AMERICAN UNIVERSITY OF ARMENIA
Center *for*
Responsible Mining

Caucasus Environmental NGO Network

Brot für die Welt

MINING IN ARMENIA

A Comprehensive Overview

Prepared in the scope of "Promoting Environmental and Social Accountability in the Mining Sector in the Caucasus" project

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1. INTRODUCTION

The important contribution of the mining sector to Armenia's economy and the potential for large-scale economic investment and benefits often overshadow the negative impacts of the mining sector on the environment and on society. When the social and environmental costs of mining are considered, the benefits of the industry to the country are far more debatable. Mismanagement, lack of proper implementation, monitoring and enforcement, gaps in legislation or a general lack of consideration of social and environmental concerns can lead to limited benefits and large costs, including costs of long-term environmental degradation and inequality in benefit distribution. Many citizens and civil society organizations, as well as some government institutions, have in fact already expressed concerns about the lack of attention to social and environmental concerns related to the mining policy and legislation in Armenia.

The mining sector in Armenia has yet to adopt global best practices. Any future development mining must be accompanied by appropriate measures for inclusive and environmentally sustainable economic growth. Putting these measures in place in Armenia could require far-reaching reforms in decision-making processes and supporting tools even before the best policies are formulated.

A new Mining Code was adopted in 2011, however, it emphasizes the importance of ease of doing business over environmental and social considerations. The government of Armenia has expressed interest in joining the Extractive Industries Transparency Initiative (EITI), which the government can put in place to strengthen revenue management in line with international good practices and to further promote good governance practices in the sector.

The aim of this report is to present facts, information, statistics and analysis regarding the mining sector in Armenia, specifically the Lori region, including the impacts of the mining industry on the local and central economy, environment and social welfare of the country.

This report can be used by all stakeholders in the mining sector including policy makers and government officials, industry decision makers, and civil society as guidance for best practices in the industry, to develop mechanism to protect the environment and human health, and to address social and environmental issues more effectively.

Methodology

This report was based on a combination of literature and statistical review, data collection, and analysis of existing data and statistics. Literature reviewed also focused on best global practices on socially and environmentally sustainable mining. However, one limitation is that certain information related to the mining sector in Armenia is not always available or readily accessible.

This report also aims to understand the social costs and benefits of the mining sector. To carry out this work, existing datasets were gathered and analyzed, including data from the National Statistical Service of Republic of Armenia (NSSRA), and studies conducted by the American University of Armenia School of Public Health (AUA SPH). The NSSRA data were used to assess the overall impact of mining on economic performance from a socioeconomic perspective. The AUA SPH data was used to assess the potential effects of mining pollution on the reproductive health of women and the level of arsenic and lead in the soil of various inhabited areas of the smelting town of Alaverdi, Lori region.

Historical Perspective, Regional Context

The Caucasus is rich in mineral resources and the long history of mineral extraction in this region is proved by the ancient Roman and Greek texts and the well-known legend of Golden Fleece in the ancient Kingdom of Kolkheti. Recent archaeological findings have indicated that gold extraction was already taking place in the Caucasus during the bronze period, IV-III centuries B.C., when chemical methods for the treatment of gold were used. The development of different techniques, fabrication of refined art crafts and their trade were historically among the key activities of the people in the Caucasus region. In the 19th century, extraction of ore reserves was activated in all 3 Caucasus countries; this was possible due to investments and new technologies introduced by European investors in the region. One significant investment in this field was made by Brother Siemens, who purchased a copper deposit in the Gadabay Rayon of Azerbaijan in 1864 and introduced new technologies for the extraction and processing of copper ore. The copper mine in Kapan, Armenia began operations in 1846.

These mining operations took on a heavily industrial character during the Soviet era, when the mining business was appropriated from entrepreneurs by the State and moved under the management of the central government. The mining industry was particularly active from the 1950s. The economy of the Soviet Union was mainly based on an industry of intensive and non-sustainable extraction of natural resources. Mineral resources were extracted and exported as raw material with only a few processing facilities, such as the copper smelter in the city of Alaverdi, in the former Soviet Republic of Armenia. The Soviet Union collapsed at the end of the 1980s and a region wide economic crisis ensued. The negative impacts of the centrally managed and extensive extraction of natural resources during the Soviet period left the environment in many areas of the Caucasus region heavily degraded with contaminated sites, in many cases, totally unmanaged.

Georgia's many mineral resources are competitive on the world market. In particular, manganese, copper, gold and zeolites are worthy of note with regards to international trade. More than 1,500 deposits with a high potential for industrial purposes have been identified, mapped and studied. Out of them, 675[1] deposits are already being exploited. The interest in the extraction of mineral resources significantly increased after 2010. According to information from the Ministry of Environment and Natural Resources Protection of Georgia, there is an annually growing trend in the issuance of licences for the extraction of mineral resources; specifically, the number of licences issued for mining extraction in Georgia in 2010 was 135, in 2011 it was 173 and in 2012 – 217. Although the extraction of these minerals contributes to the State budget's income, the poor governance of extraction practices result in heavy environmental degradation, abandoned mining sites and negative impacts on the health and social welfare of local communities living in mining hotspots. The economic development of Georgia over the last 10 years has been fast tracked, with the growth in income leading to an increased demand for construction materials such as sand, stone, clay, marble, macadam and chalk. The national interest in, and demand for, mineral resources will result in the continued and increased extraction of mineral and groundwater resources. International interest in gold, manganese and zeolites will continue to create a demand for a secure flow of minerals to the international markets. The expected increases in the scale of extraction activities will result in enhanced pressure on natural resources and the environment.

In Armenia, in spite of the global economic crisis of 2008, mining production and revenues grew significantly in 2009 due to a rise in global prices of copper, gold, and other base metals. Armenia's

[1] National Environmental Action Plan of Georgia 2011-2015, MoE, 2010.

mining sector is a key contributor to the national economy. Ore concentrates and metals accounted for just over half of Armenia's exports in last years, solidifying their status as the country's most exported products. The major mineral resources extracted in Armenia are copper, gold and molybdenum. Among metal minerals there are 7 copper-molybdenum mines, 4 copper mines, 14 gold and gold-polymetallic mines, 2 polymetallic mine, 2 iron ore mines and 1 aluminium mine. Armenia also has smaller deposits of lead, silver, and zinc as well as large deposits of industrial and non-metallic minerals, including basalt, diatomite, granite, gypsum, limestone and perlite. As of 2011, the mineral industry accounted for over half of the Armenia's exports. According to the Armenian Development Agency, Armenia has more than 670 mines of construction and aggregate minerals, including 30 base metal and precious metal mines. Among these, about 400 mines are currently being exploited[2], including 22 base metal, non-ferrous metal and precious metal mines. In addition to mines estimated and registered in the state inventory, 115 deposits of various metals have been discovered in the territory of the Republic of Armenia.

Azerbaijan is rich in deposits of natural minerals that are useful in chemistry, metallurgy, construction building and health therapy. These include ferrous and non-ferrous ores, rare and fine metals and semi-precious stones. The minerals produced in Azerbaijan are mainly alumina, aluminium, bentonite, bromine, crude Iodine, gold, gypsum, hydraulic cement, iron ore and raw steel, in addition to the well-known oil and gas deposits. The raw material basis for the ferrous metallurgy consists of large deposits of high quality iron ore, bentonite clay, dolomite and flux limestone. All of the magnetite ores are concentrated in Dashkesan, located in the Ganja-Qazakh economic region, which is an important mining industrial centre of Azerbaijan.[3] The Ganja Aluminium Factory operates on the basis of 130.2 million tons of reserves[4]. The factory manufactures aluminium oxide, sulphuric acid, potassium fertilizer, etc. In the last few years, gold production activities were renewed in the Gedabek gold and copper mine, located also in the Ganja-Qazakh economic region. These gold fields are capable of producing 2,500 t of silver, 1.5 Mt of copper and 400 t of gold. Based on this yield, the government has predicted a six-fold increase in the production of gold in Azerbaijan by 2014[5].

[2] Mining Industry in Armenia 2011, Armenian Development Agency Research and Information Department, 2011.
[3] A. M. Shekinski, The Natural Mineral Resources of Azerbaijan, http://www.azer.com/aiweb/categories/magazine/32_folder/32_articles/32_minerals.html
[4] Ibid.
[5] Gary Thomas, *Azerbaijan: Mining, Minerals and Fuel Resources,* http://www.azomining.com/article.aspx?ArticleId=228

2. MINING IN ARMENIA

2.1 Current Mining Industry in Armenia and Problem Discription [6]

The government of the Republic of Armenia considers mining as a priority industry. Mining occupies the biggest share in export structure of country's economy, as mining products comprise more than half of general exports.

Armenia is rich with the following metallic minerals: iron, copper, molybdenum, lead, zinc, gold, silver, antimony, aluminum as well as rare and scattered metals contained in them. Metal mineral mines include 7 copper-molybdenum, 4 copper, 14 gold and gold-poly-metal, 2 poly-imetal, 2 iron ore and 1aluminum ore mines.

Copper smelting centers discovered in Metsamor region of Armenia go back millennia. The mine in Akhtala, which began its operations in 1763, was already providing 20% of copper produced in Russian Empire by 1900.

Bringing about certain positive impacts in terms of job creation, tax payments and improved infrastructures, the mining industry is at the same time one of the main sources of environmental pollution in Armenia. Moreover, damage to the environment from mining activities are not assessed and compensated adequately.

Armenia's current system of economic mechanisms is not in line with contemporary methods as payment rates have not been based on economically justified principles and techniques of calculation of expenditures or distribution of incomes and adequate compensations for damage have been overlooked during definition of rates.

Ministry of Energy and Natural Resources failed to carry out proper oversight of compliance of subsoil using companies with requirements of subsoil utilization legislation.

Studies of the Control Chamber revealed breaches by subsoil utilization companies in calculation and payment of concession fees to the State Budget prescribed by the law and the decision of the Republic of Armenia on concession payments N 562-N of 8 May 2003. The amount of concession fee calculated for 20 companies possessing mining licenses comprised 158.979.6 thousand drams but only 79,812.2 thousand drams were paid to the State Budget.[7]

Material shortcomings in Armenia's current environmental and nature utilization payment system were also due to the fact that initially being introduced as types of dues paid mainly by state organizations the fees were formal and generally rather small and were calculated based on compensation indicators, criteria, conceptual or comparative calculations based on Soviet time studies, attempts of alteration of which were mostly rejected by ministries regulating the economy.

The main obstacles to Armenian system of environmental and nature utilization fees are as follows:

- Inadequacy of nature protection and utilization fee rates to damage caused or incomes received due to utilized resources.

[6] Author – Erik Grigoryan

[7] Ombudsmen's Office of the Republic of Armnia, 2011 Annual Report

- No tax is imposed on mining waste. As was already mentioned above, mining waste comprised over 99% of all industrial waste; however as per the Law on Rates of Nature Protection Fees zero rate was defined for disposal of mining waste contrary to other types of production waste specified under categories 1-4 with fees comprising from 1500 drams to 48 000 dram/ton, 600 dram/ton for non toxic waste and 60 dram/ton for non-hazardous waste from excavation of topsoil and construction, respectively.
- Under-regulated relations concerning mining waste from overburden and tailings[8]. No legal acts regulating the above relations were adopted under the Law on Waste thus actually freeing subsoil using organizations from the obligation of paying environmental fees for disposing waste into the environment, whilst giving other legal names to said waste – dumps, technical mines, etc.
- Royalties established for metal minerals were only a financial tool and contrary to nature utilization fees did not encourage rational use of resources.

As the tools for economic mechanisms enforcement the abovementioned systems of environmental management need further clarification.

Protocols of calculation of environmental damage and the Law could serve as methodological base for revision of nature protection and utilization fee rates, but before that current procedures of calculation of damage should be revised and justified according to present development conditions.

The Law on Environmental Impact Assessment and Expertise adopted in 2014[9] defined that the first phase of the EIA should also include economic assessment of potential environmental damage the methodology of which should be approved by the Government of Armenia; currently the draft is in the Government, however, it does not cover environmental systems and ecosystem services but rather separate components of earth, air and water and is based on current legislative acts.

2.2 Policy and Legal Framework[10]

Policy

Despite the strong necessity to run a sustainable policy in the mining industry, there is no worked out sector regulating distinct and comprehensive policy, strategy or conception. Even, if some efforts are underway in developing the sector regulating distinct and comprehensive policy, strategy or conception in that direction, they are not publicly available.
Numerous conceptions of energy saving and restoring energy, and on other issues, related to the energy system development, are posted in the website of the Ministry of Energy and Natural Resources of RA, but there is no more or less comprehensive document on the issue of natural resources exploitation.

Similarly, no any target document, regarding the mining industry environmental issues, is also provided in environmentally realated liable state institutions. Ecosystem services assessment, ecological damage assessment related issues, are being studied based on separate procedural

[8] Currently the Ministry of nature Protection of Armenia once again came up with appropriate legislative initiative but the proposal received negative feedback from the Ministry of Economy
[9] http://www.arlis.am/DocumentView.aspx?docid=93148
[10] Author – Arthur Grigoryan

decisions, but, as a conceptional paper/document, it has not been worked out and made it publicly available yet. Moreover, from the point of view of sector related strategical approaches, there has been structural changes, particularly, in 2005, Scientific Council of Geological Department was liquidated by the Minister of Nature and Protection, which was coordinating and summarizing the reports of geological explorations, and was providing a scientific approach to the issues of mine exploitation or not exploitation. Nowadays, the Ministry of Nature protection approve the decisions of a commission of experts, which are provided by the commission of experts existed in the structure of the same Ministry.
In the website of the Ministry of Economy of RA, in the page of Industrial Policy, the document on "industrial policy strategy addressed to the export in the Republic of Armenia", approved by the government of RA in 15.12.2011, relates to mining industry in some way[11]. The document is aimed designing and developing of new motivating fields of economical growth, by means of development of currently exporting and the fields with exporting potential.

Worked out documents on the population resettlement, is discussed also in narrow professional and public circles, where are presented the population's density in different regions of Armenia, types of occupation, economic trends and development prospectives, which can be also determined as a reference/initial document enabling to develop policy in mining industry.
Although, it has been more or less referred to the different aspects of natural resources exploitation and development perspectives in the country's economic growth overall strategies approving documents, however, those documents do not provide thorough/all round and well-grounded approaches of further procedures of the field of natural resources exploitation. In recent years, the Government of RA has referred to the issues of the country's stable development and the environmental protection in numerous reports and statements presented to international organizations. Those are" The second national project of the environmental protection procedures»[12], «Rio+20» the statement of the national assessment[13], national statements on the implimentation of Aarhus Convention[14] and other documents.

There is some reference to the development perspectives of natural resources exploitation, by Decree of RA № 422-N, dated to 27.03.2014, approved by the Government of RA on " strategical project of perspective development of the Republic of Armenia from 2014-2025, where it is presented the environmental, and in particular mining industry's legislative , environmental and economic issues related solution's vision, ploicy trends, development perspectives. In the stated document's environmental related part, it has been also touched upon/referred to the economic loss caused by currently natural resources exploitation and mining wastes 0 AMD rate of tax pay. In particular, the strategic document states that "currently used natural resources and environmental compensation payments yield to the caused actual loss for 32-40 times. Particularly, for the country's economical prosperity, further implementation of the privilege of 0% or low rate pay, estimated against the environmental payments and the use of resources, is extremely risky. In this

[11]Protocol Decree N49 on « Export-oriented industrial policy strategy of the Republic of Armenia » under the Government Session of RA, hold in December 15, 2011
[12] « The Second National Environmental Action Programme», Yerevan, 2008
http://www.nature-ic.am/res/pdfs/documents/strategic/THE%20%20SECOND%20NATIONAL%20%20ENVIRONMENTAL%20ACTION%20%20PROGRAMME%20%20OF%20THE%20%20REPUBLIC%20%20OF%20%20ARMENIA.pdf
[13] «RIO +20» National Assessment Report, Yerevan 2012
http://www.mnp.am/images/files/nyuter/2012/rio_20_2012arm.pdf
[14] National reports of Aarhus convention implementation 2005, 2008, 2011 and 2014 http://www.mnp.am/?p=169

occasion, the economic mechanism of the environmental policy must be revised/reviewed ...»[15]: It is expected to increase natural resource use and environmental payment rates, to encourage the implementation of pure production providing high-technology, to promote green economic growth and so on.

According to the document, it is also expected to make the development perspectives on knowledge- based activities of mining industry and for reprocessing-oriented sector's context of transition making from resource-based economy to industrial-economic model. This conclusion is based particularly on the approach, due to this document on "the industrial policy's direct target is the development of reprocessing industrial sectors and complexes… Industrial policy guiding vision is to make Armenia the manufacturing country of high-value and scientific products and services, the core of which is the human capital. Realisation of this vision requires phased approach, assuming the gradual transition from resource-intensice productions to the skills and abilities, and then to the knowledge-based prevailing productions function in long-term perspectives»[16].

The World Bank has also referred to the policy implementation in the sector and to existed conceptional, legal and institutional gaps[17]. Within the framework of this institution, in January and June of 2014 two documents were drafted on «Well-grounded and strategical decision-making on the issues of natural resources exploitation» and «Enhance environmental and social sustainability/stability in the field of natural resources exploitation of Armenia». Analysing resources exploitation field related strategical, legislative and sector management issues, it's turned out that there are serious problems in strategical and cumulative assessment, social liability, ecological damage economic assessment, mining wastes management and other issues, which hinder/prevent from liability of the mining industry.

The analysis of the outlined issues and provided suggestions in both documents again leads to think that, in fact there is no field management medium term or a long-term official conceptional strategy document.

Legal Framework

Natural resources exploitation field managing, as well as the sector related in some way legal acts involve a great area of legal system. It is due to the human's biosphere and mining great impacts on the wild nature. The use of resources, in particular the exploitation of metal mines is subject to rapid change in the human's environment, including social and cultural environment, as well as has an impact on the organization/formation of the country's tax and customs policy, referres to economic and labor relations, affects human health and safety, significantly interferes with the interaction of natural processes. The integrity/the overall of public relations makes resources exploitation related legislation broad/extensive.

We will touch upon only certain legal-regulations signed upon legislation referred to minerals extraction permitions, natural resources exploitation state monitoring, mining wastes management

[15] Appendix page 56 of Decree N422-N of RA 2014-2015 on «Perspective Development Strategic Programme» under the government session of RA hold in March 27,2014

[16] Appendix page 56 of Decree N422-N of RA 2014-2015 on «Perspective Development Strategic Programme» under the government session of RA hold in March 27,2014

[17] Sustainable and Strategic Decision Making and Enhancing Environmental and Social Sustainability of Mining: Armenia, an executive summary.

and liable issues. Biodiversity and water species protection, health protection, urban and cultural issues will be partially touched upon by presenting liable state bodies procedures.

Natural resources exploitation relations regulating main legislative acts are as follows:

RA Mining Code
RA Land Code
RA Forest Code
RA Water Code

RA Law on «Environmental Impact Assessment and Expertise»
RA Law on «Environmental and Natural Resources Use Fees»
RA Law on «Rates of Environmental Fees»
RA Law on «Lake Sevan»
RA Law on « Flora»
RA Law on « Fauna»
RA Law on «Specially protected areas of the nature»
RA Law on «Wastes»
RA Law on «Provision of Sanitary-Epidemiological Security of the Population»
RA Law on «Environmental Monitoring»
RA Law on «Inspection procedures proper management and implementation in the Republic of Armenia»

RA Government Decision N 1325-N, dated to 19.11.2014, approved by the government of RA, on « Defining procedure of public notification and discussions implementation»
RA Government Decision «Fundamental document and expected procedure's environmental impact implementation procedure approval»

In the mining industry, the provider of legal regulation, the highest legally binding document is the Constitution of the Republic of Armenia, in which, according to provision N10 and provision N33.2, the State provides the environmental protection and rehabilitation, the reasonable use of natural resources by ensuring human right for living in healthy and prosperous environment. Components of these provisions are regulated by current legislation and in particular by two basic legal acts, which we well refer to more detailed through Mining Code of RA and the Law of RA on «Environmental impact assessment and expertise» (henceforth, Law on EIA). Recent legislative changes in health care also have caused legislative liability for liable state bodies, in order to involve in environmental impact assessment (expertise) procedure. Particularly, according to the Law of RA on «Provision of sanitary epidemiological security of the population» , this liability clearly and in some way results from a number of provisions of the new Law on EIA[18]. It is possible to consider as an important achievement, if the legislative norms will be adequately interpreted and applied.
Especially, there has been changes in industry regulating main legal acts from 2012 to nowadays. Particularly, the new Mining Code entered into force in 01.01.2012, based on which concession-regulating Law on mining sites providing regulating issues was repealed, and provisions of the law of Ra on "Wastes" became non enforceable in mining industry: New Law on EIA entered into force

[18] «EIA assessment and inspection» the law's of RA 4th (main points used in the law) 7th (EIA inspection procedure observed environmental objects and features) 11th (EIA inspection center's liabilities) 15th (environmental and human health impact assessment and inspection), 17th (environmental and human health impact main assessing procedures) and other articles.

in 2014 by which another radical changes have been done in the issues of environmental impact assessment and expertise.

- New Mining Code of RA comprehensively regulates:
- Terms and conditions of provision of permitions for Natural Resources use, as well as the obstacles of the use of Natural Resources
- Geological information and required procedures to obtain permition for the use of natural resources, natural resources use permition obtaining terms and conditions.
- Minerals permitions implementation, transfer and termination terms,
- The framework of the issues subject to expertise,
- Mining wastes management and the issues of the property rights,
- Issues of the mine closure and recultivation, organizations social liability/accountability,
- Types of Natural resources use fees,
- Demands for the Environmental Protection,
- Subject to continuous observation and the state monitoring as well as natural resources use related other issues.

Two types of expertise is expected under Mining Code of RA:

- Technical and mining expertise, which is made within the framework of the Ministry of Energy and Natural Resources of RA, depending on the nature of the planned activities/procedure by involving also experts of other fields,
- Environmental impact expertise, made within the framework of the Ministry of Nature Protection and has greater impact of the public control.

From the point of view of stated expertise legal regulations, mining expertise is carried out under the order established by the government, environmental impact expertise order is established/defined by the Law on EIA, and technical safety expertise order is established by the Law of RA on «Provision of technical safety on state regulation»

One of the negative tendencies of the mining site's provision is so-called «one window» principle's contribution. There are real risks, under pretence of improving business environment, abuses can be caused during the natural resources use environmental negative impact incomplete assessment, on the issues of disproportionally limitation of public participation in decision-making.

Wastes managemet related issues are the main gaps of the Law of RA on Mining Code. Those are defined as "industrial waste dumps", "man-made deposits" under the article N3 of the stated Mining Code. Mining wastes tailings are now called "man-made deposits" and they become exclusive property of the Republic of Armenia since their formation. However, here there is also another problem, the mining waste may receive juridical status of a "man-made deposit", if only it has received geological-economic assessment under the established order, for which no procedure or terms are defined under the Code. Before receiving that assessment/rating, the status of existed tailings remain unclear/obscure. As for the provision of those use, There has not been the case/the precedent of tailings processing yet. It is worthy of adding, that, in 07.05.2015, the government of RA approved the draft Law on the investment project of processing heaped/stored and storing wastes dumps in tailings of «Voghji, Pkhrut, Artsvanik», as well as processing industrial waste dumps, caused in the result of «Zangezur Copper-Molybdenum Combine Closed Joint-Stock

Company's operation» [19]. Certainly, it is too early to judge the results, but the project itself can be considered as a positive move/change for the sector.

Stripping rocks have been renamed «industrial waste dumps» under the article N14 of Mining Code of RA, but, in contrast to «man-made deposit», in the beginning they are considered the property of the operating company, and go under authority of the State after the right's expiry date for the use of Natural Resources. Therefore, it is necessary to clarify the distinction between the property right exercise terms, as well as the logic of considering the mining wastes as the State's propert. According to official commentary/interpretation, mining industry wastes remain under authority of the State, as there, as there are still lots of minerals there, which are can be provided again by the state for exploitation. This interpretation is too much vulnerable. In practice, by means of this kind of legal regulation, risks of avoiding from accountability for social-economic negative impacts, caused in the result of mining wastes, by mining operators, greatly expand.

Thus, toxic wastes containing tailings are involved under the name of the «man-made deposit», which still do not have legal status, until they receive «geological-economic assessment», and stripping rocks dumps are presented under the name og «industrial waste dumps». In both cases, it is not justified to hand over them under the state authorization and exempt the organizations from paying environmental fees.

The other problem in the issues of the Code's provisions implementation, is derelictions of duties, which, perhaps relate to the entire legal field of activity of the sector/industry. Particularly, obstacles/prohibitions, established/defined under the article N26, are ignored in lots of mining projects, on the use of mining separate sites are prohibited, if there are monuments of nature, history and culture in requested mining sites, plants or animals habitation/settlements, registered in the Red Book, also, if the animals migration routes pass that territory.

Deficiencies of a systematic nature, are recorded during inspectorial matters, which Control Chamber of the Republic of Armenia also regularly touches upon/refers to in its annual and interim reports[20]: In the result of legality of the activities and productive inspection carried out by the environmental state inspectorate from 2011-2013, Control Chamber of RA revealed/found out, that it was planned in 2011 to carry out inspections, in numbers, 685 of Business Entities, but, in real, only 186 Business entities were inspected, or 27.2% of the expected project. According to 2012 project, only 156 business entities out of 2073 ones, were inspected, or 7.5% of the expected project. According to planned project of 01.11.2013, only 65 entities out of 2593 ones, were inspected, or 2.5% of the expected project.

EIA Law's new features.

- Clarification of concepts of the environment and the environmental impacts,
- Impact assessment and expertise demands separation, legislative approval of standards for the implementation of each one of them,
- Technical order provision by the state body to make an assessment, whick makes the owner liable to make an assessment within presented issues,

[19] http://gov.am/am/news/item/11922/

[20] Current report about the results of implemented monitoring against the Ministry of Environment of RA. Appendix is approved Under Decree N11/6 of the Control Chamber of RA, approved in March 26, 2014. http://www.coc.am/ShowReportArm.aspx?ReportID=259

- Division of types of activities, subject to impact assessment, into three «A», «B», and «C» categories, depending on the complexity of procedure type and potential influence,
- Strict limitation of expertise implementation terms,
- signing of liability for ecological damage assessment and compensation,
- Provision process of decision of a commission of experts and acknowledgment of being it repealed,
- Detailed regulation of transboundary impact assessment.

“Environment” and “environmental impact“ terms are affirmed for the first time in new Law on EIA. Based on them, such components have been affirmed in fact, which are subject to environmental impact assessment, and after that, to the state environmental expertise. Among the nature’s elements like water, air, flora and fauna and so on, human social environment (publich health and safety), has been considered, for the first time, as an element of the nature. Cultural monuments are the part of the environmenta and are subject to impact assessment within the frameworks of mining industry projects.

One of the innovations of the new Law on EIA, is also environmental impact procedure’s clear phased division and during the each stage, distribution of the responsibilities between private company and state bodies and (technical order, affirming of impact assessment standards and so on).

Environmental damage economic assessment and compensation liability, affected by industrial procedure, is affirmed also by the new Law on EIA, which is prerequisite for developing procedure for assessing the value of ecosystem services and environmental (including human health) impact damage financial compensation liability.

Types of procedures, subject to assessment ans environmental impact expertise, by sectors, they are classified into three categories of A, B, and C according to environmental descending impact level. Similar procedure has been established/defined before for all types of expertise, which was not a reasonable approach (e.g the same terms and procedures were established for the expertise implementation of mining project and riverbeds cleaning). Alongwith rational approact to the issue, there are also issues of high quality expertise implementation, which are due unequal short deadlines, established for the expertise and technically and professionally insufficient skilled experts.

Compared with the previous Law, detailed procedure of environmental impact assessment is affirmed in the new Law, by dividing the process in the preliminary and the main stages.. The initial stage requires to present general information about the procedure type and emplementing entities. In the initial stage of the assessment no any working project is presented. The planning process starts when the authorized representative (the Ministry of Nature Protection) considers the implementation of that procedure permissible and gives a technical assignment for working out the project. Project of all categories are presented in the initial stage, as for the wickest category C, for the procedure types presented in the category C, decisions of a commission of experts are given in the initial phase, without providing a technical order or accountability to make EIA rereport.
However, the key gaps of the new Law on EIA, are involvement in the list of procedures of from 1-10MW of power capacity hydroelectric power plants (so-called small hydroelectric power plants), which are subject to C category, without taking into consideration the latter ones construction and exploitation incompatability compared with the existed standards, and the possible risks in the

result of of the lack of it. Actually, due to the new Law, in order to get a permition is to build small hydroelectric plants no need to make a working plan, and realize the entire procedure of EIA, moreover, taking also into account, that it is not possible to consider 10MW power capacity hydroelectric plants small ones for shallow waterflows of Armenia.

It is defined, that «Environmental impact expertise center», existed in the structure of the Ministry of Nature Protection, will manage the environmental impact assessment procedure on professional bases, the institution's liabilities/authorization have been regulated. That institution must implement the order's initial assessment, make EIA expertise and provide the decisions of a commission of experts. However, the center cannot make a complete expertise all alone in accordance with the new Law on EIA, taking into consideration the healthcare phield's narrow professional issues of social environment (social health and safety) impact assessment questions. In that case, participation of the Ministry of Healthcare of RA in the assessment procedure will be necessary in order to have reliable/firm decisions of a commission of experts, which as if an administrative act, must be of compulsory/obligatory nature, and not discretionary one.

Land, Water and Wood Codes are aslo of great importance in the issue of mining expoitation, which are regulated, particularly in land category change, water mines exploitation affected territories of Lake Sevan and cpecial protecting areas mining sites exploitation restrictions related issues.

Law of RA on Environmental Monitoring

Due to the article N13 of the Law of RA on «Environmental monitoring», obligations of the State Environmental inspectorate are as follows:

- make a record oc cases on the environmental violations and and according put it into action within the framework of its liability.
- make an expertise under the law and order, in case of environmental violation.
- inform the police about the cases on environmental legislation criminal violation.

Under the same law, article N12, those procedures are also affirmed, which should be implemented by the state environmental inspector due to the nature of violation. It is as follows: decisions making on sanctions applying within the competence under the legal acts and laws, right up to suspending, terminating, prohibiting of the entity's violated activities.

Thus, the above stated law regulates the environmental state inspectorate's liabilities and duties framework of the Ministry of Nature Protection, such as inspections, and relevant measures taken based on vioaltions revealed in the result of inspections. However, established practice shows, that the inspectorate/department does not possess the necessary legal tools to evaluate the consequances result from the violation. For example, does the environmental inspectorate have the liability to demand on termination of Teghut's mining operation by giving reasons that constructions areas of the mining processing plant and other facilities /objects have changed without obtaining the EIA. Or, in general, what kind of effects can be caused in the result of such violation. Environmental inspectorate issues regulating legal acts are of discretionary nature, and can lead to big corruprion risks.

Law of RA on Organizing and implementing the inspections in the Republic of Armenia

In its turn, inspection are also implemented under the Law of RA on «Organizing and implementing the inspections in the Republic of Armenia». According to the stated law, implemented inspection under the law, is a procedure, which reveals the trustworthiness of provided reports and other documents by the entrepreneurial entity, and the latter one's actual activities compliance with the demands of the laws and other legal acts, state control/monitoring is applied to fulfill legislative demands. Inspections implementing state authorities from the nature protection and a number of other areas confirm/approve the annual inspections plan before the first of December of the proceeding year.

In mining industry, inspections can be implemented by lots of different entities starting from Tax inspectorate up to the Mining State inspectorate of the Ministry of Energy and the Ministry of Natural Resources and the Environmental State inspectorate of the Ministry of Nature Protection. Inspections observe/study the reliability of the entrepreneurial entities products manufacturing, ore extraction and realization/sale, products turnover/circulation and services delivery volumes, goods and deficit/shortage of the goods, and sale's actual rates.

As a rule, mining companies are in the category of high risks. It is permissible to carry out the usual inspections in the same entrepreneurial entity by the same state authority no more ofthen than once a year. But there are also exceptions under the law, when there are no restrictions in the implementation of inspections. Those exceptions are as follows: for e.g., when inspection implementing state authority has received an application from the citizens of Armenia or from other companies, on caused damage on the citizens life and health, State's legal interests, animals or environment, or on existing threat, which can cause such a damage. This norm has not worked either in case of Teghut, as the environmentalists/ecologists and the Ombudsman have addressed an appeal to Environmental and Mining State inspectorates about such kind of violations for many times demanding to implement inspections, but those applications have been denied without ground reasons. Inspections implementing deficiencies are reflected in Ombudsman's annual report, as well as in the annual and interim report of the Chamber of Control of RA.

RA Law on Ensuring the Sanitary-Epidemiological Security of RA

As it was stated, human social environment (public health and security), as a component of the environment, is laso formulated in the concept of «environmental impact», affirmed for the first time in the new Law on EIA. Along with this law, thearticle N10, under the Law of RA on «Ensuring the Sanitary-Epidemiological Security of RA» approved since 1995, states that citizens of Armenia have the right to get health damage compensation, resulted from Sanitary rules violation, established by the Government of the Republic of Armenia. Such law has not been established till nowadays.

Under the article N23 of the same law «Mandatory sanitary-hygienic inspections are implemented in nuclear energetic zones, areas having chemical and biological emissions and outflows, as well as in cases of objects division, reconstruction and acception in the zones having environmental disaster status/category, in the investment of unprecedented new technologies and in other cases envisaged by the legislation of the Republic of Armenia».

Moreover, according to the same article N23 Decisions of a commission of experts are being discussed and taken into consideration in decisions making on the provision of sanitary-

epidemiological security of the population, by the State bodies. However, no single healthcare inspection of the project of natural resources exploitation objects, has been carried out so far.
In such a legal-regulating case The Ministry of Health Care of RA must cacrry out an inspection on each mining project, and provide decisions of a commission of experts on the social environment impacts, in other words, decisions on healthcare issues, as « Environmental Impacts Monitoring Center», which operates within the Ministry of Health Care of RA, and which must carry out the projects state environmental inspection under the new Law on EIA, does not have professional skills to make human's health impact assessment.

In fact, the obligation of a human health environmental factors assessment is established also under the Law of RA on the Provision of Sanitary-Epidemiological Security of the Population, according to which, the competent body of the Ministry of Health Care of RA shall provide the "experts decision" on such projects subject to pose a risk to human health, that has not been recorded so far. However, in January 2014, the National Center of Desease Control and Prevention was founded under the order of the Minister of Health Care of RA, a Monitoring Center, which was founded/established instead of former operating 18 hygienic and epidemiological inspectorates and 2 scientific-practical and prevention centers.

According to the Charter of above stated Monitoring Center, goals and business trends of the Center are the sanitary-hygienic inspection, environmental impacts laboratory observations implementation and provision of decisions of a commission of experts, social-hygienic monitoring implementation on environmental factors effects on the population's health, decisions analysis and assessment, implementation of sanitary-hygiencic inspection, environmental factors, production, items and materials laboratory research, and experts decisions provision. As you see, the aim of this center is the environmental impacts assessment and inspection of the industrial projects, from the point of view of health care.

2.3 Institutional Framework[21]

Various state administrative authorities with diverse functions are engaged in the management of mining in Armenia.

1. The main administrative body is the Ministry of Energy and Natural Resources of the Republic of Armenia which is responsible for developing and implementing mining policies, providing permits and licenses, conducting the assessment of EIA's and related works;
2. Related to the environmental protection aspect of mining, the Ministry of Nature Protection of the Republic of Armenia is the head administrative body, carrying out expert assessment of environmental impacts, through the State Environmental Inspectorate;
3. The Ministry of Economy of the Republic of Armenia is responsible for developing state economic policy and strategy across all sectors of economy, including the mining industry;
4. The Ministry of Territorial Administration and Emergency Situations is responsible are the experts responsible for technical safety;
5. The Ministry of Health of the Republic of Armenia is responsible for assessment of impact of mining industry on human health.

[21] Author Erik Grigoryan

Mining licenses are issued for two purposes - conducting geological explorations and mining for minerals.

Current legislation prohibits mining in certain areas for the following reasons:
- National security concerns;
- Danger to human life and health;
- The presence of historical and cultural treasures;
- Protection of the environmental, including the presence plants and animals that are registered in the Red Book of Armenia;
- Migration routes of animals.

Moreover, in specially protected natural areas mining may be carried out only in the manner prescribed by the laws of the Republic of Armenia.

Interrelations of State Administration Authorities in Subsoil Utilization

The process of submittal of applications for subsoil utilization to state administration bodies by applicants is carried out through the Ministry of Energy and Natural Resources of the Republic of Armenia, upon which the foregoing Ministry in the manner and by the protocol prescribed by legislation shall ensure performance and coordination of functions with other state administration bodies within their scopes of competence.

Ministry of Energy and Natural Resources carries out its functions regarding subsoil utilization by below structural and separate divisions.

- Subsoil department with its two units, namely Mineral and General Geology and Subsoil Utilization Economics and Programs, is responsible for policy development in the industry;
- Subsoil Concession Agency studies the applications, refers them for environmental impact assessment and expertise, provides and records subsoil utilization permits and licenses;
- Mineral Resources Agency provides technical specifications and reassessment of mineral mines;
- State Subsoil Inspection carries out inspections of compliance with mining permits and licenses for cases of excess mining and selected exploitation;
- Republican Geological Fund state non-commercial organization maintains geological information[22].

Ministry of Nature Protection of Armenia carries out its functions through the following divisions:

- Subsoil and Land Protection Policy Department develops legal acts, technical standards and procedures for mining industry;
- State Environmental Inspection conducts audits of violations of environmental legislation due to subsoil use;
- State Environmental Expertise non-commercial organization conducts environmental expertise, public hearings and provides conclusions.

To get mineral mining licenses legal persons shall submit initial environmental impact assessment applications to the Ministry of Energy and Natural Resources, which in a 5 day period shall be referred to the Ministry of Nature Protection; the latter shall provide specifications in a 30-day time

[22] Decision N 1414-Ն of the Government of Armenia of 8 November 2012

and be held responsible in the manner prescribed by the law in case of failure to do so, allowing the applicants to prepare the specifications at their discretion.

If necessary, the applications may also be sent to the Ministries of Territorial Administration and Emergency Situations and Healthcare. In specific cases the submitted applications may be referred to other authorities to agree upon, for instance the Commission for Protection of Lake Sevan.

During the expertise phase of environmental impact assessment the impacted communities shall also be involved in subsoil utilization relations as co-organizers of public hearings.

By their economic significance resources of solid minerals and their useful components are divided into two groups subject to separate assessment and recording[23]:

1) on-balance, use of which as per approved conditions is economically purposeful if advanced equipment and technology of mining and processing of raw materials is available or employed by industry, while minding efficient subsoil exploitation and environmental protection requirements;

2) off-balance, use of which as per approved conditions and nature and environmental protection requirements is currently non-purposeful economically, with a perspective of becoming on-balance.

By complicity of geological structure and degree of versatility of quality of solid minerals mines and their sites fall into the following groups:

- 1 group: mines (sites) with simple geological structure
- 2 group: mines (areas) with complicated geological structure
- 3 group: mines (sites) with extremely complicated geological structure
- 4 group: mines (sites) with exceptionally complicated geological structure

Utilization of subsoil in Armenia is paid, except for extraction of non-metals, regional geological explorations, study, description, maintenance and collection of unique geological formations within the land plot allocated for own needs (irrespective of the form of ownership).

In all other cases utilization of the subsoil is paid and includes the following types of payments:

1. Payments for environmental activities, including for contamination of air, water resources, waste disposal, production and import of substances harmful for environment.
2. Payments (recultivation) to the Environmental Protection Fund for restoration of lands disturbed during subsoil utilization. Each subsoil user before starting its activity is obligated to make payments to the special account opened at State Treasury of the Ministry of Finance of the Republic of Armenia exclusively designed for spending on recultivation works after the closure of the mine if the subsoil user did not carry out those works on its own.
3. For monitoring of the mineral extraction area, locations of production dumps emerging during mining, and ensuring safety and health of population of neighboring communities.
4. Nature utilization payments (except for metal minerals) for use of natural resources considered as state property.
5. Royalty (metal minerals) for use of natural resources considered as state property.

[23] Decision of the Government of the Republic of Armenia N 274-Ն of 14 March 2013.

6. State duty for provision of subsoil utilization permits.

Subsoil users shall be obligated to carry out designated workforce social mitigation measures upon closure of the mine (organizing re-qualification classes, trainings in other specialties, creating incentives and opportunities for worker's job placement in other sectors, etc.), as well as specified activities for social-economic mitigation in communities in the immediate impact zone of the closing mine (participation in community social-economic projects, support to organization of small and medium businesses, etc.) and for that purpose develop Final closing plans 2 years before the end of operation of the mines and submit them to the competent authority.

2.4 Mining Business[24]

Mining is one of the most significant subsectors of industry and, why not, of entire economy of many countries. Average share of mining industry for all the countries comprises about 12%.

Global production of the most important raw material resources is growing nearly abreast with the growth of the world GDP. Thus for the period of 1951-1990 the global GDP has grown 3.6 times, while production volumes of mining companies have grown 3.7 times. To achieve this kind of growth rate 4 times more oil, 5.8 times more natural gas, 2.5 times more iron, etc has been extracted and consumed. It is noteworthy that almost similar growth rates have been observed in other sectors of economy as well. Growth rates could have been higher but for resource and energy saving technologies actively implemented in the last decades.

Many countries and various world organisations carry out active policies of raw material saving, creating reserves of critical resources, and recycling of raw materials. A number of projects relating to energy efficiency and alternative energy sources are implemented. Yet, to picture the development of economies without using mineral raw materials will be very difficult today.

The problem is still significant for the developing countries which are at such a stage of progress that produces gigantic volumes of waste. Economic development in those countries is accompanied by intense exploitation of natural resources when nature often fails to assimilate the damage caused. For obvious reasons it is impossible to forbid use of natural (mainly mineral raw material) resources but their rational and efficient exploitation and use is the duty of each country, society and organisation.

For that same reason it is important to implement appropriate legal, social-economic and environmental tools and mechanisms which will help to rationally and effectively utilize natural resources without circumventing the concept of sustainable development.

Thus despite the drop of material capacity index by countries of Organisation of Economic Cooperation and Development consumption volumes of raw material resources have not decreased, moreover they have increased.

Mining has long traditions in Armenia. The first mines began operating 3-4 thousand years ago, according to historical evidence, but the mining industry began to develop in the 18-19th centuries. The first copper smelter began operating in the northern (Akhtala-1763, Alaverdi and Shamlugh-1770) part of the country as far back as the 1763s. Later, at 1800 began operating Kapan copper

[24] Author – David Androyan

combine and at 1846 copper smelter. Since that time, over four hundred mines have been opened that have expanding metals and non-metal ores and industrial minerals. In Soviet Union period mining was an expanding sector that produced essential raw materials for the metal, chemical, for agriculture and for many other sectors of the economy. At present, there are hundreds of mines operating in Armenia, of which 8-10 produce precious or base metals (e.g. gold, silver, copper, molybdenum, zinc, lead), with the other facilities extracting industrial minerals (e.g. basalt, granite, marble, tuff, travertine, pumice-stone, limestone, perlite, bentonite, salt, gypsum, diatomite, pumice stone, zeolite). These mines stand to be complemented by a number of metal ore and industrial mineral mines currently being planned in all marzes (regions) of Armenia.

Trends and Dynamics of Extractive Industry

Table 1. Volume of industrial production by types of economic activity

present prices, mln. USD	2007	2008	2009	2010	2011	2012	2013
Total industry	**2094.6**	**2416.0**	**1842.6**	**2206.1**	**2681.8**	**2766.6**	**3032.4**
Mining and quarrying, in which:	**332.7**	**304.8**	**243.8**	**389.4**	**456.8**	**477.3**	**480.4**
Mining and quarrying, by percent	**15.9**	**12.6**	**13.2**	**17.7**	**17.0**	**17.3**	**15.8**
Mining and metal ore	312.4	278.9	2318.6	375.8	444.6	462.8	467.1
Other mining and quarrying	20.4	25.9	11.9	13.6	12.3	14.5	13.3
Manufacturing, in which:	**1397.2**	**1663.6**	**1221.0**	**1457.9**	**1730.9**	**1723.4**	**1897.0**
Manufacture of basic metals	357.4	343.0	261.1	361.4	430.2	406.1	389.7
Other industry product	922.3	1161.9	845.3	963.0	1173.5	1199.4	1375.3
Manufacture of other non-metallic mineral products	117.5	158.7	114.6	133.5	127.2	117.9	132.0
Electricity, gas, water supply	**364.7**	**447.6**	**361.6**	**358.8**	**494.0**	**565.9**	**655.0**

Table 2. Basic metal mining producton of RA

Manufacture of main base and precious metals	1995	2000	2005	2007	2008	2009	2010	2011	2012	2013
Copper concentrate, t	30214	43692	62843	67029	71307	88339	118105	127744	155545	184494
Zinc concentrate, t	458	528	6110	4924	7467	6989	14361	15588	16215	15950
Molybdenum concentrate, t	2539	6044	5942	8422	8769	8559	8583	9455	10677	11635
Ferro-molybdenum, t	-	-	5566	5977	5323	5144	5126	5525	5836	6619
Smelter production of copper, t	-	-	988	6954	6480	6858	7644	8876	10075	10771
Gold, kg	-	-	-	1300	1359	944	974	2736	2896	-
Silver, t	-	-	-	37	40.4	52.9	68.4	25.2	22.2	-

In 1995 overall industrial production of Armenia comprised USD 423.8 million where the share of metal industry was USD 37.1 million or 8.7% of overall industry.

By and large copper concentrate production has increased about 6 times in Armenia in the period of 1995-2013. In 2013 its production volumes exceeded those of 2000 by about 5 times.

Similar growth has been registered for extraction of all metals.
Below are production indicators of non metal (construction materials) products:

Table 3. Production of Basic Building Materials of RA

Basic Building Materials	1995	2000	2005	2009	2010	2011	2012	2013
Cement, 1000 t	228	219	605	467.0	488.0	422.0	438.0	431.0
Gypsum	-	-	44.2	40.1	38.7	34.0	30.4	28.7
Mural materials, 1000 m^3	-	60.6	NA	39.9	60.3	48.4	33.2	36.5
Non-Metallic Buildning Materials, 1000 m^3	101	77	395	730.0	1285.0	1152.0	994.0	1121.0
Tuff of Correct form, 1000 m^3	75.8	47.1	55.6	51.3	83.1	95.4	64.2	53.5

Table 3 suggests that growth has been registered mainly for non mineral construction materials and cement, while volumes of other non construction materials tend to drop which is mainly due to the supply of interchangeable products in the market.

Simultaneously it should be noted that there were 236 mining organizations operating in the country in 2004, including 12 metal mining. Currently their number has increased by more than 2 times. Industrial, mineral resources utilization and other production purpose land areas have also increased.

Table 4. Industrial Land Area of RA

Basic Building Materials	2006	2007	2008	2009	2010	2011	2012	2013
Total Land Area, 1000 ha	2974.3	2974.3	2974.3	2974.3	2974.3	2974.3	2974.3	2974.3
Land of Industrial, Use of Entrails of the Earth and Other Production Purpose	28.1	28.2	29.2	29.4	31.8	33.0	33.6	34.9

Land area used for this purpose has increased by about 25% for the specified period.

Area of land under mere metal mining comprises about 4,700 ha in Armenia. Land area of over 250 thousand hectares is assigned for geological-exploration works.

There are 22 operating and conserved tailing ponds in the country with cumulative capacity of about 600 million m^3 occupying an area of over 700 hectares (including the tailing pond of the Teghut mine). Majority of tailing ponds in Armenia are designed and built in Soviet times without closed-circulation water systems and newest technologies for safe storage of tails (using waterproof membranes, gas removal, etc.).

Given the lack of the foregoing and similar measures reducing operational costs, as well as cheap labour force in the country and relatively favourable tax environment Armenia's mining sector with all its shortcomings (non rational and complex exploitation of entrails, complex extraction of mineral components, end product manufacturing, etc.) is an attractive industry for investments including foreign investments.

Table 5. Profitability of organisations' products

%	2005	2006	2007	2008	2009
Total	19.5	17.5	15.4	11.3	9.6
Mining	**107.4**	**79.5**	**80.2**	**10.0**	**31.7**
Manufacturing	12.2	9.0	11.9	7.8	3.6
Production and distribution of electricity, gas and water	3.8	5.2	1.2	1.4	-3.0
Construction	2.9	6.3	8.4	8.3	16.6
Wholesale and retail trade, repair of motor vehicles	6.5	10.5	9.4	9.9	9.2
Information and communication	33.7	28.1	34.4	32.9	28.8

Table 6. Mining industry contribution to the economic development of Armenia

Indexes	2007	2008	2009	2010	2011	2012	2013
Share of mining production in GDP, %	**3.6**	**2.6**	**2.8**	**4.2**	**4.5**	**4.8**	**4.6**
Share in industry, %	**15.9**	**12.6**	**13.2**	**17.7**	**17.0**	**17.3**	**15.8**
Mining industry's gross revenue, mln. USD	332.7	304.8	243.8	389.4	456.8	477.3	480.4
Mining's share of employed population, %	**0.93**	**0.84**	**0.78**	**1.07**	**1.03**	**1.0**	**0.95**
Mining and basic metals manufacturing gross revenue, mln. USD	690.1	647.8	504.9	750.8	887.0	883.4	870.1
Export volume of Armenia, mln. USD	1152.3	1057.2	710.2	1041.0	1334.3	1380.2	1478.7
Mining and basic metals manufacturing products export volume, mln. USD	596.3	629.0	409.3	670.6	855.7	806.0	795.7
Share of mining and base metals manufacturing products in export, %	**51.7**	**59.5**	**57.6**	**64.4**	**64.1**	**58.4**	**53.8**
Payments for nature use (mining only), mln. USD	10.1	10.6	7.5	10.7	12.6	41.7	61.0
Tax income of Armenia, mln. USD	1445.3	1994.8	1427.3	1578.5	1739.0	1801.4	2495.2
Share of nature use payments in tax incomes, %	**0.7**	**0.53**	**0.53**	**0.7**	**0.72**	**2.32**	**2.44**

In 2014 payment for nature use was 55.5 million USD. Tax income of Armenia was 2564.7 USD and share of nature use payment in tax incomes was 2.16%.

Table 7. Employed population by types of economic activity

Average annual, 1000 persons	2007	2008	2009	2010	2011	2012	2013	2013 by %
Employed, total	**1101.5**	**1183.1**	**1152.8**	**1185.2**	**1175.1**	**1172.8**	**1163.8**	**100**
Mining and metal manufacturing	**10.3**	**10.0**	**9.0**	**12.7**	**12.1**	**11.7**	**11.1**	**0.95**
Indirectly employed connected with mining	**About 25000**							**2.1**

Table 8. Average monthly nominal wages by types of economic activity

USD	2009	2010	2011	2012	2013
Total average in Armenia	**264.3**	**274.7**	**290.2**	**293.7**	**357.7**
Financial and insurance activities	756.5	739.0	760.3	767.3	888.5
Mining and quarrying	**484.4**	**580.4**	**638.0**	**652.8**	**774.0**
Information and communication	508.5	578.1	611.9	643.8	716.9
Electricity, gas, steam and air conditioning supply	386.4	400.8	408.6	385.0	472.2
Construction	336.9	366.7	369.6	352.2	382.6

Table 9. Taxes paid by main active metal mining companies, 1000 USD

Company/ mine name	2008	2009	2010	2011	2012	2013
ZCMC (Kajaran)	46983.5	17443.2	33727.0	79941.4	78828.5	92437.0
Dino Gold Mining Company (Shahumyan mine) Dundee Group	4390.0	4101.5	7351.3	10240.8	17733.0	13031.0
ACMC (Agarak mine)	5913.3	1991.3	4594.0	6491.5	7668.2	8541.5
GEO PRO MINING GOLD (Sotq mine)	2095.5	2624.0	2614.1	4937.0	12597.0	17727.0
Teghut	-	-	-	-	-	3942.3
Metal Prince LLC (Akhtala mine)	901.1	853.8	1027.1	1294.0	1147.2	1083.2
Geoteam (Amulsar mine)	-	-	-	-	-	1064.0
Sagamar LLC (Armanis mine)			1008.8	1146.5	1788.3	1925.0
Avan Salt Plant	-	-	-	-	-	1871.5
Ler-Ex LLC (Hanqasar mine)			-	227.7	492.0	614.3
Megradzor Gold (Meghradzor mine)	-	-	-	-	662.7	2165.4
Main Active Metal Mines, Total, 1000 USD	**60283.4**	**27013.8**	**50322.3**	**104278.9**	**120916.9**	**144402.2**
Tax Income of Armenia, Mln USD	**1,994.8**	**1,427.3**	**1,578.5**	**1,739.0**	**1,801.4**	**2495.2**
By Percent to Tax Income of Armenia	**3.0**	**1.9**	**3.2**	**6.0**	**6.7**	**5.8**
Tax paid by active metal manufacturing plants, 1000 USD						
Company/plant name	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
ACP	-	1024.4	4797.4	3730.6	3362.5	3694.5
Pure Iron Plant	-	2801.0	2289.7	1832.2	4002.8	4702.3
Dzulakentron	-	773.8	1135.8	1375.2	1664.6	3028.9
Armenian Molybdenum Production	-	703.6	535.4	1299.0	1500.0	2116.5
Zangezour Mining	-	373.8	683.7	1162.0	976.9	1097.0
Active Metal Plants, Total, 1000 USD	**-**	**5676.6**	**9443.1**	**9459.1**	**11506.8**	**14639.2**

By Percent to Tax Income of Armenia	**-**	**0.4**	**0.6**	**0.54**	**0.64**	**0.59**
Incomes from Main Mining and Metal Manufacturing, Total, by percent		**2.3**	**3.8**	**6.54**	**7.34**	**6.39**

List of Valid Licenses and Periods

Overall, for 2015 499 licenses were issued for mineral extraction, including 28 licenses to operate metal deposit, 442 licenses to operate non-metal deposit and 29 for mineral water. Also issued 85 licenses for geological study, 62 of them for the exploration of metal minerals, 20 of them for exploration of non-metal minerals and 3 of oil and gas (see appendix 1, 2, 3).

At the same time at 2012, 97 mine (including 5 metal mine) licensees have provided statement to the tax service of Armenia on the termination of activity.

The information about metal mine ores and metals deposits of Armenia and also information about mining licenses and annual productivities are shown in appendix 4.

Sources and Volume of Investments

As previously mentioned mining industry of the Republic of Armenia is a considerably attractive sector in terms of investments, particularly for foreign investors. Statistics on foreign investments into Armenia's real sector is below.

Direct foreign investments (DFI) of USD 390 million in total or annual average USD 43 million were made during 2002-2010 with the main share of which, around 75%, only between 2004 and 2007. Some 77.5 % of total DFI was made only by Germany. Investment flows were attracted from Canada, Cyprus, Australia and Switzerland.

In 2014 total foreign investment flows into the real sector of Armenian economy comprised USD 2017.7 million where the share of direct investment was USD 840.9 million.

In January-December of 2014 foreign investments into the real sector of Armenia's economy mainly came from Russia (USD 737.3 million), Cyprus (USD 367.1 million), Germany (USD 276.7 million), Canada (USD 91.6 million), Lebanon (USD 81.3 million), France (USD 58 million) and the Netherlands (USD 57.4 million).

Foregoing investments were mostly directed to the following sectors of economy: transportation, information and communication (USD 236.7 million), mining industry (USD 168.2 million), real estate activity (USD 46.1 million), processing industry (USD 46 million), infrastructures, including electricity, gas, water production and distribution (USD 41.6 million) and construction (USD 30.9 million).

In 2013 the flow of foreign investments into real sector comprised USD 597.4 million of which direct investments comprised USD 271.2 million demonstrating 20.5 and 52.2 percent decrease respectively compared to the previous year.

For the reporting period investments have come mostly from Argentina (USD 117.9 million), France (USD 99.1 million), Russian Federation (USD 86.3 million) and Canada (USD 53.6 million).

In 2013 foreign investments mainly were directed to “Mining Industry and Open-Pit Mine Operation” (USD 168.2 million), “Telecommunications” (USD 113.7 million), “Air Transportation” (USD 108.9 million) and “Real Estate Related Activity” (USD 46 million) areas.

Table 10. Foreign investment flows into the real sector by countries as of 2014 (ths USD)

Countries	2011		2012		2013		2014*	
	Investment	DFI	Investment	DFI	Investment	DFI	Investment	DFI
Total foreign investments	**816,273**	**631,421**	**751,805**	**567,410**	**597,375**	**271,160**	**2,017,679.7**	**840,908.9**
Including								
Russia	**393,851**	**338,164**	**122,715**	**88,278**	**86,258**	**58,615**	**737,272.7**	**618,419.5**
share, %	*48,2*	*53,6*	*16,3*	*15,6*	*14,4*	*21,6*	*36,5*	*73,5*
Mining	*mining. 180,867*							
Netherlands	**2,134**	**1,511**	**190**	**1**	**82**	**-**	**57,380.3**	**-2,072.8**
share, %	*0.3*	*0.2*	*0.03*	*-*	*0.01*	*0.0*	*2.8*	*-0.2*
sector of investment							*mining*	
Germany	**24,596**	**24,069**	**48,143**	**48,143**	**22,130**	**22,130**	**276,717.2**	**47,609.6**
share, %	*3.0*	*3.8*	*6.4*	*8.5*	*3.7*	*8.2*	*13.7*	*5.7*
sector of investment	*mining. 23,530*						mining	
Canada	**31,715**	**19**	**106,649**	**-**	**53,560**	**53,560**	**91,613.2**	**513.9**
share, %	*3.9*	*0.0*	*14.2*	*-*	*9.0*	*9.0*	*4.5*	*0.1*
sector of investment	*mining*							
Cypres	**17,644**	**16,378**	**6,663**	**5,269**	**76,500**	**602**	**367,067.0**	**-9,503.6**
share, %	*2.2*	*2.6*	*0.9*	*0.9*	*12.8*	*0.2*	*18.2*	*-1.1*
sector of investment							*mining*	
Switserland	**18,642**	**7,930**	**44,692**	**43,705**	**10,266**	**10,266**	**41,659.8**	**23,343.8**
share, %	*2.3*	*1.3*	*5.9*	*7.7*	*1.7*	*3.8*	*2.1*	*2.8*
sector of investment							*mining*	
United Kngdom	**33,680**	**9,964**	**8,923**	**142**	**10,527**	**10,527**	**39,492.8**	**33,868.6**
share, %	*4.1*	*1.6*	*1.2*	*0.0*	*1.8*	*3.9*	*2.0*	*4.0*
sector of investment							*Mining*	

***** In 2014 methodological changes took place in the system of information collection on foreign investments due to which 2014 statistics does not match with statistics for previous periods.

Of the above countries financing mining industry particularly Cyprus, the Netherlands, the United Kingdom and Switzerland are offshore zones.

Table 11. Volume of foreign investment flows into the real sector by types of activity (consolidated) as of 2014 (ths USD)

Type of activity	2011		2012		2013		2014*	
	Total	Including direct investment	Total	Including direct investment	Total	Including direct investment	Total	Including direct investment
Total	**816,273**	**631,421**	**751,805**	**567,410**	**597,375**	**271,160**	**2,017,679.7**	**840,908.9**
Including								
Mining	76,440	36911,8	201,372.9	93,793.3	168,178.6	40,022.6	477,998.3	46,284.0
share, %	*9.4*	*5.8*	*26.8*	*16.5*	*28.2*	*14.8*	*23.7*	*5.5*

***** In 2014 methodological changes took place in the system of information collection on foreign investments due to which 2014 statistics does not match with statistics for previous periods.

New Mining Code was adopted in the Republic of Armenia on 28 November 2011 which has certain advanced provisions related to taxation, mine closure, environmental impact assessment.

Mining industry has ensured about 7% of tax revenues; in fact over 60% of taxes has lied with Zangezour Copper-Molybdenum Combine CJSC.

According to the new law, royalties paid shall be calculated as follows: $R = 4 + [P/(Ix8)]x100$, where:

R is royalty rate in percent, P is profit before taxation in drams, I is income from sales of products without VAT in drams. This method of calculation obviously has advantages from the viewpoint of simple administration and guaranteed revenues for the Government, however, on the other hand it creates a risk zone for relatively small profitability mines.

The newly defined rate has been approximated to the world average indicator for mining (4.14%).

Table 12. International Royalty Rates

Country	Gold	Platinum	Diamond	Coal	Industrial minerals	Iron	Copper
Argentina	**3**	**3**	**3**	**3**	**3**	**3**	**3**
PRC	**4**	**-**	**4**	**1**	**2**	**2**	**2**
RF	**6**	**8**	**8**	**4**	**3.8-4.5**	**4.8**	**8**
Indonesia	**2**	**-**	**10**	**13.5**	**1**	**2.5**	**2.5**

Mexico	**1.5**	**-**	**-**	**1.5**	**1.5**	**-**	**1.5**
SAR	**3**	**4**	**8**	**2**	**1**	**2**	**2**
Papua New Guinea	**2**	**-**	**-**	**-**	**2**	**2**	**2**
Philippines	**2**	**-**	**-**	**-**	**2**	**2**	**2**
Poland	**10**	**-**	**-**	**2**	**6**	**-**	**3**
Uzbekistan	**4**	**-**	**24**	**5.4**	**1.5-3**	**3**	**7.9**
Australia	**1.2-2.5**	**-**	**5**	**7.5**	**-**	**2-7.5**	**5-7.5**
Bolivia	**1-7**	**-**	**3**	**-**	**1**	**1**	**1**
Botswana	**3**	**3**	**3-10**	**3**	**3-10**	**3**	**3**
Total average	**4.14**						

Yet, mining inevitably has an impact on environment. Prevention of negative impacts requires sound management of environmental matters, beginning with exploration and planning of a mine, through the life-cycle of its operation, to closure and rehabilitation of the site. Environmental and mining legislation on environmental impacts has been enacted in order to prevent pollution of the environment and to reduce emissions. Although the environmental and mining legislation (Mining Code of RA, article 3, point 34; article 50) provides the application of the best international practices as well as reasonable and complex utilization of mines, they are not used in practice.

The European IPPC (Integrated Pollution Prevention and Control) Bureau has drawn up a separate Best Available Technique (BAT) reference document for the management of tailings and waste rock in mining activities (EC 2009). In addition, international guidance on best environmental practices in mining is available from various countries (e.g. Environment Canada 2009, INAP 2009, PDAC 2011). The present volume represents an Armenian national report bringing together the best environmental practices and best available techniques in the mining sector, with a focus on the mining of metal ore.

Technologies Used

Existing Gaps in Available Techniques and Environmental Practices

- There are more than 20 tailing dumps and only in one of them kept in dry tailings; (BEP implies dry tailings);
- Not all companies use water recycling;
- Using explosive and poisonous materials;
- Low recovery ratio of the metals;
- Using equipment with low technical efficiency
- Low efficiency of nature and environment preservation fund;
- Low efficiency of social programmes and relationship with affected communities.

Good Practices

- Some mines use emulsion explosive and water recycling;

- In Armenia few operating international companies follow equator principles.

Mine Closure and Land Reclamation

Gaps

- There are many abandoned mines and overburdens, including those remained from Soviet period.
- Bad quality of mine closing and land reclamation: in most of the cases old technologies and techniques of mine closing and land reclamation are used.
- Using wrong mechanism of land reclamation can cost the government huge expenses.

Positive aspects

- Mining Law reform in the field of mine closing and land reclamation. EIA report contains provisions on mine closing and land reclamation
- Implementation Guidelines for Applying Environmental Impact Assessment to Mining Operations: (adopted by the Government -04.09.2014).
- Implementation Guidelines for Applying Cumulative Impact Assessment to Mining Operations (in progress: DRAFT).

Corporate Environmental Policies and Compliance

Mining activity causes damage to environment at ore extraction, transportation, processing, as well as decommissioning and reclamation stages and after depending on the level of implementation of closure and recultivation plans. Below presented are best environmental practices in mining sector and current state and gaps in mining industry of Armenia.

Ore extraction (drilling and blasting works): There are still many mines in Armenia where ammonite N6 and ammonal explosive substances are used for the purpose of retrieval of ore as well as overburden. Use of such explosive materials in industry has been forbidden in European countries for more than one decade as they contain poisonous substances. They are being used in CIS countries until now.

The base of this group of explosives is ammonal saltpetre (72-80.5%), and the rest are aluminium powder (1.5-4.5%), trotyl (15-21%), in rare cases also cyclonite (1.5%). The last two are poisonous substances.

Trotyl emanates hazardous gases while exploding: 1 kg of trotyl emits 800 l of gas into the atmosphere with 300 l being nitric oxide and CO.

Best environmental practices in mining provide for use of diverse emulsion explosive materials which are free from the foregoing or contain them in much less quantities. Particularly they are 1.5-2 times cheaper than trotyl, are not highly explosive (they become explosive immediately during the blasting works), emit almost 10 times less hazardous gases.

Thus, following world best environmental practices in mining it would be advisable to implement emulsion type explosive materials in mines in the Republic of Armenia.

However, application of any explosive material assumes emission of gas alleviation and absorption of which is possible by:

- Optimum selection of charge of the explosive,
- Ventilation of underground mines and use of gas absorption and efficient cleaning equipment.

Ore transportation: The main environmental damage caused during ore transportation is emergence of dust. Armenian mining practices show that ore transportation by auto vehicles and railway is carried out in open dump trucks and wagons, which is a dust generation source. “Wet” transportation of ore in its turn incurs additional transportation costs.

According to best mining practices it is advisable to transport ore dry and in closed dump trucks which will help to mitigate environmental damages and reduce transportation costs. At the same time in case of open transportation of ore liquid binding materials are used worldwide to subject open surface of ore to erosion treatment, which is also rather effective.

Another source of dust during ore transportation is dust generated by mobile vehicle movement along dirty roads. Generally designs for mine operation provide for dust settling works by water machines. But if installation of water collection and cleaning facilities is not included in the design the use of water machines will also cause environmental damage by polluting the water.

World practices say that the best option is to build asphalt concrete roads from the production area of the mine: this expenditure is purposeful also from point of view of reduction of costs for maintenance of machinery.

Atmospheric emissions, noise and vibration: Another source for atmospheric dust in mines is crushing of ore.

The best way to reduce the extent of pollution is to place the crushers in closed spaces; and as for underground mines, depending upon the employed processing system they could well be set in adits of the mine: simultaneously it will help to reduce noise.

Generally noise and vibration could be reduced by using silent equipment and technologies, insulating sources of noise, building soundproof constructions, correct organization of blasting works (blasting phases, optimal selection of the amount of explosive charge), coordinating the schedule of performance of potentially noise and vibration generating works with local population.

Polluted water runoff control: Another source of negative impact on the environment during mine operation is polluted water. Monitoring shall be carried out for water runoffs in the areas outside the ore field.

Water quality control shall ensure:

- Monitoring of efficiency of water cleaning;
- Obtaining sufficient information about various water particles and penetrating substances, as well as impact (chemical, biochemical, physical, etc.) on water areas downward the potential source of pollution.

At the same time it is necessary to pay attention to management of surface water flows, particularly to their cleaning and use for technical purposes.

Enrichment of ore and tailing ponds: In regard to enrichment of ore environmental impact is reduced by lessening of iron sulphides, hence the acidogenic components. As a research area it is purposeful to consider as well separation of iron, sulphur and other components from tailings. This is an urgent problem for our country as metal mines in Armenia have sulphide and many other formations, and extraction of a number of metals, mineral components is not carried out yet. Significant environmental problems related to emission of sulphur exist particularly in the city of Alaverdi where ACP Company operates its copper smeltery. It is necessary to research local and regional markets of production and sales of sulphur and sulphur products (gypsum, gypsum plasterboard production, use of sulphur for amelioration of saline alkaline soils in Ararat valley, etc.).

For safe storage of tailings it is necessary to:

- Also apply substances which increase the neutralizing property of tailings (lime mixture, mineral powder containing carbonate),
- Use methods of decomposition of hazardous substances before disposing tailings into the pond or reduction of their residues in the tailings (e.g. decomposition of cyanic acid in the technological process),
- Bring potentially hazardous microelements to a weakly soluble form by adding chemical reagents.
- Identify the presence of diverse precious high technology minerals and metals (e.g. lanthanides, Ga, In, Nb, Li), which will provide an opportunity to use the mentioned tailing particles in the future.

Transparency and PR

Social impact mitigation or alleviation measures could include:

- Provision of information about the form of the dialogue between companies and local population (regular information exchange, establishing good relations). It is important to fill the void of information by reliable information to avoid misunderstandings.
- Companies' care about living conditions of their employees and their families and not only during working hours.
- Companies' voluntary participation in improvement of public services, e.g. active participation in community educational, healthcare, social projects. Open contact with beneficiaries is important and likely to result in finding proper compensation options.
- Creating social-economic development conditions for employees involved from communities, as well as community population upon closure of mines.

Closure of mines: After operation of a mine its area shall be closed and reclaimed. The purpose of it is to ensure safety of people and the environment and harmony with nature.

Best environmental practice of mine closure

- Availability of a mine closure plan still in the initial phase of the mine life cycle considering peculiarities of the place. In fact, for mines with short term of service it is desirable to prepare the plan at an earlier stage as possible (design phase).

- A mine closure plan should be based on risk assessment.
- A mine closure plan should be adapted and modified in line with changes during operation.
- Economically preparation of mine closure should be conducted during operation of the mine.
- Optimizing site land use, which assumes creation of opportunities for further use of sites, including with rich biodiversity.
- Dismantling of machinery (assumes such dismantling of equipment to be able to resume works safely during reopening of the mine if necessary).
- Double use of dismantled elements.
- Checking physical and chemical stability of designed facilities of the mine.
- Removing or neutralizing hazardous structures and buildings.
- Waste water disposal or processing.
- Mitigation of social-economic negative impacts of decommissioning and consideration of interests of local populations.
- Free publication of information about mine closure and site reclamation.

Reclamation: The purpose of recultivation of the area of the mine is to ensure its physical safety, adaptation to the environment to the extent possible and prevention of environmental pollution by contaminated water from the mine.

Thus physical safety of underground and open-pit mines could be ensured by:

- Stabilizing the slopes of open-pit mines, reinforcing the area by stones or filling it with water.
- Preventing the collapse of the adits of underground mines, closing the roads and adits leading to the mine, placing warning signs about dangerous areas/sections in the mine. The open-pit mine area could be adapted to the environment by landform design and development of biodiversity in the mine area.

Pollution of natural waters could be prevented or reduced by:

- Covering affected walls of open mines by special covers during their operation.
- Disposing useless and polluting infrastructures, equipment, materials and reagents from the territory of the mine.
- Studying and assessing possible directions of water outflows (blocking water outflow, collecting and cleaning the water, etc.).
- Providing technical guarantees for safety of waste placed in a treated area.
- Carrying out biological and chemical treatment of open-pit mine water (e.g., use of sulphate-reducing bacteria, alkaline wash).

3. IMPACTS OF THE MINING INDUSTRY

3.1 Impacts on Socio-Economic Environment[25]

Since 1998 Armenia has been operating a specific system of economic mechanisms (leverage) to mitigate negative impacts on the environment and ensure efficient use of natural resources (regulatory role), as well as generate financial resources for nature protection investments and as complement to the State Budget (increase in money flows) (fiscal role) through enforcement of the

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Law of the Repulic of Armenia “On Nature Protection and Nature Use Payments” (hereinafter: the Law) and relevant regulations.

A summary of annual reports of the Ministry of Nature Protection of Armenia shows an increase in the volumes of nature protection and nature use fees by more than 43,5 times in the last 15 years - from 608,0 million drams in 1998 to 32,8 billion drams in 2013, which creates favorable conditions for funding programs and measures aiming to address environmental problems in the country.

However, the share of the nature protection and nature use fees (in %) still remains considerably lower in the GDP considering that it represents the amount of compensation money charged for environmental degradation (damage) resulting from economic activity. According to expert assessment, in countries with a level of development similar to Armenia each year economy suffers an 8,0-10,0% damage or wear commensurate to the GDP, i.e. compensation amounts are less than the actual damage by more than 12-15 times.

Nature Use Fee

Defined as payment to the State Budget, as per the Law, for efficient and complex use of natural resources considered as state property.

The types of nature use fees under the Law are for:

a) water use,
b) use of liquidated solid natural resources (apart from metal natural resources, extraced resources of underground fresh and mineral waters and salt,
c) use of bioresources,
d) royalty - for sales of products resulting from extracted metal natural resources and their processing.

Nature use fee rates are defiend by the Decision of the Government of Armenia N 864 of 30 December 1998.

According to the Law “On Nature Protection and Nature Use Fees” as well as simultaneously enacted amendments to the Mining Code in January 2012, bonuses, concession fees, as well as nature use fees and royalties for extraction of metal natural resources previously paid to the State Budget by mining companies were substituted with royalties as nature use fees.

Royalty payers are organisations and physical persons from the Republic of Armenia and foreign countries operating metal natural resources mines in due manner and/or producing metal concentrate in Armenia.
The base for calculation of royalty shall be considered the revenue from sales of supplied/produced mining production in the reporting period, without VAT (hereinafter sales revenue).

Royalty cost (percentage) rate shall be defined against the royalty calculation base[26]:
The procedure for calculation of sales revenue for calculation of royalties was defined by Decision N 1901-Ն of 29 December 2011 of the Government of the Republic of Armenia.

Nature Protection Fees

As per the Law of the Republic of Armenia "On Nature Protection and Nature Use Fees" the following types of environmental payments are defined:

a) for emitting hazardous substances into the environment (airtmosphere and water basin),
b) for discharging production and consumption waste into the environment in due manner,
c) for products harmful to the environment.

Nature protection fee rates are defined in the Law "On Environmental Payment Rates" of the Republic of Armenia.

Provision of Funds to Communities for Implementation of Environmental Programs

Within the scopes of enforcement of the Law of the Republic of Armenia 'On Targeted Use of Environmetnal Fees Paid by Companies" adopeted on 15 May 2001 by the National Assembly of Armenia environmental fees paid by large mining companies are allocated to impacted communities.

Allotments to communities' administrative and funding budgets from environmental fees are targeted means and shall be used exclusively for implementation of environmental programs in the territory of those communities[27].

Prioritization of implementation of the planned measures and their funding proportions shall be agreed with state environmental and health authorities in the manner prescribed by the Government of the Republic of Armenia.

According to this law allotments shall be made from environmental payments charged for emission of hazardous substances into the air basin from fixed sources, discharging hazardous substances and compounds into the water basin and placement of production and consumption waste in the environment in due manner.
According to the Law of the Republic of Armenia 'On Targeted Use of Environmetnal Fees Paid by Companies" in total 28 communities in marzes of Lori (8 communities), Syunik (13 communities), Ararat (1 community), Kotayk (3 communities), Gegharkunik (1 community) and Armavir (1 community) and the city of Yerevan shall be entitled to receiving allotments for implementation of environmental programs.

[26] Basis: the Law of the Republic of Armenia "On Amendments and Addenda to the Law on Nature Protection and Nature Use Fees", adopted 28.11.2011:
http://parliament.am/legislation.php?sel=show&ID=4339&lang=arm/.

[27] Statement on works specified in 2012 Annual Work Plan under the 2010-2013 Social-Economic Development Program of Lori marz and their actural performance http://lori.gov.am/files/docs/2250.pdf/.

Within the scope of performance of the 2004-2014 state budgets total amount of subventions provided to communities for environmetnal programs comprised 1 615.5 million drams.

Increasing targeted financial resources/flows will gradually (phase by phase) enhance efficiency of local environmental programs supporting the balanced territorial develolment, building capacities of local self-government bodies, improve their significance/role and rating in the process of planning and implementation of foregoing programs.

Environmental Protection Fund

According to the Mining Code of the Republic of Armenia mining companies shall make contributions to the Environmental Protection Fund for the purpose of accumulation of adequate guarantee funds for recultivation, leveling, landscaping, tree-planting and construction works in areas disturbed due to mining activity.

The Procedure for use of the Nature and Environmental Protection Fund and calculation of the amount of allotmmetns is approved by Decision N 1079-Ն of 23 August 2012 of the Repubilc of Armenia.

Information about amounts allocated to the Environmental Protection Fund by companies operating natural resource mines in the territory of the Republic of Armenia is under permanent control. The money paid to the Environmental Protection Fund further will be used to implement nature and environment protection measures for reclaimation of lands disturbed in the result of planned subsoil utilization under natural resource extraction projects or geological study projects for the purpose of natural resource extraction.

Employment

In the past the Republic of Armenia was one of the leading republics building the raw material base for the Soviet Union. Alongside with territorial location of mines regional industrail districts and cities were created and labor force distribution was carried out, particularly preparation of specialists and job creation and staffing related to mining and ore processing of Lori marz Shamlugh and Alaverdi copper, Syunik marz Kapan, Kajaran and Agarak copper-molibdenum mines.

The country is well provided with engineers (Mining and Mettalurgical Department of Yerevan State Engineering University and Geological Department of Yerevan State University) and workers.

Currently mining industry while playing a key role in industrial development of the Republic of Armenia, also provides significant employment.

Although accurate statistical data are not available, one can judge from below examples that large mining companies only employ at least 800-1200 people each depending on volumes of mining operations.

Box 1. Mining Employment Rates

Lori marz: Shamlugh and Alaverdi copper mines employ up to 800 people, Armanis gold-multimetal mine up to 300 people. Gegharkunik marz:

Sotk gold mine employes up to 900 people.
Syunik marz:
Kajaran copper-molybdenum mine employs up to 1200, while Agarak copper-molybdenum mine up to 800 people.

Corporate Social Responsibiity: Donations, Charities. Support to Infrastructure Creation and Development

Alongside with organization of their work mining companies usually make donations, carry out phylantropic activities in communities in the territories of which the mines are located, particularly supporting construction and repair of community roads, gas and water supply pipelines, as well as partial compensation of student tuition fees, remodelling of kindergartens and schools and cultural centers[28].

Box 2. Corporate Social Responsibiliy Cases, Mining Companies

The company operating Sotk gold mine in Gegharkunik marz repaired the Sotk community road and gas supply pipline, as well as the school.
The company operating Kajaran copper-mlybdenum mine in Syunik marz repaired the roads in the city of Kajaran and the gas supply pipeline.[29]

Public Involvement

Considering the importance and role of mining industry, as well as its impact on social, health and environmental areas, typically the society takes an active part here.

The following examples are convincing facts about active participation of the society with its diverse feedback both positive and negative.

Box 3. Public Envolvment Case Discriptions

Announcements about public hearings are posted in the official site of the Ministry of Nature Protection of the Republic of Armenia, specifying the venue and time and who is going to conduct any specific public hearing.[30]
Usually they are conducted in impacted communities in the presence of community members, experts and representatives of operating companies.
Population of marzes and communities having minies in their vicinity/territories are interested in their r operation and the development of mining industry as it guarantees them steady and long-term employment and addresses many social issues.
Many environmental NGOs are interested in both prevention of negative impacts of mining companies on humans and the environment and allocation of subventions from the State Budget
(also from environmental payments) for carrying out environmental and health measures and activities implemented by the communities (for instance, “An open pit mine as the reason for

[28] http://teghout-old.vallexgroup.am/images/docs/Short_Infromation_On_Company_9.12.2014.pdf
[29] Statement on investments by international and other organizations in Syunik marz of Armenia in 2010 (Annex 2) http://syunik.gov.am/files/docs/69.pdf
[30] http://www.mnp.am/?aid=2585

health and agricultural problems[31]")
Significant work in this process is carried out by environmental information centers Aarhus operating in all countries parties to the Aarhus Convention, which has the biggest network in Armenia - 15 centers in marzes of the country and Yerevan, actively participating in the processes of organization and conduction of public hearings. Independent experts are invited to make the stakeholder voice heard by relevant authorities. This is important also for educational/learning purposes. For instance, public hearings and discussions on metal mines, approval of designs, launch and operation of tailing ponds in marzes of Aragatsotn, Lori, Syunik (e.g. "Public hearing in Melikgyugh[32]", "Final public hearings on expansion of gold multimetal mine in Armanis on May 8[33]", "Dundee Precious Metals Kapan" CJSC and Kapan Aarhus Center's 2015 joint actions were clarified[34]").

Work Conditions and Rights

Technical conditions for work are specified by design documents as per relevant technical norms. In terms of livlehood special attention is paid to water supply, water disposal, ventilation, dust collecting, controllin noise and vibration levels within specified limits, as well as keeping production area free from waste, hazardous substances (explosive, poisonous substances) to the extent possible.
Potable water supply of mines is carried out from the watersupply network of the nearest community or a better-positioned water source.
Technical water for dust sedimentation at work platforms and nearby motorways is taken from open waterways – rivers, creeks or wells. In hot seasons of the year watering machines are used.
Disposal of water (including precipitation) is carried out through grooves existing in the terrain or by building appropriate ruts (culverts).
Work conditions are ensured as per relevant sanitary and technical normatives, and control is carried out by labor oversight bodies in cooperation with the employees.

Migration

The main source of information about migration is the Household Integrated Living Conditions Survey (HILCS) carried out by the National Statistical Service of the Republic of Armenia providing information about location and reasons for departure of household members of 15 and over involved in migration processes (the results of the last survey are also published in Social Snaphot and Poverty in Armenia according to 2013 Integrated Household Survey outcomes).[35]
Armenia still lacks established integrated administrative information sources about migration. The State Registry of population of Armenia is in the phase of completion. There is also border management information system available in the country providing information about crossings of border and administrative recordings of the number of people who cross the border.
According to the results of the 2013 HILCS, members aged 15 and over of 7,8% of households have been involved in internal and external migration processes during 2010-2013, comprising 9,6% of total number of household members of 15 and over. In the reporting period 28,7% of movements of the 15-year-old and over household members involved in external and internal

[31] http://www.azatutyun.am/content/article/25354352.html?utm_source=dlvr.it&utm_medium=facebook
[32] http://aarhus.am/?page_id=2662
[33] http://aarhus.am/?page_id=9861
[34] http://aarhus.am/?page_id=8586
[35] RA NSS, World Bank, 2014, Chapter 1. "Demography and Migration", page 23-26, http://www.armstat.am/file/article/5.poverty_2014a_2.p df

migration has been in-country as of 2013, to Yerevan and marzes of Armenia and NKR, the remaining 71,3% has been interstate with an overshelming share of 90% to Russian Federation. In fact, according to respondents for the majority of household members departed for/arrived in Russian Federation and other countries the main reason for departing /arriving has been employment, job seeking and seasonal work.
Reasons for and main directions of migration, 2013

Table 13. Migration Reasons and Main Trends

Main reason for departure	Location							
	Yerevan	Marzes	RF	Other CIS countries	European countries	USA and Canada	Other	Total
1.Employment	4.5	1.0	89.3	1.9	1.3	0.6	1.5	100
2.Job seeking	2.6	0.0	95.5	0.0	1.9	0.0	0.0	100
3.Family	8.5	14.7	64.3	0.0	9.0	0.9	2.6	100
4.Visiting frineds/ relatives	0.0	13.4	69.8	0.0	0.0	16.8	0.0	100
5.Studying and training	71.6	7.7	14.2	0.0	3.2	0.0	3.3	100
6.Medical	0.0	0.0	68.0	0.0	8.9	23.1	0.0	100
7.Other	8.1	40.0	1.1	1.3	0.0	0.0	49.5	100
Total	8.7	10.3	65.7	1.4	1.7	0.8	11.4	100

Source: National Statistical Service of the Republic of Armenia

The main specificity of internal migration for the purpose of employment inside the country is that the chief end of migration are big cities sometimes with no certain prospects at that, to find any job. Whereas in mining works mainly population of the neighboring communities is involved. Those jobs are very limited and they address employment issues partially.

3.2 Impacts on human health

The assessment of impact on human health has some specific characteristics. First, the diseases that can be considered to be directly or indirectly related to environmental pollution are not absolutely defined. While some illnesses emerge in a short period of time, others take months or even years to come to light, complicating the identification of cause-and-effect. However, according to expert opinion, ceratin illnesses are catalyzed by contaminants in the air, water and soil, which can be transferred to humans through crops. However, the lack of comprehensive studies and information in Armenia make it difficult to identify with reasonable certainty the scale of the impact. According to certain expert assessments, illnesses range from infectious, parasitic, respiratory, gastrointestinal, tumors, allergies and other maladies. According to information from the Ministry of Health, illnesses and diseases are on a growth trajectory in Armenia, accelerated by the inability of a substantial portion of the popluation to receive proper healthcare due to the high poverty rate in the country, officially at 32%.

Morbidity of population in Armenia per one-hundred-thousand residents.

Table 14. Illness Rates (per 100 thousands popolulation)

	2008	2009	2010	2011	2012	2013
Infectious and invasion diseases	2146.8	2241.5	2497.1	2628.9	2785.8	2479.1
Tumors	264.8	279.7	268.7	293.1	334.9	332.3
Respiratory diseases	10090.2	12682.7	11898.6	11017.5	11495.6	12008.9
Digestive organ diseases	1388.2	1369.2	1438.9	1455.4	1625.0	1676.3
Diseases of skin and hypodermic cellulose	1156.0	1240.8	1382.0	1406.5	1672.1	1662.8
Injuries and poisonings	1703.7	1748.7	1726.9	1758.6	1893.3	1913.2

Source: Ministry of Healthcare of the Republic of Armenia

Some experts believe that mining activity exposes the population in the surrounding area to a high risk for maladies and illnesses such as high blood pressure (Melik village area).

View the issue from the definition of qualitative assessment indicators, it is easier to conduct moinitoring of water quality, particularly potable water. This is carried out by the relevant agency at the Health Ministry, and the correspoinding results are publicly available.

From the point of view of assessment of the impact of atmospheric emissions, currently there are difficulties in measuring the presence of 2.5 μm and 10 μm (and in the near future also 1 μm) diameter particles in the air, dangerous to human health impact.

3.2.1 Case of Akhtala Community, Armenia: Environmental and Health Consequences of Mining Industry[36]

The Republic of Armenia (RA) is a lower middle income country with a population of 2,871,771 and an area of 29,743 km^2 located in the South Caucasus region at the mean altitude of 1,800 meters above sea level (RA National Statistical Service, 2013a, 2013b; World Bank, 2014). It is bordered by Georgia to the north, Azerbaijan to the east, Turkey to the west and Iran to the south (RA National Statistical Service, 2014). Forests make up 11.2% of the country, 11.1% is classified as special protection territory, 68.9% is agricultural land and 8.8% of the land is reserved for other purposes (RA National Statistical Service, 2014). The nine largest rivers of Republic of Armenia are Aghstev, Akhuryan, Araks, Arpa, Debed, Hrazdan, Pambak, Qasagh, and Vorotan. The largest lake is Sevan, which has an area of 1,275 $meter^2$. The country is divided into 10 marzes or regions (Aragatsotn, Ararat, Armavir, Gegharkunik, Lori, Kotayk, Shirak, Syunik, Vayots Dzor and Tavush). The capital city is Yerevan (RA National Statistical Service, 2014).

According to Armenia's National Statistical Service mining and quarrying is the largest industry of the country by volume of production (RA National Statistical Service, 2013b). The metal resources of the country include iron, copper, molybdenum, lead, zinc, gold and silver (RA Ministry of Energy and Natural Resources & Armenian Development Agency, 2011; RA National Statistical Service,

[36] Author – Ruzanna Grigoryan

2013b). Under-regulation has resulted in increased foreign investment in the mining sector of the country (Ishkanian, Gyulkhandanyan, Manusyan, & Manusyan, 2013). As a result of the recent growth of the mining and quarrying industries, there are currently 670 mines in Armenia, including 30 base metal mines, fourteen of which are gold and gold-polymetallic mines, seven copper-molybdenum mines, four copper mines, two polymetallic mines, two iron-ore mines and one aluminum mine (ALS Minerals et al., 2011). Of the 30 base metal mines, 22 are currently in operation (ALS Minerals et al., 2011). Additionally, Armenia has 19 tailing ponds - 9 currently active, 8 in cultivation phase, 1 ready for utilization and 1 abandoned, with no officially responsible party (RA Ministry of Emergency Situatoins, 2013).

The main pollutants produced as a result of mining and smelting activities that are dangerous to human health are heavy metals including but not limited to lead and arsenic. Lead does not degrade in nature (Agency for Toxic Substances and Disease Registry (ATSDR), 2007b). It has high bioaccumulation and is toxic for both the environment and human health. Lead is a possible human carcinogen (B2) which means that there is sufficient evidence that it is carcinogenic for experimental animals and almost sufficient evidence that it is carcinogenic for humans (Agency for Toxic Substances and Disease Registry (ATSDR), 2007b). There is no safe dose of lead for the human body - even a small dose may affect a child's neurobehavioral development. In other words, there is no evidence-based threshold for safety (US Environmental Protection Agency, 2014). Nonspecific symptoms of lead poisoning include headache, weakness, muscle or joint pains, loss of appetite and insomnia (The Risk Assessment Informaiton System, 2013). More specific signs of exposure to lead are metallic taste in the mouth, colic that may occur with abdominal pain and constipation, anemia, impaired function of the liver, signs of neurotoxicity as a result of damage to the central nervous system (malaise, irritability, dizziness, headache, lethargy, forgetfulness, vomiting, ataxia, visual disturbance), nephropathy, and chromosomal defects (The Risk Assessment Informaiton System, 2013). Children are more vulnerable than adults to lead exposure (US Environmental Protection Agency, 2015a). The reasons include tissues more sensitive to lead exposure due to anatomic-physiological structure, not fully developed brain blood barrier, poor hygiene, active hand-to - mouth activities, higher absorption of lead and higher dose of exposure because of low body weight (Ide & Parker, 2005; US Environmental Protection Agency, 2014). Lead may lead to decreased intelligence, shortened attention span, reading, learning and hearing disabilities, and hyperactivity among children (US Environmental Protection Agency, 2015b).

Arsenic is classified as metalloid indicating that it has chemical and physical characteristics typical for both metal and non-metal elements (Agency for Toxic Substances and Disease Registry (ATSDR), 2007a). There are three types of arsenic: inorganic, organic, and arsine gas (International Agency for Research on Cancer, 2012). The sources of inorganic arsenic are copper and lead containing ore and smelting activities. (Agency for Toxic Substances and Disease Registry (ATSDR), 2007a). According to the International Agency for Research on Cancer inorganic arsenic is a known human carcinogen (International Agency for Research on Cancer, 2012). Arsenic may cause rhinitis, bronchitis, laryngitis, hypotension, arrhythmias, cyanosis of fingers and toes, Raynaud's disease, nausea, vomiting, diarrhea, abdominal pain and hemorrhage, anemia and leucopenia, hepatic injury, dermatitis, encephalopathy, spontaneous abortion, and low birth weight (Agency for Toxic Substances and Disease Registry (ATSDR), 2007a).

Akhtala is a small town located in the northern part of Lori marz, situated along the Debed river, close to the Georgian and Azerbaijani borders. Akhtala is 4.3 square kilometers in area and has a population of 2,400 (55% female) (RA Lori Marzpetaran, 2014). The town is divided into the following four districts – "Transport", "Svinets", "Barit" and "Sarahart" (Petrosyan, Grigoryan,

Melkomian, & Akopian, 2014). Akhtala has a Soviet-era underground mine and an open pit barite-poly-metallic mine (Bekchyan, 2013; Zoï Environment Network, 2012). It also has a processing factory – "Akhtala Mountain Enrichment Combinat," which processes the copper ore extracted from Akhtala and Shamlugh, a nearby town (Bekchyan, 2013; USAID, 2014). Mining has been taking place in Akhtala for approximately 250 years. The mine ceased operations in 1990s with the economic collapse after the fall of the Soviet Union. In 2001, Akhtala's mine was privatized and its operation restarted. Currently the annual production of the mine in Akhtala is 12,000 tons (USAID, 2014). It is estimated that with the current exploitation rate the mine will have a lifetime of 25 years. The mine has three tailing ponds (Zoï Environment Network, Environment and Security Initiative, 2012). The first called "Nazik" is non-operational and located below the church, in the center of town (RA Lori Marz Rescue Department of the Ministry of Emergency Situations, 2014). The main operating "Nahatak" tailing pond is located 8 kilometers from Akhtala. The third tailing pond "Paytutsik Nyuteri Dzor" is located 2 kilometers outside of Akhtala (RA Lori Marz Rescue Department of the Ministry of Emergency Situations, 2014).

There have been several attempts to assess the environmental and public health risks stemming from mining in Akhtala. In a study conducted in 2001, Petrosyan and colleagues revealed that 11% of soil samples taken from the yards of residential areas and 17% of loose soil samples taken from the front of the residential buildings exceeded the Maximum Allowable Concentration (MAC) for lead, which is 400 mg/kg (Petrosyan et al., 2004). Moreover, 58% of soil samples exceeded the MAC for arsenic, which is 12 mg/kg (Petrosyan et al., 2004).

The American University of Armenia School of Public Health (AUA SPH) in partnership with Blacksmith Institute conducted several studies and community empowerment activities in Akhtala from 2012-2014 (Petrosyan et al., 2014). The first study was the Initial Site Screening conducted in 2012. It targeted Akhtala along with 18 other mining and smelting communities in Armenia (Petrosyan et al., 2014) . The Screening included general observation of the potentially toxic site and community, and testing of soil samples taken from the community for heavy metals. At the moment of observation the researchers identified the following potential toxic sources: the re-cultivated "Nazik" tailing pond; tailings discharge from the processing factory into the river due to the damaged pipes; and yellow abandoned tailings located across the river, isible from the Akhtala churchyard. In addition to their observations, the research team also collected seven soil samples from Akhtala – two targeted (from the churchyard and a kindergarten playing yard) and five composite (from gardens in "Transport" and "Svinets" districts, from the front-yards of houses in "Transport", "Svinets" district as well as from the front of the entrances of multi-storied buildings in the "Sarahart" district). According to the results of the laboratory analysis of the various soil samples, the research team concluded that all seven soil samples exceeded the MAC for arsenic; lead levels exceeded MAC in the churchyard sample, front-yard sample in "Transport" district and garden samples in "Svinets" and "Transport" districts. The most polluted area was the churchyard where the level of arsenic and lead exceeded the MAC by 12 and 11 times, respectively (Petrosyan et al., 2014).

Following the Initial Site Screening, the American University of America School of Public Health conducted a thorough environmental risk assessment in Akhtala in 2013 (Petrosyan et al., 2014). Overall, 202 targeted surface samples were taken from all 4 districts of the town. The samples were categorized into the following sample types – 111 yard samples, 37 garden, 20 school/kindergarten yards, 20 churchyard, 9 background (taken from the depth of 10 or 20 cm), 5 tailing pond samples taken from "Nazik". The samples were collected, stored, transported, prepared and analyzed via an XRF testing machine based on the pre-developed evidence-based protocols. The research team

found that the lead in 26.7% of all soil samples (54/202) exceeded the MAC (400 mg/kg) with the geometric mean (GM)[37] of 294 mg/kg. The geometric mean of lead was below the Maximum Allowable Concentration for lead. For arsenic 93.6% (169/175) of samples exceeded the MAC (12 mg/kg) with the GM of 38 mg/kg. The geometric mean of arsenic was 3.1 fold the Maximum Allowable Concentration for arsenic. The most polluted districts were those located nearest to the processing factory and "Nazik" tailing pond – "Transport" district with 40.5% and "Svinets" district with 27.0% of samples exceeding MAC for lead. Less polluted districts were "Sarahart" and "Barit" with only 4.0% and 10.6% of samples exceeding MAC for lead, respectively. Arsenic exceeded the MAC in more than 93% of samples in all four districts. The most polluted sample type in the community was the churchyard where 95% of soil samples exceeded MAC for lead with GM exceeding the MAC by 13 times. Arsenic in the churchyard was above MAC in all samples with the GM exceeding the MAC for arsenic by 5 times. The second most polluted sample type was those taken from gardens, followed by yard samples (Petrosyan et al., 2014).

Following the environmental risks assessments the AUA School of Public Health conducted another study to assess the level of lead in blood samples taken from children 4 to 6 years of age from three communities of Armenia: Akhtala, Alaverdi, and Erebuni district of Yerevan (Petrosyan et al., 2014). Overall 162 children were tested by a LeadCare II Analyzer – 39 from Akhtala, 69 from Alaverdi and 54 from Yerevan Erebuni district. Approximately 53% of children were males. Nearly 26% of the children had a family member working in a mine, processing factory or a smelter. Though scientific literature reports there is no safe level of lead in blood, the Centers for Disease Control and Prevention (CDC)-recommended 5mcg/dl was selected as a reference level for lead in blood. In Akhtala 84.6% of children exceeded the CDC-recommended reference level with a geometric mean of 6.8 mcg/dl. In Alaverdi 75.4% of children exceeded the reference level with a geometric mean of 6.4 mcg/dl. The least exposed community was Yerevan's Erebuni district with 57.4% of children exceeding the reference level of lead in blood with a geometric mean of 5.2 mcg/dl. The percentage of children in Akhtala exceeding the reference level of lead in blood was statistically significantly higher compared to the same percentage for children from Yerevan's Erebuni district. The percentage of children in Alaverdi exceeding the reference level of lead in blood was also statistically significantly higher compared to Yerevan. No statistically significant difference was found between Alaverdi and Akhtala. This data suggests that children from Akhtala and Alaverdi are at higher risk for lead exposure than children from Yerevan (Petrosyan et al., 2014).

In addition to the studies assessing the environmental and health risks in Akhtala, the AUA School of Public Health also conducted community capacity building and empowerment activities (Petrosyan et al., 2014). An evidence-based training package was developed based on the international and local literature review. It covered the environmental and health risks from the mining industry in general and the health consequences of heavy metals, in particular. Using the final results of the above mentioned environmental and health risk assessments conducted in Akhtala, AUA SPH developed preventive measures to reduce the associated risks among the general population and particularly among children, the most vulnerable segment of the population. From December 2013 to July 2014, ten training sessions were conducted in Akhtala for 122 community members that included various stakeholder groups such as the staff of kindergartens and schools, healthcare providers, representatives from mayor's office, active community members, parents of young children, and high school students. To assess the effectiveness of the training sessions, pre-training and post-training evaluations were conducted with the participants to measure the

[37] Geometric mean is a specific way of averaging data by multiplying N numbers and taking Nth root of the multiplication.

difference in their knowledge, if any, before and after the training. This assessment found that the knowledge score of the participants was statistically significantly increased by 39.0% as a result of attending the training (Petrosyan et al., 2014).

The research team in close collaboration with 15 community members from NGOs, the local council and the mayor's office, conducted an assessment of Local Needs and Capacity followed by a Local Action Plan to reduce the environmental and health risks due to the mining industry in the community (Petrosyan et al., 2014). The most urgent preventive action recommended by the Local Action Plan was clean-up of the Akhtala churchyard. For this purpose a more thorough assessment of the churchyard was recommended to find a more comprehensive and detailed picture of the pollution at that site in terms of shape and depth. It was also recommended that this be followed by the technical design of remediation and implementation plans (Petrosyan et al., 2014).

3.2.2 Mining and Reproductive Health Issues in Lori region[38]

Heavy metals and sulfur dioxide can adversely affect the reproductive health of women. The main aim of this study was to determine the prevalence of reproductive health problems, particularly infertility, birth defects, stillbirths, induced abortions due to medical indications, early neonatal mortality (newborn died within 7 days after birth) and check if there was an association between living near a polymetalic smelter (as a proxy measure for being exposed to heavy metals and sulfur dioxide) and the reproductive health problems.

This study was done in the towns of Alaverdi (Lori region) and Artik (Shirak region) in 2013 in the scope of the Masters project (Sargsyan et al, 2013) at the American University of Armenia School of Public Health (AUA SPH) with the assistance from the Center for Health Services Research and Development (CHSR) at AUA. The research team prepared the study proposal and received ethical approvals to conduct a survey involving 370 participants (women of reproductive age who were married at the time of the survey or have been married before) from Alaverdi and 370 participants from Artik, the town used for comparative purposes.

The instrument of the study was a self-administered questionnaire. The main outcome variables of interest were infertility, miscarriages, induced abortions due to medical indications, stillbirths, early neonatal mortality, and birth defects. The main independent variable of the study was living in Alaverdi (proxy measure of being exposed to heavy metals and sulfur dioxide) or Artik (proxy measure of not being exposed to heavy metals and sulfur dioxide). The team entered the survey results in STATA database (Stata, 2015) and conducted analysis. The results showed the risk of having stillbirth was 2.38 times higher (OR=2.38; 95% CI: 1.07- 5.26; p= 0.033) (Szumilas M, 2010), the risk of having an induced abortion due to medical indications (health/life threatening pregnancy, congenital defects, dead fetus) was 2.67 times higher (OR=2.67; 95% CI:1.31 – 5.45; p=0.007), and the risk of having early neonatal mortality was 2.67 times higher (OR=2.67; 95% CI: 0.98 - 7.26; p=0.054) among women living in Alaverdi compared with women living in Artik after adjusting for confounders (extraneous variables that correlate with both the dependent variable and the independent variable, and can bias the relationship between them; e.g. endocrine diseases, infections, etc.)

<u>Introduction</u>

[38] Author – Aelita Sargsyan

According to the Centers for Disease Control and Prevention (CDC) of the United States of America (US) many factors can alter the reproductive health of a woman and her ability to give birth to healthy children (CDC, 2013). Among the most frequent effects of reproductive hazards are infertility, miscarriage, birth defects, neonatal mortality, and stillbirths (NIOSH, 1999). Exposure to sulfur dioxide can lead to fetal death, preterm birth, miscarriage and stillbirth (OEHHA, 2011). Exposure to heavy metals, such as arsenic, lead, cadmium, can affect both female and male reproductive functions leading to various reproductive problems (Lindbohm et al., 1991; Telisman et al., 2000).

Environmental pollution containing heavy metals and sulfur dioxide can occur during the smelting process. Armenia is a country with significant reserves of polymetallic ores. Approximately 670 construction material and aggregate mineral mines exist in Armenia, among which are 400 active mines (including 22 metal mines) and 270 inactive mines (including 8 metal mines) (MENR, 2011). Armenia's largest polymetallic smelter is located in Alaverdi (Lori region, population: 16,500 people). The smelter operated in low capacity from 1990 to 2000, producing only 535 tons of copper in 1999 (Nazaryan G, 2009) and in its full capacity since 2001 (Levine and Wallace, 2001), producing 4955 tons of copper in that year. The emissions released into the air from the stack of the smelter contain sulfur dioxide, with a concentration 10.4 times higher than the maximum allowable concentration (MAC) (Environment Canada, 2005; Nazaryan G, 2009).

In 2001 a study was done to analyze heavy metals in residential soil and dust in Alaverdi. It showed that the lead levels in 44% of yard soil and 77% of exterior loose dust samples exceeded the US Environmental Protection Agency standard of 400mg/kg (US EPA, 2001). The levels of arsenic in 50% of yard soil and 70% of loose dust samples exceeded the remediation level of 80 mg/kg (Petrosyan et al., 2004).

The main aim of this study is to determine if there is an association between living near the polymetalic smelter in Alaverdi (as a proxy measure for being exposed to heavy metals and sulfur dioxide) and reproductive health problems after controlling for other reproductive health risk factors. A further aim of the study was to estimate the prevalence of reproductive health problems.

The objectives of the study are:

- To estimate the prevalence of infertility, birth defects, stillbirths, induced abortions due to medical indications, early neonatal mortality among women of childbearing age in the towns of Alaverdi (Lori region) and Artik (Shirak region).
- Explore associations between living in Alaverdi and Artik and reproductive health problems after controlling for other reproductive health risk factors.

Methodology

A cross-sectional survey was conducted by the study team in Alaverdi and Artik to address the study objectives. The target population of the survey included adult women of reproductive age (18-49) living near the polymetalic smelter (Alaverdi) and the comparison town (Artik). Artik, a town in the Shirak region of Armenia, had a population of 17,400 in 2009. (NSS, 2012). Artik is chosen as the comparison town because there are no metal mining or smelting activities there. Moreover, Lori and Shirak regions were found to be similar in several aspects such as basic sources of livelihood, age and gender distribution of the population and education level. (NSS, 2001). The study sample size was 370 women in Alaverdi and 370 women in Artik.

A multistage cluster sampling was used for the study. The first stage was selection of starting points of clusters through systematic random sampling from the 2013 RA Presidential election lists. The second stage was the selection of 10 participants in each of the 37 clusters in each town. (see Appendix).
The study instrument was a self-administered questionnaire, which was developed based on the Reproductive Health Survey Instrument of the US Institute for Health Metrics and Evaluation. (IHME, 2005). The 73 questions that made up the questionnaire were divided into the following domains:

- Reproductive health history (including pregnancies, infertility, miscarriages, stillbirths, abortions and birth defects
- Other health issues
- Behavioural factors
- Demographic/socioeconomic data

Results

The mean age of participant women from Alaverdi was 34.99 (SD: 7.89) and 33.91 (SD: 7.94) in Artik (Bland and Altman, 1996). More than half of the women in both towns mentioned having at least 2 children (52.10% in Artik and 55.75% in Alaverdi). The mean body mass index (BMI) (which is calculated by the formula: weight (kg)/[height(m)]^2) of participants from Alaverdi was 24.84 and 24.21 from Artik (WHO, 1995). The respondents from both Alaverdi and Artik were mainly unemployed - 66.76% in Alaverdi and 73.51% in Artik. The distribution of participants according to family monthly expenditures was almost the same in the two towns:

Table 15. Monthly Family Expenses Allocation

Family monthly expenditures	Alaverdi	Artik
<50,000 AMD	29.17%	25.89%
50,000 – 100,000 AMD	32.22%	33.61%
101,000 – 200,000 AMD	28.33%	30.58%
201,000 – 300,000 AMD	7.22%	7.99%
> 301,000 AMD	3.06%	1.93%

Table 16. Prevalences of reproductive health problems in Alaverdi and Artik

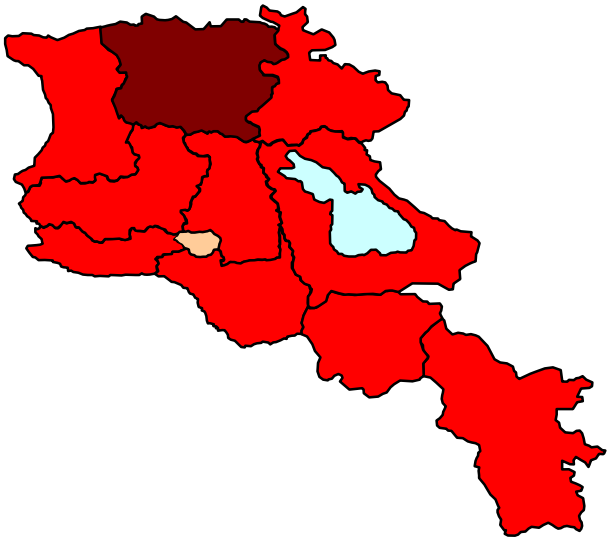
Reproductive problem	Alaverdi	Artik
Miscarriages	18.11%	22.97%
Infertility	16.22%	17.03%
Birth defects	2.70%	1.89%
Stillbirths	5.95%	2.43%
Induced abortions due to medical indications	7.57%	2.97%
Early neonatal mortality	4.32%	1.62%

After adjusting for confounders the risk of having stillbirths was found to be 2.38 times higher among women living in Alaverdi compared to women living in Artik (OR=2.38; 95% CI: 1.07- 5.26; p-value 0.033), having early neonatal mortality was 2.67 times higher in Alaverdi (OR=2.67; 95% CI: 0.98 - 7.26; p-value

0.054) and having induced abortions due to medical indications - 2.67 times higher among women living in Alaverdi compared to women living in Artik (OR=2.67; 95% CI:1.31 – 5.45 ; p value 0.007).

This cross-sectional study found significant differences in the reproductive health of women of reproductive age living in Alaverdi, the smelter town, and Artik, the comparison town. These differences could be the result of women in Alaverdi being exposed to pollution from heavy metals and sulfur dioxide.

3.3 Impacts on Sustainable Development (Lori Region)[39]



Marz center: *city of Vanadzor*
Regions:
Spitak, Stepanavan, Tashir, Tumanyan, Gugark
Cities:
Vanadzor, Spitak, Stapanavan, Alaverdi, Tashir, Akhtala, Tumanyan, Shamlugh

General Information

Lori marz is rich with various minerals and is the second in the Republic of Armenia by its significance. Minerals are represented mainly by capstones of intrusive origin, sand-gravel mixes, and basalts; metal minerals include copper, molybdenum, gold. Companies involved in mineral mining and geological studies are demonstrating activation of geological exploratory works in new and previously incompletely explored areas of the subsoil.

According to the four-year regional community [development] program (without marz centers) the total amount required for funding of sectoral capital projects comprised 29 billion 972.86 million drams, and 8 billion 226.39 million drams for the city of Vanadzor. Generally funding of 2014-17 Lori marz social-economic development program comprised 162 billion 741 million 708.7 thousand drams.

Lori is in the 5th place by its share in the total volume of industry of Armenia. Currently in the industrial complex of the marz, by volume of production, the potential is concentrated in Tumanyan region, Vanadzor has about 50 operating enterprises with around 2500 employees. Of the operating enterprises 6 are large, the other 120 represent small and medium productions with only 30% of industrial employees. About 40% of small and medium enterprises in the marz are agriproduce processing and food production companies. Stone processing shops also comprise a significant number; there are wood processing, energy and other enterprises.

[39] Author – Erik Grigoryan

In recent years the volume of industrial production in Lori marz has grown significantly and in 2008 comprised 7.1% of industrial output of the Republic of Armenia versus the former 5.6%, which in terms of money is over 80 billion drams compared to 42 billion.

Table 17. Volume Rates of Industrial Products in Lori Region

	Lori Marz of Armenia				
	2008	**2009**	**2010**	**2011**	**2012**
Volume of industrial output at current prices	42,378.4	44,048.2	60,052.0	73,582.7	80,043.7
Sale of finished products at current prices	41,420.2	46,060.2	62,286.3	74,509.0	77,551.7
Index of physical volume of industrial products, %	98.9	105.0	111.3	115.2	113.7
Volume of industrial production, %	5.6	6.6	7.3	7.4	7.1

A significant share in total volume of production of the marz belongs to ACP CJSC of Alaverdi, Akhtala MEC CJSC, Sagamar CJSC, AT Grain LLC, Dzoraget Hydro LLC (DzoraHES), Avtogen-M LLC.
During 2008-2012 processing industry dropped by about 10% and contrary to that the share of subsoil utilization increased by 11%.
In 2010-13 large investments of around 151 billion drams were made in industrial sector of the marz. The big portion of capital investments, around 300 milion US dollars, was made in Teghut CJSC of Valex group of companies (for construction of Teghut copper-molybdenum mine and adjacent enrichment factory) and by Sagamar CJSC - around 12 million US dollars (for construction of Armanis gold-multimetal mine and processing company).
During 2010-13 large investments in mining sector will result in drastic increase in the share of mining industry in coming four years with production volume of the sector increasing about 7 times to reach annual 85 thousand tons in average by only copper concentrate, over 70 billion drams in terms of money.
As of 1 June 2013 around 50 organizations were licensed to carry out mining activities, of which 5 operated metal mines (operating are copper mines in Alaverdi, Shamlugh, gold-multimetal mines of Mghart and Armanis and copper-molybdenum mine of Teghut).

Agriculture

Lori marz indicators of the agricultural sector show that the share of the region in agriculture comprised 7.1 of Armenia's agricultural sector production - 59.7 billion dram total output in 2012.
Some 32% or 54939 ha usable agricultural land is privatized, including 83% or 32430 ha of arable lands of which 27.8% or 8712 ha is irrigated, 74.3% or 1029 ha is used for perennial plantings of which irrigated is 975 ha, and 54.7% or 21480 ha of hayfields. One rural household possesses 0.6 ha

arable land and 1 ha hayfield in average. Annually around 8.4 thousand ha arable land in average is not circulated for various reasons.

Areas under crops comprised 23612 ha in 2012, of which 9691 ha were grain crops, 3712 ha potatoes, 1359 ha vegetables with a yield of 212, 544 and 180 centner respectively, while the crop of melons and watermelons, fruits and berries and grapes comprised 300, 175 and 1061 centner respectively.

Of key importance for agricultural development of the marz is undertaking of complex ameliorative measures, an important component of which is improvement of irrigation systems as without artificial irrigation it is not possible to organize intensive production of agricultural products. Currently irrigated lands of the marz comprise 9612.1 ha, watering of which is carried out through 4 big interfarm canals, viz. 36 km long big Canal of Nalband, Lori Main Canal with its dotation canals with total length of 62.81 km, 9.3 km long Kirov Canal and 17.2 km long Ayrum-Jojkan main Canal, as well as 12 pump stations and over 400 km long intra-farm irrigation networks which currently are in severe destruction completely.

Various development projects were carried out also in agricultural sector, for instance the 2012 Community Agricultural Resource Management and Competitiveness project providing 25 million drams for the purpose of co-funding support to several communities in Lori marz.

Table 18. Agricultural Support Examples Through Separate Projects

	2010	2011	2012
Provision of zinc phosphide for fighting mouse like rodents, kg	2.714,0	2.680,0	1441,4
Centralized measures against locust, ha	1.360	360	
Nitric fertilizers, ton		2000	2134
Corn seeds provided to the marz, kg	-	11,0	--
Spring barley seeds provided to the marz, ton	--	190	--

Animal husbandry in the marz was represented by 81540 heads of which cows comprised 39127, pigs 13701 and sheep and goats 32190 as of 2013 January 1. Some 4000 tons of meat, 2100 tons of milk and 2,1 million eggs were sold.

Table 19. Agricultural machinery in the marz.

Name of Item	Available number (piece)		Of which in working condition (piece)		Ratio of available and working machinery, %	
	Lori marz	Armenia	**Lori** marz	Armenia	**Lori** marz	Armenia
Tractors of all models	1700	14683	1350	11625	79.4	79.2
Grain combines	110	1362	87	1005	79.1	73.8
Tractor trailers	706	6075	671	5284	95.0	87.0
Tractor mowers	406	1971	370	1693	91.1	85.9

Forage harvesters	14	347	10	246	71.4	70.9
Seed cleaner machines	43	432	35	364	81.4	84.3
Tractor drill seeders	144	1866	126	1615	87.5	86.5
Tractor ploughs	390	3809	348	3425	89.2	89.9
Cultivators	212	2210	185	1898	87.3	85.9
Collector-crushers	140	1524	110	1314	78.6	86.2

Tourism

Tourism is one of priority sectors of Lori marz development. Lori with its geographical position, natural-climatic conditions, and rich historical, cultural as well as natural heritage has a big potential for tourism development. There are about 40 entities involved in hotel business operating in the marz (hotels, holiday houses, guesthouses, restaurant-hotels, sanatoriums, rest and children's camps) with total capacity of about 750 man/days. Observations show that around 400 thousand tourists visit Lori marz during the tourist season.
Armenia's Lori marz and France's Provence-Alpes-Côte d'Azur region within the scope of international cooperation planned to carry out tourism and agro-tourism development projects worth up to 80 thousand Euros. Based on the rich advanced experience of the French party it was designed to establish a regional office of tourism in Tumanyan region (city of Alaverdi).
Supported by Rhône-Alpes region Decines-Stepanavan organization jointly with Stepanavan City Hall and Informational Center was planning to implement eco-tourism development project in the city of Stepanavan and neighboring communities. The term of the project was 2 years; the beginning of it was in the second half of 2013. The project plan included development of hiking trails, training of hiking trip guides and local role players, mapping and upgrading of the material and technical resources.

Lori Marzpetaran undertook specific steps aiming at tourism development. Mainly, it initiated to establish the Lori Tourism Foundation with participation of 7 communities in Tumanyan region (Alaverdi, Akhtala, Tumanyan, Odzun, Ardvi, Haghpat, Dsegh) targeting the maintenance and operation of a marz office of tourism to be built in the city of Alaverdi, as well as implementation of other tourism development projects in the marz.

Regional Development

Development of marz and community infrastructures is an important priority of Lori marz development program. Main problems of infrastructure development in the marz are relating to roads of marz and community significance which were in poor condition (particularly in rural settlements), potable water supply (including implementation of up to date technologies and improvement of quality), sewage (including reconstruction and building of cleaning facilities), as well as gas supply issues. These problems are particularly of prior importance for border communities and those with larger number of population.
In 2014-17 approximately 15 billion 542 million dram total investments are required for roads of marz significance in urgent need of repair. Strategic financing of water supply sector comprises 8 billion 691.074 million drams, gas supply will require 2 billion 256.78 million drams.
Main communities relating to mining industry are:
The city of Alaverdi (13.8 thousand permanent residents as of January 2013) is on the river Debed (167 km far from Yerevan, 55 km from Vanadzor). The city was founded after construction of the

copper smeltery. Re-launched copper production is currently active and accounts for a solid share of Lori marz economic indicators.
The town of Akhtala having 2.1 thousand permanent residents as of 2013 January 1 is situated on a terraced terrain on the right bank of the river Debed (190 km far from Yerevan). City's industry is specialized in subsoil utilization (producing copper concentrate).
Shamlugh (807 permanent residents as of 2013 January 1) is a town on the left bank of the river Debed (196 km far from Yerevan, 77 km from Vanadzor). It is well known for its copper and silver mines and is considered one of the most significant mining centers in South Caucasus.

Human Resources

Along with 17% decrease of urban population in the marz the number of insecure (poor) people increased by 24%, while in rural communities the same indicators were 16% and 28% respectively. In fact a significant increase of poverty was recorded in Tumanyan and Tashir regions and Vanadzor urban community. At the same time an increased number of social pensioners and people with disabilities was recorded.
According to the National Statistical Service data the number of people with cardio-vascular diseases went up by 48% in the last 4 years, the number of patients with diabetes – by 28%, the number of people with tumors by 13%. Usually this kind of growth happens when no conspicuous steps are being undertaken to enhance population's knowledge in healthcare, and there is a very low awareness of early revelation and prevention of non infectious diseases yet. In other words some people are not aware of their diseases and do not apply to appropriate medical establishments.

Impacts on Sustainable Development

Agricultural, tourism and regional development sectors sometimes are in conflict with mining industry as lands fit for crop production and animal husbandry are being allocated for mining purposes, and considering that open mining is prevailing in Armenia then the damage to land resources is even bigger.

From tourism perspective the risks relate to the fact that mining districts are out of the scope of preference of tourists. Tourism in Armenia is mostly conditioned by the diversity of natural and cultural monuments, natural sceneries, while mining industry leaves significant negative imprint on all environmental components - atmospheric air, water and land resources.

The critical load is the maximum level of compounds flowing into the ecosystem with no chemical changes harmful for structure and life activity of the ecosystem occurring.

Impact of the main pollutants due to mining activity is identified on the following systems:

- Human health,
- Vegetation cover,
- Agricultural crops,
- Forest ecosystems,
- Surface waters,
- Buildings and constructions,
- Cultural and historical monuments,
- Land.

Sulfur dioxide generates acid clouds directly affecting the above ground organs of plants. Nitrogen dioxide is one of the main air pollutants which is produced particularly in the processes of burning/combustion and oxidation of natural fuels – gas, oil and coal. Ozone and other photochemical pollutants are secondary pollutants not emitted into the atmosphere directly but rather emerging in the result of photochemical reactions. Impact of ozone is the result of cumulative effect; moreover impact of ozone on plants depending on concentration is not linear: increased concentration brings about much bigger effects of exposure. Exposure to ozone and photochemical pollutants damages the leaves of plants, covering them with spots, accelerates defoliation, slows down vegetation and growth of trees, leaves become sparse, plant and tree morbidity increases, biomass and crops decrease.
An indication of the negative impact of polluted air is loss of weight of seeds of cereals and grain crops, for instance of wheat family. Known are also cases of overall drop of root crops, for instance potatoes, and perennial crops, for instance harvest of grapes, due to ozone exposure.
Ozone exposure slows down the growth of wintering organs of plants lowering cold resistance, environmental stress endurance and interspecific competitiveness of plants.
Heavy metals in atmospheric air are in the form of vapors, fine-dispersed particles and most toxic metal-organic compounds. Fine-dispersed particles, salts and oxides of metals are included in the composition of dust. Atmospheric precipitations also contain cations, soluble salts and complex compounds of those metals. The main sources of emission of heavy metals into the atmosphere are high-temperature technological and fuel combustion processes, mining industry, metallurgy, reemission from polluted areas, for instance through clouds of dust from the topsoil caused and scattered by wind.

Heavy metals are divided into two groups:

- Main priority pollutants - **Cd, Pb, Hg,**
- Long-term priority pollutants/contaminants - **As, Mn, Fe, Cu, Ni, Cr, Ti, V**

Generally heavy metals and their compounds have harmful effects on ecosystems, lands, plants, forests, and lead to degradation of the latter. Hazardous exposure to heavy metals and their compounds is particularly significant on surface waters and water ecosystems. Exposure to heavy metals is expressed by:

- Decrease in biomass, drop of vegetation speed,
- Damage and decline of crops,
- Drop of plant endurance,
- Accumulation of toxic substances in seeds, rootcrops, fruits, biomass and harvest,
- Accumulation of toxic substances in fodder,
- Accumulation of toxic substances in food.

Fine-disperse particles suspended in the air represent diverse mixes of nonorganic and organic substances in solid or liquid condition. Large suspended particles are the result of mechanical destruction of bigger fractions. These particles include dust brought by wind from farmlands and lands not covered with vegetation, unpaved roads and mining enterprises. Smaller-sized particles emerge in the result of condensation of vapors and gases of metals and organic substances. Particles also are produced due to various reactions of nitrogen and sulfur oxides in the air.

Contamination of water resources due to mining activities causes acidation of water of lakes and rivers, eutrophication, alteration of aquatic organisms and biomass, microbiological changes, drop of fish population, change of species composition.

On building and construction materials and monuments - concrete, limestone, dolomite rocks building stone, stone monuments, the impact is expressed by destruction of materials, degradation of quality, construction and aesthetic features, increase in technogenic dangers and accident risks. The 2014-2017 development program of Lori marz reads that industrial and environmental problems are closely interconnected in the marz. Rational analysis of the problems, adoption and implementation of an appropriate comprehensive program will lead to economic and environmental harmony in the marz. An important prerequisite is the upgrading of mining, wastewater, landfill facilities and treatment plants to mitigate environmental pollution in the marz. Regarding poor condition of forest areas the program articulates that it is necessary to forbid geological exploration and mining activities in those regions ***unquestionably***, if it is not a state priority strategic interest.[40]

The risks to subsoil utilization improvements in the marz are as follows:

- The overloaded sector and extremely close arrangement of mines;
- Environmental, ecological and technogenic undesirable changes caused by subsoil utilization (high level of contamination of land resources, air and water basins)
- Lack of cooperation between subsoil using and processing companies.

As per the Law on Targeted use of Environmental Fees Paid by Companies of the Republic of Armenia in relation to subventions provided to exposed communities in Lori marz including Alaverdi, Odzun, Haghpat, Akori, Hagvi, Akhtala, communities exposed to negative impact of Alaverdi copper smeltery and Akhtala Mountain Enrichment Combine shall receive allocations from the State Budget to carry out environmental and healthcare projects.

Under the Law on Targeted use of Environmental Fees Paid by Companies of the Republic of Armenia it is earmarked for exposed communities in Lori marz for 2015:

1. Community of Alaverdi - 94 677.0 thousand drams
2. Community of Odzun – 7 511.4 thousand drams
3. Community of Haghpat – 27 470.6 thousand drams
4. Community of Akori – 20862.2 thousand drams
5. Community of Hagvi - 30 000 thousand drams (2014)
6. Community of Akhtala - 4 500 thousand drams (2014)

As it is well-known negative impact on environment and agriculture is produced by tailings produced as a result of mine enrichment which alongside with heavy metals also contain various chemical reagents. There are 7 tailing ponds in Lori marz, which are mainly in administrative territories of Akhtala, Mets Ayrum, Koghes communities and obviously leave their negative impact on neighboring areas.

Lori marzpetaran proposed to verify through specialized organizations impacts and boundaries of compounds penetrating into neighboring lands from the tailing ponds through water erosion and

[40] http://lori.gov.am/files/docs/3185.pdf

weathering and include their owners, too, in the list of those who are exposed to harmful activities of companies for provision of addressed compensation.

To have the funds for community environmental projects at least doubled marzpetaran of Lori also suggested that Ministry of Nature Protection of Armenia jointly with other interested agencies helps communities which receive environmental allocations to submit their projects, with extended budgets and required criteria, to international donor organizations.

3.4 Impacts on the Natural Environment

In terms of impact on the environment, the mining industry is deemed to be amongst the most dangerous activities. The degree of impact depends on type of mining operation, the methods used for resource extraction and processing, the types of minerals and mining deposits present, and so on. However, there are certain activities that are carried out in practically all mining operations, and a brief analysis of such activities will elicit the main risks of mining.

During various periods of time, nearly 300 deposits of ferrous, non-ferrous, precious and radioactive metals have been explored in Armenia. Small mining deposits, high in quality ore, found in mountainous regions are of particular importance today. Nearly 15 such mining operations are expected to begin based on explorations of ferrous and non-ferrous metals deposits[41].

Mining operations are presented in all regions of Armenia. The main mines in Lori region are as follows:

1. Teghut's copper-molybdenum deposit
2. Alaverdi's copper deposit
3. Gold's poly-metallic deposit of Armanis region
4. Copper-pyrite deposit of Shamlugh
5. Qaraberd's gold mine
6. Arjut's gold mine
7. Fioletovo Gold mining region
8. Marts-Prvashen-Budaghidzor gold-poly-metallic deposit

In additions to the mines stated above, Lori region's city of Alaverdi is home to the only copper smelting plant in Armenia.

Main Environmental Risks of Mining Operations

Mining related activities that affect the environment

A. Mountainous fundamental activities:

- Construction of buildings, plants, etc.
- Constrction of roads
- Constuction of tailing ponds
- Storage of fuel, lubricants and other toxic substances
- Temporary storage of explosive materials

[41] Tamara Hovhannisyan: "MINING INDUSTRY ISSUES AND DEVELOPING PERSPECTIVES OF RA", ՀՊՏՀ, 2011

- Movement of heavy machinery and vehicles

B. Open-pit mining/strip mining activities:

- Excavation works carried out heavy machinery, construction equipment (excavators, bulldozers, trucks)
- Drilling and mechanical loosening
- Drilling and explosive loosening
- External waste dump fill

C. Ore extracting and processing activities:

- Drilling and mechanical loosening
- Drilling and explosive loosening
- Extraction and transfer (by excavators, bulldozers, trucks) to the processing plant (grinding mill, aconcentrator/milling plant)
- Grinding, milling, sieving

D. Ore processing activities:

- Extraction of metals
- Transfer and storage of mining waste

E. Mine closure and conservation activities:

- Dismantling and demolishing of construction site, buildings
- Technical and biological reclamation of the external waste dump
- Technical and biological reclamation of the mining cavities
- Restoration of landscape

Main Environmental Risks

- Destruction of vegetation in the areas of mining operations, external waste dumps, industrial constructions and infrastructure sites,
- Removal of the upper fertile layer of soil of the areas of mining deposits, external waste dumps, industrial constructions and infrastructure sites, which partially damage the removed soil.
- Changes in the environment of animals, and destruction of sensitive ecosystem
- Dust emissions and spreading onto surrounding natural landscape and residential areas
- Explosive material emissions and spreading onto surrounding natural landscapes and residential districts
- Diesel fuel emissions
- Shallow streams of pollution around the deposits spread with rocks
- Noise pollution
- Leakage of fuel and lubricants leakage during operation of machinery

Main Subjects Affected by Mining Activities

- Airspace environment
- Water resources
- Land resources
- Biodiversity
- Lithosphere

Impact Assessment Methods and Tools

A. Flora

- Destroyed vegetation, plants, forests, ecosystem habitats

In some cases, large territories of land are damaged and thousands of trees are cut down. To make way for the mine in Teghut, Lori Region,, more than 158,000 trees are expected to be removed[42]. During public discussions, there was information that approximately 350 hectars of forest would be felled, but many non-governmental organizations and independent experts believe the figure is closer to 900 hectars. similar points of views were expressed by the representatives of "Greens Union of Armenia" and "Armenia's Forests" non-governmental environmental organization.

The destruction of large areas of forests and other species of vegetation creates a precondition for severe ecosystem change that can affect climate, water resources as well as flora and fauna reproduction in the area.

There is no methodology established in Armenia allowing one to assess the the impact on vegetation from emissions, effluents or harmful substances. The damage to flora is calculated and evaluated only upon the amount of flora destroyed. Damages are calculated in accordance with Republic of Armenia Government Decision № 884, Nature Utilization Payments Rates, issued on December 30, 1998.

B. Fauna

- Mine pits, buildings and infrastructure, and tailing dumps limit the movement of animals
- Air pollution can affect the health of animals
- Waters pollution can cause health problems in animals
- Vegetation damage reduces the feed base
- The sound from construction machinery and detonations has a negative impact on animals
- Heavy metals present in feed can be passed onto animals

Eventually, the changes to long-term migration patterns, the loss of feed base, and the increase in sound level will lead to negative to changes by reducing the numer of animal species in a mining affected area.

Sound level is calculated based on operating mechanical equipment passport data. In the case detonations, sound levels are evaluated according to the type and magnitude of the load and charge of the explosives utilized. In Armenia, where excavators, bulldozers, and heavy trucks are utlized, the sound level ranges from 72 to 96dB[43]. The simultaneous operation of these types of machinery can lead to a greater cumulative effect.

[42] "Armenian Copper Program" CJSC. Teghut copper-molybdenum plant. Working project. Environmental Protection

[43] "News on Theoretical and Applied Acoustics" Third Pan-Russian conference materials. (Sankt Petersburg, 23-24 October, 2003.)

The spread of noise level is calculated according to “GOST 3195-2005. Noise: Damping/reducing of the sound level with the distance. Calculation of sound absorption/reduce by the atmosphere”.
C. Soil and grass

- In mine sites, either the top soil is completely removed, or the shallow layer of the top soil is damaged as a result of mining operations.
- Outflows of fuel and lubricants contaminate soil.
- Waste rock heaps can cause a change in the property of soil.
- The removal, transfer and storage of fertile soil cause irreversible damage to the soil.

All of the above-mentioned factors can directly or indireclty cause soil erosion and qualitative change in soil property. As a result, in large areas of mining operations, where soil loses its natural properties, the process of vegetation reproduction is also negatively affected. These areas can become unsuitable for agriculture.

Soil damage can be estimated by established calculations, as well as by means of factual studies and measurements.

Soil pollution is regulated by Government Decision № 01-N issued on January 25. 2010, approved by the Ministry of Health, on “Soil quality hygienic requirements N 2.1.7.003-10 with sanitary rules and norms”.

Economic damage to land resources is calculated according to Government Decision № 92-N, issued January 25, 2005 approved by the Government of RA, on “Procedure for Economic Impact Assessment on Land Resources”. The procedure is based on land cadastre evaluations and the cost of restoring the quality of damaged soil. The rehabilitation or reclamation of damaged soil is a topic that must be addressed in the environmental impact assessment of a future mine operation, the cost of which is calculated according to Government Decision № 95N issued on April 15, 2004, approved by the Minister of Nature Protection, on (EIA) on “Calculation of estimated costs of recultivating activities and indexation procedure.”

As a rule, in EIA reports of the mines only technical recultivation is determined. Biological recultivation is calculated in rare cases.

Currently, professional organizations, well-known in international circles, are conducting in-depth studies of soil pollution and quality, which will be compared to the results of soil studies conducted in the regions of Armenia that are affected by mining.

D. Air Basin/Atmosphere

The air basin is polluted mainy with the ore dust that is produced and spread during mining operations. The spread of dust depends on the size of dust particles along with its composition and structure.

Harmful substances such as nitogen oxide, carbon monoxide, sulfur dioxide and solid particles such as soot and ash are also emissited into the air during the operation of a mine, mainly through the use of heavy machinery and vehicles, which typically burn diesel fuel.

During preparation of reagent solutions and their use harmful vapor is generated. Some substances that are commonly used are xanthate butyl, cyanide compounds, acids, and alaklis.
The amounts of dust particles thare are emmitted during mining operations is significant. And depends on the processing technology that is utilized. During the ore loosening process, including removal, transfer and offloading, the dust that is produced is a comparably larger type of dust. Smaller particles of dust are caused during the grinding, crushing and milling processes.
The formula of emissions and amount of particles released depends first and foremost on the mining process that is being utilized i.e. open-pit or underground. It also depends on the method used to extract the metal from ore, which includes gravitation, flotation, or leach heaps. The size of the mining operation, as in the amount of ore removed and processed, also plays a large role in the amount of dust and emissions that are produced.

Below is a table with figures of expected emissions from several minings operations in Lori region[44].

Table 20. Substances Emitted to Air Bassin

N	Emitted substance	Amounts of emitted particles, y/year			
		Teghut[45]	Armanis	Qaraberd	Shamlugh
	Inorganic dust	792.6	384.79	9.69	378.23
	Carbone monoxide	39.45	90.2	1.19	46.84
	Hydrocarbons	-	17.66	0.2	8.66
	Nitrogen oxides	57.86	111.51	1.23	58.87
	Solid particles	-	8.99	0.11	4.4
	Sulfur dioxide	-	8.36	0.1	4.1

Being of a sustanable nature, emissions change the chemical composition of the air basin, which in turn affects human health, as well negatively impacting flora and fauna. As dust spreads around, the increase in content of nitrogen oxides and sulfur dioxides creates acid rain.

In order to assess the impact on the air basin, it is first necessary to accurately calculate the actual emissions of harmful substances. Various methodologies can be used for the calculation of emssions. The methodological currently used in Armenia were developed during the former Soviet Union. The emission of harmful substances emissions caused during mining activities such as excavation, onloading, transfer, machinery operation, diesel fuel combustion, and blasting are calculated in accordance Government Decision on the" Temporary Directory of emitting substances calculation, caused from unorganized sources of construction materials production" approved in 1987 by the ministry of Construction during the period of former Soviet Union. However, methodologies from the European Monitoring and Evaluation Project of the European Environment Agency, "Air pollutant emission inventory guidebook", United States Environmental Protection Agency, "Noncoal Industrial Minerals Mine" and " Ore and gravel processing" are aslo utilized.

To evaluation the total cost of air pollution, Government Decision № 91-N, on "Assessment of economic activities impact on the atmosphere", issued on January 25, 2005, is utilized.

[44] Hereinafter all figures about all mines are presented from the Environmental Impacts Assessments reports of those mines.
[45] Mining machinery emissions of Teghut's EIA reports are involved in the structure of the plant.

E.Water resources

Mining operations use a large amount of water for its industrial processes, mainly to extract the valuable metals from the ore. Mining operations can risk overwhelming a local water supply, if the mine operation puts too great demand on the water balance, especially in dry seasons or periods.

The table below lists the expected water supply and drainage figures from areas in Lori region that are affected by mining operations.

Table 21. Water Usage and Water Drainage Indicators in Lori Region Among Certain Mining Operations

N	Name of the mine	Water suuply, m^3/year			Drainage, m^3/year
		Total	Technical	For drinking	
1	Teghut	7233000.0	7125000.0	108000.0	74000.0
2	Armanis	24019.6	19230.7	4788.9	4655.7
3	Qaraberd	925.0	844.7	80.3	79.1
4	Shamlugh	12052.9	11468.8	584.1	575.6

Water supply volumes in Armenia are mainly calculated in accordance with "Consolidated (averaged) standards/norms of water supply and drainage of different industrial branches" (Moscow, Constr.Edition, 1982) or using the methodology in "Sanitary rules for ore mining and enrichment enterprises" (N 3905-85, approved by the Chief Sanitary Doctor of the Soviet Union, dated June 28, 1985.)

For water use, mining companies are obligated to prepare documents[46] and file them with the Ministry of Nature Protection, who issues the necessary license if all the requirements are met.

Water pollution is caused as a result of mining operation industrial outflows. Surface and ground water pollution is at greater risk when there are dumps and open storage of rocks. Rain water can react with exposed overburden heaps, causing acid rock drainage, which can pollute surface and underground water resources.

Bypassing streams, ditches and dams are methods of preventing water resource pollution. However, the effectiveness of these measures are not considered to be enough by experts. During the public discussions regaring the potential negative impact from mines at Tezh Sar, Amulsar and Armanis mines, opponents argued that it was not possible to isolate from water large open-pits and rock dumps, especially given the culture of mining in Armenia, which often does not take into account best international practices.

These claims have basis as shown through studies such as "Area Environmental/Ecological Assessment of Qajaran city", the " Study of Zangezur Plant's tailings dumps impact on the Environment", "The tailing dumps of mining industry and assessment of Kapan copper plant industry impact on Kapan city environment (Syunik region)", "Sotq gold mine and nearby areas environmental risks assessment"[47], carried out by the Center of Ecological Research of the National Academy of Sciences.

[46] Decree of RA N218-N, dated to 07.03.2003, approved by the Government of RA

[47] http://www.sci.am/resorgs.php?oid=10&langid=2

There is no applicable assessment methodology Armenia for the pollution of effluent waters that are caused by mining operations.

In case polluted waters reach surface or ground water sources, mining companies undertake to develop/work out a project with standards/norms on water resources flowing harmful substances' allowing marginal leakage (Decree of RA № 464-N, dated to 10.12.2003, approved by the Minister of Nature Protecting of RA "Assessment Methodology of the amounts of wastewaters allowing marginal outflow to water resources" and provide it to the Ministry of Nature Protecting of RA.

Water quality demands/requirements of water resources are defined in accordance with Decree of RA №75-N, dated to 27.01.2011, approved by the Government of RA, on "To meet water quality standards of each water basin management area, due to the specifics/peculiarities of the area".

The economical impact on water resources is calculated in accordance with Decree of RA №1110-N, dated to 14.08.2003, approved by the Government of RA, on Assessment procedure of Economic Activities Impact on water resources".

F. Lithosphere

Ore extraction activities are carried out from lithosphere for further prosessing during the mining operation.

An underground cavity/open-pit occurs during the undergroung processing activities. The volume of the open-pit is equivalent to the volume of the extracted ore and empty rocks. The danger of the open-pit depends on its position, surrounding rocks and peculiarities of the layers and so on.

The ore extraction and the availability of the cavity in case of the open-pit do not create any further change in the earth's crust. But it makes landscape change, which in its turn can make erosion phenomena.

There is no applicable methodological documents in RA, enabling to assess the environmental impact on lithosphere.

G. Tailings dumps

Tailing dumpls play an important role in mining industry. Their influence extends to all elements of the environment. In the result of heavy rains, floods and water leakage, through the cracks of tailings dumps, water outflow extends all around, contaminating/polluting surface and underground water basins, soil and grass, lithosphere. Dust is caused in tailings dumps drying conditions, which is spread around.

Man-made accident, or natural disaster (an earthquake) are of particular threat/danger, in the result of which dams and constructions of tailings dumps can be damaged or completely ruined/destroyed. In such cases, sludge mass will quickly spread to low-laying areas by destructing/destroying the species of flora and fauna, even residential districts.

There is no specific methodology for the tailings dumps impact assessment. For that reason, general methodological documents are applied for the assessment of ambient air/atmosphere, water resources and soil damage/impact.
It should be stated, that “dry tailing ” storage method has begun to be used in the recent years. Such technology allows to dry the tailings to a certain degree and store up like external dumps. Dry tailings differ little from the classic tailings in terms of chemical structure/formula, but, in terms of safe maintenance, those are incomparably safe and reliable, and do not create/cause emergency situations. The reliability of this method depends on the degree of dryness of the tailings, which can reach up to 8%, and in some cases, can be even more dry.

Particularly, in Armanis mining complex, the tailings drying and dray storage activities are already being carried out.

Tailings drying and dray storage activities are also going to be carried out in Arjut gold extracting plan.

3.5 Impacts on Cultural Heritage

Highlighting of this aspect of impact assessment is important also for the fact that due to operation of mines the components of a single unified geosystem of the natural environment of the mine site (relatively homogenous geographical area), viz. landscape, climate, waters, lands, which are in complex natural interaction, appear at a great risk of degradation and consequently have a negative impact on tourism, particularly ecotourism.

Due to deficiency of relevant mechanisms for monitoring ecological, social-economic and in the future also political/activity aspects of impact assessment only expert conclusions, sometimes as well results of surveys among the locals are very often relied upon. It should be noted that while the registries of historical-cultural objects are to some extent complete, landscape registry is far from being sufficient. Therefore the area assessment will be incomplete and will require public hearing/discussion sessions.

Measures for prevention of possible impacts of mining activity and if it is less likely those of elimination of consequences should be worked out still in the initial stage of the design. It is also necessary to quote analogous cases with further appropriate monitoring assessment. Included also should be answers to a number of questions or assumptive/presumable conclusions:

- Availability of a set of evaluation indicators, existence and accessibility of relevant information databases,
- How is the natural environment likely to change or has already changed?
- Planned or implemented measures and outcomes, etc.

There are two main ways of non-market valuation:

- Revealed preference,
- Stated preference.

In fact transfer of preferences helps to consider the existing valuation method in a new context.

The revealed preference method. Non-market valuation uses studies on purchases or other actions. For instance, the hedonic pricing tries to insulate the price or cost of a product (e.g. price of a home) from the influence of non-market attributes (e.g. parks or dumps in the vicinity).

The stated preference method. This method includes contingent valuation and choice modeling. Principally this method can be used almost for all kinds of valuations, but the outcomes will be controversial. Based on population surveys selection of a policy option is carried out, where environmental outcomes are conditioned by significant expenses (for example high taxes on environmental resource use and economic losses).

Box 4. Case Description

Amulsar gold-bearing quartz mine

The possible operation of Amulsar gold mine has caused big problems.

On April 20, 2012 the Nature Protection Ministry posed several requirements before Geoteam CJSC. The Historical-Cultural Heritage Research Center on behalf of the Ministry of Culture carried out exclusively exploratory works in Amulsar area with Geoteam CJSC financial support and discovered settlements, graveyards and a cemetery.

The specified values were presented to the Ministry of Culture in December 2012 for assigning the status of monument. The graveyards are 10 km South-East from the village of Kechut at the bottom of Amulsar, 1823 km far from the village of Gndevaz on Erato, Tigran and Artavazd peaks of Amulsar (6-7 c).

Expert Commission for Lake Sevan Conservation of the Academy of Sciences of the Republic of Armenia pronounced a negative conclusion regarding the project of operation of the mine on 5 June 2012.

In July 2012 Nature Protection Minister pronounced a positive conclusion about the EIA of the Amulsar mine.

According to Article 26 of the Mining Code of the Republic of Armenia:

1. Subsoil use shall be prohibited in specific areas in the manner prescribed in the legislation of the Republic of Armenia from the viewpoint of national security, protection of people's life and health, conservation of historical-cultural values or nature and environment, if the land on the requested subsoil area contains:

1) tombs,

2) monuments of nature, history and culture,

3) plant or animal habitats registered in the Red Book of the Republic of Armenia, as well as if the given area is crossed by migration routes of animals.

In Amulsar all three cases are present.

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Appendix 1. Metal mines of Armenia

N	Name of mine	Deposites of ore, 1000 t.	Deposites of metal,		Ownership	Annual ore productivity, 1000t
NON-FERROUS METALS *Copper mines*						
1	Alaverdi	1,268.0	Cu 66,200 t		Walex Group (ACP), (Armenia&Lichtenstein)	Inactive (underground mine)
Copper-molybdenum mines						
2	Agarak	30,930.7	Mo-7,500 Au-640.3 kg Re-6.81 t Bi-50.13 t	Cu-117.1 Ag-29.7 t Se-83.52 t S-323.8	GeoProMining, (Russian Federation)	Active-about 3,000.0-3,500.0 (Open-Pit)
3	Teghut	453,796.0	Mo-97,940t Au-4,776 kg	Cu-1,609,700t Ag- 303.8 t	Walex Group (ACP), (Armenia&Lichtenstein)	Active (Open-Pit)
4	Ajgedzor	124,208.0	Mo-41,320t	Cu-207,300t	Tatstoun LLC: Txkut place (Armenia) Aktiv Lernagorc: Central place (Armenia)	Inactive (Open-Pit: prepared for operation with 600,0 (Txkut) 500,0 (Central) annual productivity)
5	Dastakert	18,345.6	Mo-10,400t	Cu-127,500t	Molibdeni Ashkharh-branch: Global Metals Group Neva Rus Copmany (Russian Federation)	Inactive (Open-Pit: prepared for operation in 2015 with 2,000.0 annual rpoductivity)
6	Lichq	34,065.0	Mo -480 t Cu-214,200t Se 35.0 t S 110.0 t	Au 584.0 kg Ag 43.6 t Te 20.1 t	Tatstoun LLC	Inactive (Open-Pit: prepared for operation with 500,0 annual productivity)
7	Hanqavan	127,742.0	Mo-39,053 t Re 22.6t Se 5.43 t Te 2.7 t	Cu 129,300 t Bi 10.23 t Ge 269.55 t Au 31,894 kg Ag 112.31 t	Golden Ore LLC	Inactive (Open-Pit)
8	Kajaran	2,244,000.0	Mo-737,000t	Cu-5,274,000t	Zangezur Copper-Molybdenum Combine CJSC (Main Shareholder: Cronimet Mining AG (60%) Germany	Atcive (Open-Pit: annual productivity is about-17000)

Metal mine of Armenia

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NON-FERROUS METALS *Copper mines*						
1	Alaverdi	1,268.0	Cu 66,200 t		Walex Group (ACP), (Armenia&Lichtenstein)	Inactive (underground mine)
Copper-molybdenum mines						
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3	Teghut	453,796.0	Mo-97,940t Au-4,776 kg	Cu-1,609,700t Ag- 303.8 t	Walex Group (ACP), (Armenia&Lichtenstein)	Active (Open-Pit)
4	Ajgedzor	124,208.0	Mo-41,320t	Cu-207,300t	Tatstoun LLC: Txkut place (Armenia) Aktiv Lernagorc: Central place (Armenia)	Inactive (Open-Pit: prepared for operation with 600,0 (Txkut) 500,0 (Central) annual productivity)
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N	Name of mine	Deposites of ore, 1000 t.	Deposites of metal,		Ownership	Annual ore productivity, 1000t
NON-FERROUS METALS						
Copper-pyrium mines						
9	Kapan	3,684.0	Au-433.84kg	Cu-142,700t	Conserved	Inactive
10	Shamlugh	4,462.0	Cu-152,500t Pb-4,900t Zn-14,200t	Au-1798.0 kg Ag-28.0t	Metal Prince Ltd British Nevis Island	Active-about 200.0 (Combine: Open-Pit; underground mine)
Gold-polymetallic mines						
11	Shahumian	18,000.0	Au-42,500kg Ag-882.12 t Cu-110,300t	Zn-447,900t Pb-33,7t	Dundee Precious Metals Inc. (Canada)	Active (underground mine: annual productivity 550.0-600.0)
12	Azatek	8,307.4	Au-19,558kg Ag-434.0 t Pb 40,200.0 t Se- 52.6 t Bi-254.8 t Ga-133.5 t S-418.4 t	Cu-14,800t Sb-5,400t Zn 24,100t Te-12.9t Cd-113.7t As-28.5 t	Azatek Gold CJSC Anglo-African Minerals plc & Alrosa	Inactive (underground mine: annual productivity should be 200.0)
13	Lich-vaz tey	3,026.0	Au-17,870kg Ag- 97,7t	Cu-11,980t	LV Gold mining CJSC: Global Metals Group Neva Rus Copmany (Russian Federation)	Inctive-about 400.0 (Combine: Open-Pit; underground mine)
14	Terterasar	174,700.0	Au-2,016.4kg Ag-16,2t	Cu-1,038.9	Sipan-1	Inactive (underground mine: annual productivity should be 50.0)
15	Armanis	14,833.3	Cu-160,000t Zn-381,300t Pb-178,900 t	Au-12547kg Ag-163.7 t	Sagamar CJSC Global Metals Group Neva Rus Copmany (Russian Federation)	Active-about 300.0 (Open-Pit)
16	Marjan	4,707.8	Au-19,998kg Ag-435,1t	Pb-56,900t	Marjan Maninig LLC, Global Gold Corporation (USA)	Inactive (Open-pit 150.0)

			Cu-6,240t	Zn-46,700t		

N	Name of mine	Deposites of ore, 1000 t.	Deposites of metal,		Ownership	Annual ore productivity, 1000t
Polymetallic mines						
17	Akhtala	1,293.0	Cu-7,100t Zn-55,000t Ag-118,8t	Pb-20,500t Au-1,552 kg	Metal Prince Ltd British Nevis Island	Active-about 200.0 (Underground mine)
18	Gladzor	3,780.0	Pb-169.7 t Zn-159.1 t Cd- 669.0 t	Cu-36.9t Ag-224.4t Se-28.9 t Te-24.0 t	GeoProMining, (Russian Federation)	Inactive (underground mine: annual productivity should be 250.0)
PRESIOUS METALS *Gold mines*						
19	Sotq	31,141.2	Au-133,533 kg Ag-175.6 t	Se-56,3 t Te-280 t	GeoProMining, (Russian Federation)	Active (Open-Pit : annual productivity is about 850.0)
20	Amulsar	56,434.5	Au-52,664kg	-	GeoTeam Lidian International LTD Canada	Inactive Is under exploration
21	Meghradzor	410.6	Au-4,968.4 kg	Ag-407 t Te-9.35 t	Meghradzor Gold Armenia rented from GeoProMining	Active (underground mine; open-pit 7,2)
22	Mghart	-	-	-	Multi Group Armenia	Inactive (is under exploration)
23	Tuxmanuk	1259.4	Au-8,007.3 kg	Ag-44,7 t	Mego Gold LLC, Global Gold Corporation (USA)	Inctive (is under exploration)
24	Karaberd	303,3	Au-1,631.9kg	Ag-2,92t	Asaat LLC Armenia	Inactive (Open-Pit-by annual productivity-12,5; underground mine-by annual productivity-30,0)
25	Barcradir (Mazra)	917,7	Au-9,643kg	Te-4.6t S-53.2t	Ophuland Trading Solituions	Inactive

N	Name of mine	Deposites of ore, 1000 t.	Deposites of metal,		Ownership	Annual ore productivity, 1000t
NEPHELINE SYENITES *(Aluminium raw material)*						
26	Teghsar	457,000.0	Al-98,255.000t	-	Alumina Corporation LLC	Inactive (Open-Pit-by annual productivity-3000,0-11,000)
FERROUS METALS *Iron mines*						
27	Abovian	260,800.0	Fe-67,788.000t	-	Bounty Resources Armenia Limited& Fortune Oil Armenia-Virgin Islands-China	Inactive
28	Hrazdan	50,061.0	Fe-16,000.000t	-	Bounty Resources Armenia Limited& Fortune Fortune Oil Armenia-Virgin Islands-China	Inactive
			Ag-14,4t	Bi-14.5t		(Open-Pit-by annual productivity-30,0)