members to implement 3R (reduce, reuse and recycle) programs in Asia and the Pacific[56] and also disseminate best practice information including mining.

IV. POLICY OPTIONS

1. Cooperation with international initiatives

69. International initiatives can better harness civil society organizations and community groups, and mobilize them to monitor environmental and social "performance". Such groups should be sought, encouraged and financially assisted by stakeholders, especially by the UN and other top-level groups.[57] The concept of "human security"[58] could play a pivotal role in the formulation and implementation of such

54 Japan Oil, Gas and Metals National Corporation (2005) JOGMEC Current Topics No. 05-62.

55 Asia-Pacific Forum for Environment and Development website, http://www.apfed.net/.

56 Asia-Pacific Forum for Environment and Development (2006) Draft Co-chairs' Summary, APFED Expert Meeting on the 3Rs in Asia, March 27, 2006,Tokyo, Japan.

57 G8 (2007) recognized CASM and other international mining initiatives in the official declaration. See "Growth and Responsibility in the World Economy", Summit Declaration, 7 June 2007, Heiligendamm.

58 Commission on Human Security (2003) Human Security Now, NY, 159pp.

projects.

70. With respect to mercury, intergovernmental dialogue is a pressing need, the EU ban of mercury could promote the mining of more mercury outside of the EU region, shifting the export trade from western countries to Asia-Pacific. Providing incentives for the production of incentives for clean gold without using mercury is one area of action that should be considered.

2. Regular exchange of information

71. Governments should foster inclusive mechanisms for exchanging information among stakeholders including NGOs and CBOs. Regional mining associations could serve as coordinators of such mechanisms. Best practices and discussions could be published on academic and trade journals which can cover wide range of subjects from science to social issues. Also existing web sites such as India Environment Portal[59] should be linked each other and be utilized.

3. Investment policy

72. With respect to investment policy, it is recommended that Processes for determining whether a mining activity is in the "public interest" should be deliberate and transparent. Potentially-affected stakeholders should be given the opportunity to provide input into the process.

4. Capacity building

59 http://www.indiaenvironmentportal.org.in/

73. Many capacity building programmes have been targeted to Government officers in the region; more joint programmes between NGOs/CBOs and governments should be implemented.

74. Governments and civil society are alike struggling to meet the requirements of those in need of help. However, it seems difficult to reach clear conclusions on the degree to which there is potential for collaboration i.e. whether an anti mining stance can become a one which promotes responsible mining.

75. Accountability of mining stakeholders should be increased, including the accountability of NGOs and CBOs working on mineral issues.

76. Existing international funds available for local community development should be applied to mining communities.

5. Land-use planning

77. Proper long-term land use planning is needed to optimize the benefit of the community from natural resources. Lack of appropriate land use planning sows the seeds of conflict with local communities.; there are several examples across the region. [60]

6. Artisanal and small-scale mining

78. ASM issues should be integrated into a country's overall development strategy. In some areas, ASM

60 Penney, K., McCallum, R., Schultz, A. and Ball, A. (2007) Mineral exploration in APEC Economies: a framework for investment, APEC Energy Working Group, Report no. APEC #207-RE-01.10, Australian Bureau of Agriculture and Resource Economics, Canberra, 2007.

is a subsistence activity but in some areas it is already a small business.[61] Pilot programmes and policies should clearly distinguish between the two target groups.

79. Microfinance is an option to facilitate equitable, mining community-based financial institutions. If any scheme is available, it is imperative to disseminate the information widely. In the Philippines, there is a scheme called "Social Security System" which is applicable to the ASM, but until an international workshop of entrepreneurship it was evident that the facility was not known to the ASM workers.

80. Governments and companies have paid little attention to the wisdom of traditional ASM which has protected the environment and community since time immemorial.[62] [63] The wisdom should be revisited to construct an acceptable manner of mining to the local communities.

7. Indigenous people's issue

81. The rights and interests of unrepresented groups, such as indigenous peoples and others, must not be subordinated to the majority interest. Mining firms' willingness to commit to Free, Prior and Informed Consent (FPIC) will set the future direction of mineral development in Asia and the Pacific. FPIC initiatives are found in Australia but not in many other countries. Governments in the region should initiate consultations with local communities and to envisage how they can incorporate this concept in mineral development plans.

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61 National Institute of Geological Sciences of the University of the Philippines, Mines and Geosciences Bureau, and National Institute of Advanced Industrial Science and Technology (2004) Proceedings, International Symposium on the Diversity of Mining and Sustainable Local Development, 17 March 2004, Baguio, Philippines, 60pp.

62 Caballero, E.J. (1996) Gold From the Gods: Traditional Small-Scale Miners in the Philippines, 263 pp, Giraffe Books, Quezon City, Philippines.

63 Domalsin, C. (2002) Kabunian's gold in last frontier, In: Small-Scale Mining in Asia, Observations Towards a Solution of the Issue, 51-54, Mining Journal Books, London.

8. Women's issues

82. It is a concern that tribal women's issues seem to be outside of the scope of decision-making process. The inclusion of women's perspectives in policy making and planning is of paramount importance and the issue should be incorporated in stakeholders' agenda.

83. It has been alleged that unregulated mining has deepened poverty and marginalized many women[64] Another international ecological campaign advocates for enhancing the role of women in equitable management of natural resources by guaranteeing the participation of indigenous women in decision-making.[65] Women in the mining community often share the work but are disadvantaged in other respects.[66] Their capacities to process and market products should be developed.

84. The United Nations "Convention on the Elimination of All Forms of Discrimination Against Women" (1997) should be referred to in terms of mining. Governments and other stakeholders should

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64 Chan, C. Z. (2004) The impact of gold mining on women, communities and environment in Burma's Kachin state, AKSYU website at http://www.aksyu.com/ The%20Impact%20of%20Gold% 20Mining%20on%20Women,%20Communities%20and%20Environment%20in%20Kachin%20State,%20Burma.pdf, 20pp.

65 "Indigenous Women's workshop at AMAN Congress, the position and role of indigenous women facing development aggression", Down to Earth website at http://dte.gn.apc.org/74din.htm.

66 Murao, S., Daisa, E., Sera, K., Maglambayan, V.B. and Futatsugawa, S. (2002) PIXE measurement of human hairs from a small-scale mining site of the Philippines, Nuclear Instruments and Methods in Physics Research B189, 168-173.

respect its principles and ensure that their policies do not discriminate against women in the workplace.

9. Public relationship

85. Since mining is not the only option for the sustainable development of the society, role of mining in the long-term development of a society should be discussed, to enable rational choice and conflict mitigation. Providing information is necessary; Governments should explain the benefits and disadvantage of mining. Where mining can potentially have a negative impact on local communities, national mining policy should acknowledge their presence, traditional rights, and incorporate their historical knowledge, skill and ethics in development plans.

86. Grievance mechanisms where locals can table issues for further consultation are found in some companies. Consultation has taken place between mining companies and a university to improve such mechanisms;[67] a sign of the progress towards responsible mining. As of 2009, the Global Mercury Project is indicated as one of the best practices of artisanal/small-scale mining.[68]

10. Risk management and communication

87. The extractive industry needs to handle chemical substances properly. Scientific and technically robust approaches to risk assessment are vital component of effective chemical management.

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67 Kemp, D. and Gotzmann, N. (2008) Community grievance mechanisms and Australian mining companies offshore: an industry discussion paper", The University of Queensland Center for Social Responsibility of Mining, 24pp. The paper can be downloaded from the university's website at http://www.csrm.uq.edu.au/docs/ CSRM_%20minerals%20industry %20grievance%20discussion%20paper_FINAL.pdf October 2008.

68 APFED Good Practices database, The Global Mercury Project (GMP), APFED website at http://www.apfed.net/ki/database/doc/BPP145.pdf.

88. ICMM and Eurometaux have coordinated a comprehensive project aiming at developing a Metals Environmental Risk Assessment Guidance Document (MERAG). Similar risk assessments should be conducted in Asia-Pacific and any benefits should be widely disseminated. Such assessment should be an integral part of comprehensive risk management which covers every dimension of risk in the extractive industry.

89. Stakeholders should learn not only assessment but also the whole process of risk management. For this purpose learning tools[69] [70] developed by social-science experts will be useful.

90. It is also necessary to forge good platforms for risk communication among stakeholders and to train major players for the proper methodology through educational kits[71]

13. Advanced Technology

91. It is recommended Governments allocate grants and funds for the research and development of

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69 Hirose, Y., Sugiura, J. & Shimomoto, K. (2004) Simulation game of industrial wastes management and its educational effect. Journal of Material Cycles and Waste Management, 6, 1, 58-63.

70 Hirose, Y., Sugiura, J. & Shimomoto, K. (2004) Simulation game of industrial wastes management and its educational effect. Journal of Material Cycles and Waste Management, 6, 1, 58-63.

71 "Crossroad: Kobe: A training tool for disaster preparedness and response", In: W.C. Kriz & T. Eberle (Eds.), Bridging the Gap: Transforming Knowledge Into Action Through Gaming and Simulation, 245-253, Munich, Germany：SAGSAGA.

advanced mining technology such as clean coal technology, uranium extraction from sea water, deep-sea mineral exploration, deep-sea tailings placement (DSTP), advanced pollution control such as metal insolubilization, on-site remediation, biaoremediation, phytoremediation, electro-remediation and so on.

92. Technologies should be driven not only for the greed of national/corporate profit but also for the benefit of local communities. It should be remembered that indigenous knowledge regarding mining and environmental conservation has been proven to be efficient, sustainable, diverse and grounded in collective community ethics and responsibility.[72] Approaches to prevent the erosion of local and indigenous knowledge systems and to incorporate such knowledge in the modern mining management are needed.

93. In this context, the author recommends academia to expand a mineralogical concept "geomimetics" into a wider discipline. Geomimetics is analogous to biomimetics - i.e. chemists developing new organic compounds by copying and enhancing natural ones and is to replicating the synthesis of minerals in the laboratory.[73] It could be developed as a blend indigenous and modern mining technologies and systems to promote sound management to protect the environment, culture and tradition.

14. Urban mine

94. Mineral resources are finite and non-renewable. In order to secure sustainable development of the

72 "Iwami Ginzan Silver Mine and its Cultural Landscape" at http://ginzan.city.ohda.lg.jp/wh/en/technology/index.html.

73 University of Southampton website at http://www.soton.ac.uk/~solids/geomimetics.htm

society, it is inevitable to promote recycling of mineral-based materials to prolong their useful life in the life cycle. Recycling technologies and approaches such as inversed manufacturing, and urban mining[74] are promising.[75] [76]

95. The National Institute for Material Science has found that Japanese urban mines (stock of recoverable metal from recycling) match world-class primary deposits86 both for base and rare metals. Minamino et al.87 have found that the total material requirement (TMR88) in Japan calculated for natural ore is larger than that of urban ore of gold, silver, copper and so on.

96. "Akita Urban Mine Development Academy"[77] is one of the success stories in Asia and such scheme should be formulated and extended by Governments and national institutions.

15. Life Cycle Assessment

74 The concept urban mining was proposed in 1980s by Professor Michio Najo of Tohoku University, Japan, and has been materialized into practices including "Recycle Mine Park" program by the Ministry of Economy, Trade and Industry.

75 According to JOGMEC (2008), in Japan, about 70 % is from recycled product for the total consumption of copper, 80 % for dental gold and 95 % for buttery lead. JOGMEC (2008) Material Flow, 2008, 283 PP, Kawasaki City, Japan.

76 Already a Japanese trading house and an Australian firm started to explore the business opportunity in Asia. See "Mitsui to explore urban mines in Asia" by Jiji Press News Service, February 24, 2009.

77 http://www.urbanmine.eng.akita-u.ac.jp/

97. Life cycle Assessment (LCA) is another promising tool for the extractive industry to contribute to the sustainable development. LCA is an objective process that evaluates the environmental burdens associated with a product, process, or activity.[78] LCA challenges the mining (both primary and urban mine)[79] and metals sector how they could adapt the methodologies to improve environmental sustainability. Already at the Workshop of the 3rd Environmental Cooperation Workshop on Sustainable Development of Mining Activities (ECOW'99), its introduction to the mining sector was widely discussed and Japan's Ministry of Economy, Trade and Industry established the all-nation league for the LCA promotion to which Japan Mining Industry Association and Limestone Association of Japan are participating. It is recommended that such cooperation schemes be established in other countries.

98. A new system 'Industrial Symbiosis" could be the concluding term of this review. It engages traditionally separate industries in a collective approach to competitive advantage involving physical exchange of materials, energy, water, and/or by products.[80] The keys to the Industrial symbiosis are collaboration and the synergistic possibilities offered by geographic proximity.

78 "Japanese urban mines match for world-class mineral deposits", National Institute for Materials Science, Press Release on January 11, 2008 .

79 Minamino, R., Yamasue, E., Nakajima, K., Murakami, S., Okumura, H. and Ishihara, K.N. (2009) Evaluation of Elemental Recyclability in Laptop PC and Mobile Phone Using Urban-ore TMR, Abstracts for the 4th Meeting, Institute of Life Cycle Assessment, Japan, 222-223.

80 Chertow, M. (2000) Industrial symbiosis: literature and taxonomy. Annual Review of Energy and Environment 25, 313–337.

99. A best practice in this context is Japan's "Eco-Town Program"[81] which based on Industrial Symbiosis tries to maximize the economic and environmental benefit from close geographic proximity of industrial and urban areas, through the use of previously discarded commercial, municipal and industrial waste materials in industrial applications.

81 Van Berkel, R., Fujita, T., Hashimoto, S. and Geng, Y. (2009) Industrial and urban symbiosis in Japan: Analysis of the Eco-Town program 1997–2006, Journal of Environmental Management 90, 1544–1556.