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Technical Support for Grassroots Public Interest Groups

Glencore Xstrata's Espinar Province Mines:

Cumulative Impacts to Human Health and the Environment

July 2013

Prepared for: Oxfam America

Prepared by: Stuart M. Levit
The Center for Science in Public Participation

EXECUTIVE SUMMARY

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Introduction and Background

This report presents results from an investigation and review of issues regarding the Tintaya and Antapaccay mines' impacts to water quality, water quantity, animal deaths, human health, and other resources in Peru's Espinar Province. The goal of the report is to review Glencore Xstrata's mines with a particular focus on community concerns and mining best practices. This report further seeks to ensure that all mining activities in the Espinar Province, including monitoring and public participation, are consistent with best international practices and protocols. Because of the relationships between the various Glencore Xstrata mines in the area and the connections between their operations and impacts, special attention is given to cumulative impacts analysis and environmental impacts analysis. The report is based on reviewing publicly available data and reports and visits to the communities and the mines (tours provided by Xstrata personnel).

Glencore Xstrata's mines in the Espinar region include the Tintaya and Antapaccay mines and the Coroccohuayco exploration project. Glencore Xstrata's Las Bambas mine is a little more distant and is in development for anticipated production in 2014.

The Tintaya copper mine is located in the Yauri district and is expected to continue mining until approximately 2018. It consists of multiple pits, multiple waste rock disposal piles, a processing plant used to process Tintaya's ore, and multiple tailings impoundments. The Tintaya Mine site also contains a new processing plant to be used to process ore from the Antapaccay and Las Bambas mines, and presumably from the Coroccohuayco orebody if that site is developed. Wastes from the new processing plant will be disposed of in the Tintaya pit(s).

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[1] Stu earned his Master's Degree in Land Restoration from Montana State University and received his law degree from Montana State University. With over 20 years of experience with mining science, law, and issues, his work for CSP2 focuses on providing technical, scientific, and legal assistance to indigenous peoples and tribes, grassroots groups, governments, and businesses on natural resource issues. He also practices law in Montana and US federal courts focusing on indigenous issues, natural resource and environmental analysis.

[2] The Center for Science in Public Participation (CSP2) provides objective research, education and technical advice to grassroots groups, non-governmental organizations, regulatory agencies, businesses, and indigenous communities on natural resource issues, especially those related to mining. CSP2 provides technical support so that communities around the world have access to technical research and expertise required to protect their environment and culture, so they can make informed and proactive decisions on natural resource protection and development issues, and insure that extractive industry practices follow the highest standards.
Neither the author nor CSP2 advocates for mining or against mining (and are not advocating for or against Xstrata, Glencore, or any of their mines). CSP2 and the author seek to the use of best practices in mining, and to maximize public participation in regulatory and permitting decisions and issues that impact the environment and human health, and to ensure that the public has access to appropriate data and information to help promote the public's independent review and analysis of mining activities.

The Antapaccay orebody is in the early stages of ore development. The Antapaccay mine will have two pits and waste rock piles associated with each. Ore will be transported to a 'loading' facility that will place ore on a conveyor belt that will convey the ore to the Tintaya Processing facility. The Coroccohuayco orebody, nine kilometers southeast of the Tintaya operation, is currently being explored for potential development.

The Las Bambas Mine is located 72 kilometers from Cusco and in 2010 Xstrata PLC approved $4.2 billion for its development. The project will contain multiple pits and a slurry pipeline that will transport its ore to Tintaya for processing in the new processing plant. It is expected to be commissioned in late 2014. As part of the merger between Glencore and Xstrata, Chinese regulators demanded that the Las Bambas mine be sold. It is unclear how this sale will impact the proposed mine and its ore transport/processing

Environmental Data and Impacts

In April 2013 the Ministry of Environment released the summary of results of its Participatory Health and Environmental Monitoring (PHEM) which was commissioned by Peru's government in 2012 following violent protests by local residents and politicians that accused Xstrata PLC's Tintaya copper mine of contaminating water. The company had rejected the accusations - asserting that its mining operations caused no contamination.

The PHEM Report determined that there is pollution in the Espinar Province that appears to be the result of mining and there is pollution in the Espinar Province that appears to be from "natural" sources. These contaminants include metals contamination in surface waters and sediments of the Camacmayo, Tintaya and Collpamayo waterways. Over half of all sites monitored were contaminated with at least one sample exceeding regulatory standards and heavy metal contamination (mercury, arsenic, cadmium and lead).was discovered at 64 sites that correspond to water used for human consumption. Surface and ground water in some sites close to Xstrata's mining activities have physical and chemical contamination exceeding standards and suggesting potential impacts by mining. A related finding was that people living in the communities directly affected by Tintaya are exposed to arsenic, thallium and lead.

In response to the PHEM Report, Glencore Xstrata concluded that the contamination discovered above environmental standards was only in a few samples and that most of those samples were from outside of the "mine's area of influence" - asserting that the contamination measured was the result of natural, or "background," metals contamination and not from current or Xstrata mining activities.

The PHEM Report helps highlight that Peru's regulatory framework is inadequate in terms of requiring sufficient pre-mine assessment and disclosure of pre-mine assessment data to the government and public.

If Xstrata is correct that most of the contamination discovered by the PHEM Report is natural/background, then there appear to be problems with the accuracy and precision of Xstrata's monitoring programs because Xstrata should have known about the contamination but

did not, or did not disclose them. Something is clearly wrong if this contamination was just discovered and disclosed - in spite of years of company and participatory (community and company) monitoring.

Over the years, Xstrata has produced numerous reports and informational booklets about its mining operations, company programs, and environmental impacts (or lack thereof). However, the publicly available data is insufficient to independently evaluate whether or not the water quality monitoring is adequate and whether or not the mine has degraded water quality or caused other water-related environmental and human health impacts. This independent evaluation is essential to respond to community concerns, evaluate mine impacts, and explain the apparent differences between company data/reports, the government's PHEM Report, and community complaints/concerns. These data are further critical to determine the adequacy of mine monitoring, closure and reclamation plans, cumulative impacts, and responsiveness to community concerns.

Existing study of environmental impacts appears to be improperly limited. As the government's PHEM Report underscores, it is not clear where and to what extent Glencore-Xstrata's mines are impacting human health and the environment. Environmental Impact Analyses (EIAs) are appropriate tools to evaluate environmental and ecological impacts based on widely accepted, scientific methods. These can provide regulators and the public with reliable information to evaluate a mine proposal and promote sound decision making. The EIA process can evaluate natural and mine-caused impacts and the direct and indirect impacts from mining.

Further, Cumulative Impacts (or, cumulative effects) analysis is needed to identify impacts to the environment and human health that result from the incremental impacts from the region's various existing and proposed mines. Cumulative Impacts Analysis is necessary to capture impacts from past, present, and reasonably foreseeable future actions.

Recommendations

The public and government should have access to all existing company and other (including PHEM Report) data sufficient to ensure that the public and the government can each make an independent analysis and review of contamination in the area.

Local, sub-regional, and national government entities should all participate in and oversee both company and community monitoring activities to ensure that all activities are transparent and documented.

Cumulative impacts analysis is particularly important as a matter of public policy. As a governmental matter - and for the individual communities themselves, cumulative impacts analysis of all of the mines can most accurately demonstrate how mines are impacting the entire province and its peoples - and not just the individual communities separately impacted by the individual mines. The government should ensure that Environmental Impact Analyses and Cumulative Impact Analyses are completed. All aspects of these analyses, from planning to the reporting of results should be fully transparent and include public participation and public comment.

Participatory monitoring has been occurring for years and has yielded valuable data. Additional participatory and community monitoring should be developed and implemented to reflect, expand, and corroborate the PHEM Report's findings.

A combination of environmental impact analysis, strategic impact analysis, and cumulative impacts analysis should be employed to provide the information and tools necessary to approach and resolve many if not all community concerns and comport company claims with the conclusions from the recent PHEM Report.

At the Espinar Mines, and throughout Peru, mine regulators should adopt more rigorous, defensible surface and ground water quality standards. Current Peruvian standards are often significantly less protective than more recent and scientifically supported standards from elsewhere around the world.

In May 2013 Glencore International acquired the Xstrata PLC to create the newly named Glencore Xstrata PLC. Much of this report focuses on Xstrata PLC because Xstrata has owned and operated the mines in recent years. It is unknown at this time how the newly formed Glencore Xstrata PLC will change operations, if at all, at its Espinar region mines. However, the change in corporate ownership presents the newly formed company with an opportunity to remedy what many in the public perceive as Xstrata's failure to provide essential information and data and engage the public in a dialogue that serves to resolve, not perpetuate, public concerns about the mines' impacts to the environment and human health.

INTRODUCTION

This report seeks to investigate, review, and comment on issues regarding the Tintaya and Antapaccay mines' impacts to water quality, water quantity, animal deaths, human health, and other resources in Peru's Espinar Province.

The goal of the report is to review the mines with a particular concern for identified community concerns[3] and general mining best practices. A particular focus is placed on the need to assess cumulative impacts because of the relationships between the various Glencore Xstrata[4] mines in the area and their operational interconnections.[5]

The report is based on reviewing publicly available data and reports and visits to the communities and the mines (tours provided by Xstrata personnel).

Viewed separately, each of the Glencore Xstrata mines does pose some level of potential threat to human health and the environment. However, the impacts of all of the mines could be cumulatively much greater than the sum of just the independent mines (viewed separately). On the technical level, cumulative impacts analysis is important to accurately quantify, or predict, impacts from the various mines in Espinar Province. Importantly, cumulative impacts analysis is also important as a matter of public policy. As a governmental matter - and for the individual communities themselves, cumulative impacts analysis of all of the mines can most accurately demonstrate how mines are impacting the entire province and its peoples - and not just the individual communities separately impacted by the individual mines.

Figure 1 Glencore Xstrata Mines in South America

Data

Data from the following sources was reviewed:

- Xstrata's released materials, such as public and informational reports
- Xstrata's website (prior to Glencore's takeover, then Glencore's website)

[3] These concerns, which are discussed in more detail below, came from community members' comments to the author while visiting the community, concerns from local government officials heard during visits to the communities, and from issues raised by Oxfam America that it has heard from community members and other nongovernmental organizations in the area.

[4] Glencore purchased Xstrata PLLC, creating Glencore Xstrata. The new ownership does not retroactively change Xstrata's policies or reports. Therefore, this report refers to Xstrata in the past and Glencore Xstrata as the current owner relevant responsible for future activities.

[5] For example, transporting ore from Antapaccay and Las Bambas to Tintaya increases the footprints of the individual mines, the potential for contamination between them, and their respective mine lives.

- Local government and other sources in the Espinar Province, which mostly consisted of reports supplied by Xstrata.

An initial data request was submitted thru Oxfam America to Xstrata. The materials provided in response to this request were the same as otherwise available. A second request was submitted after meeting/touring the mine sites. In response to this request Xstrata provided data from Las Bambas (which was not specifically identified by the request) but no further or requested data from Tintaya and Antapaccay. This is deemed problematic because what was sought was raw data and original laboratory analysis/reports intended to confirm the summary and other wise general data provided by Xstrata to the public at large.

The goal of these requests is to independently review that data used by Glencore Xstrata for its reports and conclusions (that its mine operations do not impair water quality or water quantity - and therefore are not impacting human health, animal health, or the environment).[6] The requested data is necessary and appropriate for this goal to evaluate the accuracy, precision, and completeness[7] of the data and the representativeness of the company's conclusions.

These data are important to independently evaluate the individual mines (Tintaya, Antapaccay, etc.) and also to evaluate the cumulative impacts that occur collectively from all of the mines and their infrastructures. As described in more detail below, cumulative impacts are the sum of impacts from different geographic and material sources. The Tintaya mine's impacts are the sum

[6] The mine has acknowledged and identified minimal, localized mine impacts but there appears to be a significant separation between the company's assertions that its mines have not caused any major or long term impacts to the environment or human health and community concerns about such impacts, and the community's perception of the impacts the mines have caused/are causing. It is not uncommon for communities to be concerned about impacts that mining companies claim do not exist or are not mine-related. CSP2's goal is to provide technical and science-based independent review and analysis to help narrow the distance between company and government/community concerns.

[7] In this context, *Accuracy* refers to the degree of correctness with which a number reported for a monitoring sample (data) reflects the true value of the parameter being assessed;
Precision refers to the degree of variation in repeated measurements of the same monitoring sample.
Completeness refers to the degree to which the data evaluated is truly all of the available data and the data presented (or made available) is truly all of the data that should exist.

To help clarify the terms, if twenty measurements are taken for arsenic at the same time and at the same location by the same methods, *accuracy* would be indicated by how the average of the twenty measurements (20 results) reflect the actual concentration of arsenic present at the location. *Precision* would be indicated by the variation between the twenty different measurements. *Completeness* would be whether or not all twenty sample results were provided (made available by the company). In this context, *representativeness* could mean a number of things, including whether the company's reported results and conclusions truly reflect what exists in the water and whether the company's reported results and conclusions reflect what exists in the data.

Underlying all of these factors is whether the sampling and analytical protocols are appropriate for the sites and whether they were properly followed and documented. For example, the protocol for arsenic sampling requires certain procedures for sample collection, handling, and laboratory analysis. Further, when and where the samples were taken can be critical. All of these factors work together in determining whether or not human health or the environment have been degraded. The data analysis is particularly important because it is the only quantifiable method of showing what happened, where, and when.

or its individual parts - the mine pits, the waste rock piles, the tailings ponds, the mill facilities, etc. The cumulative impacts from mining in the Espinar region are the sum of all of the individual mines' impacts - the impacts from the Tintaya mine plus the impacts from the Antapaccay mine, plus the impacts from the Las Bambas mine plus the impacts from all of the related roads, powerlines, and conveyor belts, etc. When examining an individual mine it is difficult or impossible to understand its true impacts on the local and regional ecosystems unless cumulative impacts are considered.

Preparation for this report included two visits to the Espinar Province in August and November 2012 which both included multiple meetings with local government, local officials, community groups, and local individuals; three sets of presentations about mining and the local mines that were open to the public; site tours of both mines; meetings with Xstrata technical and public relations personnel; and review of data available in Xstrata reports and on the internet, and as provided by Oxfam America. A third request was submitted to Glencore Xstrata in conjunction with the release of this report.

Most data provided by Xstrata includes tables that compare company/environmental data with applicable or other water quality standards. Data analysis includes both numeric evaluation and also evaluation based on experience and in light of concerns or questions raised. Data analysis includes many steps, including, but not limited to:

- Assembling and evaluating data provided by the company
- Assembling and evaluating data from other sources (government, private citizens, others' reports, etc.)
- Reviewing data protocols (such as collection protocols, blanks and splits,[8] and test samples,[9] etc.).
- Review Quality Assurance Quality Plan[10]
- Review compliance with quality control plans and documentation/reporting.
- Review raw data in addition to summaries of data.
- Comparing data results with expectations of the mine, the community, government, etc.
- Comparing data with regulatory or other standards for protecting human health, the environment, and regulatory compliance.

As described in more detail below, the protocols used by Xstrata appear to be reasonable and consistent with generally accepted protocols and practices. As further discussed, however, the available information is not sufficient to conclude that the protocols and practices were properly followed and data reporting was adequate to allow independent parties (including the government and public) to independently evaluate the company's conclusions.

[8] Blanks refer to "empty" samples that test whether the laboratory analysis correctly identifies zero amounts of the tested chemical. Splits, or duplicates, refers to taking one sample and splitting it into two separate samples for analysis to test whether the laboratory analysis correctly came out with the same results for each.

[9] A test sample would include sending to the laboratory a known amount of the tested chemical, allowing the laboratory results to be compared with the known amount.

[10] A Quality Assurance Project Plan documents the planning, implementation, and assessment procedures for a particular project, as well as any specific quality assurance and quality control activities. It integrates all the technical and quality aspects of the project in order to provide a "blueprint" for obtaining the type and quality of environmental data and information needed for a specific decision or use. http://www.epa.gov/QUALITY/qapps.html.

Xstrata and Glencore

In May 2013 Glencore International acquired the Xstrata PLC to create the newly named Glencore Xstrata PLC.

The Xstrata that Glencore acquired was actually a series of Xstrata-named entities (Xstrata PLC, Xstrata Copper, Xstrata Peru, etc.) that are now owned and/or sub-owned by the primary corporation, Glencore Xstrata. Appendix A includes more detailed corporate information about Glencore Xstrata and the structure of its corporate hierarchy, ownership, and operations.

Like many large corporations, Glencore maintains (and Xstrata maintained) various corporate policies and statements intended to guide the corporation's business operations and present the corporation to interested parties, investors, and the public. Like most large corporations, Glencore Xstrata will produce annual reports for financial and other purposes (some required by financial laws and requirements; others voluntary and intended for public relations, investor relations, education, etc.). Collectively, these policies, statements, and reports should describe the company and its operations. With the recent acquisition, Glencore Xstrata has at the time of this report not produced joint sustainability or other reports. Therefore, Appendix A summarizes Xstrata's and Glencore's previous, separate policies and guidance and then provides selected information and resources about the newly formed company.

It is unknown at this time how the newly formed Glencore Xstrata PLC will change things, if at all, at its Espinar region mines. As discussed elsewhere, the change in corporate ownership presents the new company with an opportunity to remedy what many in the public perceive as Xstrata's failure to provide essential information and data and engage the public in a dialogue that serves to resolve, not perpetuate, public concerns about the mines' impacts to the environment and human health.

I. Tintaya

Background

The Tintaya mine is located in the Yauri district of Espinar Province, Cusco region, at 4,100 meters above sea-level. Tintaya commenced production by Magma Copper Company in 1985 and in 1996 Magma was acquired by BHP Billiton. Xstrata Corporation bought Tintaya from BHP in 2006 for US $750 million. The mine's life is expected to continue until approximately 2018.

Figure 2 Tintaya Pit in 2004 and 2011 - as seen from the air (From SkyTruth.org)

The orebody includes copper sulphides and copper oxides mineralization. The Tintaya orebody is a copper skarn deposit, which consists of Cretaceous sedimentary rocks

intruded by monzonitic plutons, with bornite, chalcopyrite, chalcocite and copper oxides as the main copper bearing minerals.

The mine consists of multiple pits, multiple waste rock disposal piles, a processing plant used to process Tintaya's ore, and multiple tailings impoundments. The Tintaya Mine site also contains a new processing plant to be used to process ore from the Antapaccay and Las Bambas mines, and possibly from the Coroccohuayco orebody if that site is developed. Wastes from the new processing plant will be disposed of in the Tintaya pit.[11]

Both the Tintaya and Antapaccay mines produce copper concentrates and cathodes that are processed in two processing plants. The oxide plant produces cathodes with a purity of over 99% copper by a hydrometallurgical process. The sulfur plant produces copper concentrate with a composition of 30-32% by comminution and the flotation process.

In 2011 the sulfide plant processed 7.38 million tonnes of ore and the oxide plant produced 3.68 million tonnes of ore, corresponding collectively to 113.88 million tons of rock mined. The 2011 production was 74,261 tonnes of copper in concentrate and 20,969 tonnes of copper cathode. Mine products are trucked to the port of Matarani on the Arequipa region coast, and then shipped to Japan, China, Brazil, United States, Korea, the Philippines and Peru.

Water Quality

Figure 3 Tintaya Main Pit (2012)

The company has produced numerous reports and informational booklets about its mining operations, company programs, and environmental impacts (or lack thereof). However, the data available to the public is insufficient to independently evaluate whether or not the water quality monitoring is adequate and whether or not the mine had degraded water quality or caused other water-related environmental impacts. As described above, there are numerous steps necessary to evaluate data. Xstrata has not released raw and laboratory reported data that are essential for any data review. An example would be the laboratory reports resulting from a particular sampling event, whereby the actual numerical results would be provided, and not simply a summary or averaged result. Without these data, it is impossible to determine the accuracy or precision of Xstrata's reported results.

[11] The pit is still active and is waste rock from Tintaya Mine mining is being deposited to create a dike to contain the Antapaccay mill wastes which are expected to begin production before the Tintaya pit is fully retired from mining.

This independent evaluation and public reporting is essential to respond to community concerns. This requires access to all environmental monitoring data, including water quality and quantity - to address the adequacy of:

- Monitoring
- Closure and Reclamation
- Cumulative impacts
- Responses to Community Concerns

Water Quality Monitoring Representativeness

Taking samples for metals when water has high turbidity, for example after a heavy rainfall, may yield higher metals levels. On the other hand, the concentration of some metals (e.g. zinc) are sensitive to the time of day that they are sampled. This underscores that when sampling occurs may be very important and yield potentially unrepresentative results. It is therefore possible to take samples at selective times with the result being potentially unrepresentative. Therefore, it is important for data reporting to include a discussion of potential factors that could impact the samples. The data should also be presented to facilitate the public's ability to review data for such problems in representativeness.[12]

Tintaya Watersheds

There are thee micro-watersheds in the Tintaya area. They include:

1. Watershed of the rivers and Ccamacmayo Tintaya
2. River Microcuena Cañipía
3. River Microcuenca Ccaccemayo

Tintaya River Basin

The Tintaya river basin drains an area of approximately 3168 hectares in elevations ranging from 3900 m to 4500 m. The drainage near the mine includes waters from Yanamayo, Sangrillá, (above the Tintaya mine) and Yanamayo streams (below the Tintaya mine). The Tintaya River flows into the Rio Salado. Communities in the drainage include, but are not limited to Tintaya Marquiri rural communities, and Huancané.

Ccamacmayo River (Huinumayo) Basin

The Ccamacmayo River Basin comprises an area of approximately 2370 hectares in elevations ranging from 3900 m to 4600 m. The Chullumayo River joins with waters from Paccpaco Creek and ultimately flows into the Rio Salado. Communities in the drainage include, but are not limited to High Huancané and Huano.

[12] Laboratory data appears to have a process of qualification of laboratory data, such as presented in ANALISIS RESULTADOS E INFORMES V-2009, which includes encoding laboratory analytical data so as to describe the degree to which data can be considered reliable or useful. These codes identify strengths, weaknesses, and applicability of the data. Similarly there are protocols to establish standardized procedures for collection of samples, ensuring they all collected in the same way using the same criteria. *See e.g.* RECOLECC Y MANEJO DE MUESTRAS V-2009. Such standardization of methods and reporting helps ensure that data is more reliable if the methods are followed and the reporting is accurate and complete.

Cañipía River Basin

The Cañipía River Basin has an area of approximately 40832 hectares in elevations ranging from 3850 meters to 4950 meters. The Cañipía River includes the waters of the Huilcarani, Choco San Martin, Chalchamayo, Coluyo and Huinumayo rivers.

Figure 4 Canipia River Flow-Thru at Antapaccay Mine Site

These three watersheds are important to the communities that depend on them for water and their livelihoods and to Xstrata Copper which uses water from them at its mines. There appear to be outstanding claims and concerns from communities regarding both water quality and water quantity.

Xstrata claims that it has not substantially degraded water quality and has not exceeded water quality standards.[13] The company also asserts that it has used less water than it is permitted to use and that its water use has not impacted the environment. These claims cannot be independently corroborated without access to all relevant data. These data are further discussed elsewhere in this report.

II. Antapaccay

Figure 5 Antapaccay Mine Site

Background

The Antapaccay deposit is located at 4,100 meters above sea-level in the Yuri district of Espinar Province in southern Peru. It is located approximately ten kilometers south-west of the Tintaya mine. The Antapaccay orebody is in the early stages of ore development and is being developed at a cost of $1.47 billion. The company explains that this is a brownfield[14] expansion of Tintaya

[13] When considering water quality standards it is also important to consider water use. Water that may be asserted to be safe for human consumption may be hazardous to fish. For example, copper contaminated water may be deemed safe for human consumption but could be toxic to fish. Human use does not necessarily indicate that it is safe for fish or wildlife or other uses, even such as irrigation.

[14] A "brownfield" project is one that utilizes unutilized or underutilized industrial or commercial land. The company's reference therefore refers to the Antapaccay mine "using" the Tintaya mine facilities for continued ore

is currently under construction and will average 160,000 tonnes of copper per annum for the first five years starting in the second half of 2012. In 2011 the company published its mineral resource (the amount of valuable, minable minerals, such as copper and gold) at 813 million tonnes at a copper grade of 0.52% using a cut-off grade of 0.2% copper. In 2012 the company identified additional resources in the southern pit of the Antapaccay ore body that increase the mineral resource by 27% to over 1 billion tonnes at a grade of 0.49% copper using a cut-off grade of 0.15% copper, including gold and silver by-product credits. This represents a 15% increase in contained copper to 5 million tonnes.[15]

The Antapaccay mine will have two pits (North and South) and waste rock piles associated with each. Ore will be transported to a 'loading' facility that will place ore on a conveyor belt that will convey the ore to the Tintaya Processing facility. Additionally the mine includes typical administrative, maintenance, support, and storage facilities and buildings.

Water Quality

Water monitoring points are shown in Figure 6. These sites were established by the company. As described in the above discussion about Tintaya, the data that the company has released in its reports is simply not technically adequate for any entity (public, private, or government) to independently evaluate whether or not the water quality monitoring is adequate and whether or not the mine had degraded water quality or caused other water-related environmental impacts.

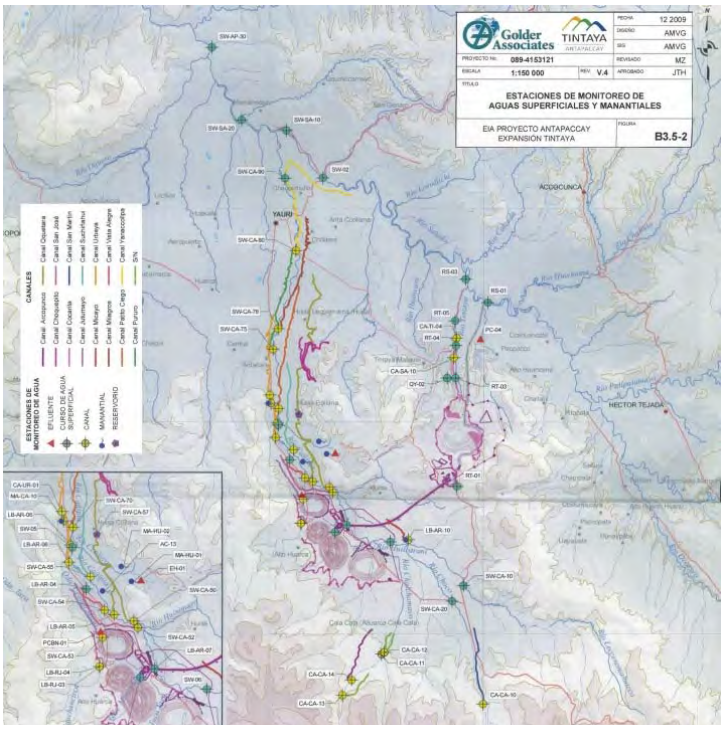

Figure 6 Xstrata Monitoring Points

During a tour of the site the company representative stated that there were no ground water monitoring points, in spite of the fact that there were numerous wellheads at the site. These wells were installed by the company or its contractors for some company or mine-related purpose. But that purpose, and the data or information resulting or derived from the wells is unknown and could help the public understand the site and how the mine(s) may impact human health and the environment.[16] These wellheads

processing/milling and waste disposal. Therefore, instead of the Tintaya mine site being reclaimed, the Antapaccay - and Las Bambas - mines will extend Tintaya's active life as a processing and waste disposal facility.

[15] Xstrata Release, August 7, 2012. http://www.xstrata.com/media/news/2012/08/07/0801CET/pdf.

[16] A common example would be to allow hydrologists to characterize and describe the hydrology in the area and how it will interact with and be impacted by the mine. More specific examples may include surface and ground water interactions and flow regimes (such as when surface water may flow towards ground water, or ground water may flow towards surface water - which could impact not only environmental quality but help characterize

were locked and had no pumps or pipe to deliver water anywhere, so it is unclear what the wells were used for or are currently being used for. A future data request to the company will repeat the request for ground water data.

Like the Tintaya Mine, Xstrata's released data suggests that there has been no water quality contamination at the Antapaccay site. Unless Xstrata releases data necessary for an independent review of the mine's impacts on water quality it is impossible for anyone - including Xstrata - to support a claim that the Tintaya or Antapaccay (or any Xstrata Espinar Province mine) has or has not degraded human health and/or the environment. Sufficient data is essential to evaluate and assess what will effectively be the 'background' water quality data used in the future to compare and determine whether the mine has degraded water quality in the area.

III. Related Mine Projects

Coroccohuayco

Xstrata is also exploring development of the Coroccohuayco orebody, nine kilometers southeast of the Tintaya operation. Xstrata purchased the property from BHP Billiton as part of the Tintaya/Antapaccay purchase. According to the company, pre-feasibility studies are underway at Coroccohuayco deposit. In December 2011 the company announced a mineral resource of 324 million tonnes at 0.93% copper. If developed, Coroccohuayco could augment Tintaya-Antapaccay's production and mine/processing life.[17]

Las Bambas

The Las Bambas Mining Project is located 72 kilometers from Cusco, between the Cotabambas and Grau provinces in Apurímac, at an elevation of over 4,000 meters. It covers 35,000 hectares that include the Chalcobamba, Ferrobamba, Sulfobamba and Charcas mining concessions.[18]

The project will include multiple open pits and produce an average of 400,000 tonnes of copper in concentrate including significant gold, silver and molybdenum by-products, and first quartile cash costs. The mine is expected to be commissioned in fourth quarter of 2014.[19]

In 2010, Xstrata PLC approved $4.2 billion to develop the Las Bambas mine. In December 2011, Xstrata Copper announced increases in the Las Bambas project Mineral Resource estimate to 1.710 billion tonnes at a grade of 0.60% copper, using a 0.2% copper cut-off grade (which was an increase of 10% compared to its October 2010 mineral resource estimate).[20]

monitoring); surface and ground water volumes during different seasons and during different phases of mining (notably impacted by water flowing towards the pit when it is fully developed); etc.

[17] Xstrata Release, August 7, 2012. http://www.xstrata.com/media/news/2012/08/07/0801CET/pdf.

[18] http://www.xstrata.com/assets/pdf/xcu_sustainability_2007_lasbambas.en.pdf.

[19] http://www.xstratacopper.com/EN/Operations/Pages/LasBambas.aspx.

[20] http://www.xstratacopper.com/EN/Operations/Pages/LasBambas.aspx.

The project's Environmental and Social Impact Assessment received community approval in July 2010 and was approved by Peruvian authorities in March 2011 paving the way for final permitting and construction to commence as scheduled in the first half of 2012.[21]

Figure 7 One of Tintaya's Current Tailings Disposal Areas (Ponds)

Tintaya Mine plans include a slurry pipeline (mineral duct) that will carry ore materials from the Las Bambas mine to the Tintaya Mine processing facility for ore processing and tailings disposal. This would add to Tintaya Mine's mine life/duration and also increase the amount of tailings waste deposited in the Tintaya Mine's pits.

As part of the Chinese government's approval of the Glencore-Xstrata merger, the newly formed company must attempt to sell the Las Bambas mine project by August 2014.[22] Las Bambas is scheduled for production shortly after the August 2014 sale date. It is unknown whether the slurry pipeline or processing at Tintaya will be completed/occur as planned before the merger. Removing processing and tailings disposal at Tintaya could change Tintaya's current operating plans. This may be most evident for the operating life, economics, and closure plan of the new processing facilities and for tailings disposal in the Tintaya pit.

IV. Related Issues

Participatory Monitoring

With multiple mine sites at multiple sites potentially impacting multiple environmental resources, it is important for impacted communities, the government, and the company to ensure

[21] http://www.xstratacopper.com/EN/Operations/Pages/LasBambas.aspx.

[22] China's Ministry of Commerce approved the Glencore-Xstrata merger, subject to the provision that the newly formed company has three months to begin the process of selling Las Bambas, with the expectation of finding a buyer, which must be approved by China's Ministry of Commerce, by the end of August 2014. http://www.gulf-times.com/business/191/details/355351/sale-of-glencore-peru-mine-may-play-into-china%E2%80%99s-hands; http://www.steelguru.com/metals_news/Chinalco_and_MMG_eye_Glencore_Xstrata_copper_mines_in_Peru/314485.html.
"If Glencore fails to enter into a binding sale and purchase agreement by 30 September 2014 or fails to complete the transfer of its ownership interest in Las Bambas by 30 June 2015 then, unless otherwise agreed by MOFCOM [Beijing's Ministry of Commerce], Glencore must appoint a divestiture trustee to sell by way of auction its ownership interest in one of [copper assets in] Tampakan, Frieda River, El Pachón or Alumbrera, as designated by MOFCOM, at no minimum price within three months from 1 October 2014 or 1 July 2015." Two other investment banks will also be appointed to supervise the Las Bambas mine during the sale process. http://news.sky.com/story/1095253/glencore-xstrata-kicks-off-4bn-mining-sale.

that environmental monitoring is accurate, complete, and fully reported. Xstrata completes environmental monitoring at its mines to demonstrate that it is in compliance with applicable permits and laws and also Xstrata corporate policies.

Xstrata's Espinar Province mines impact at least four sites and dozens of waterbodies. Company monitoring is not necessarily sufficient to characterize environmental conditions (and impacts or lack of impacts) and ensure that community and government interests are satisfied with the monitoring practices and results. One way of enhancing community support - and trust - in environmental monitoring is for companies to engage with communities and local government in participatory monitoring.

Participatory monitoring is the gathering of information or data on a regular basis by community members.[23] The data gathered can be analyzed and serve as an indication of water condition and be compared to earlier data (background) to demonstrate impacts from mining or other sources. In addition to increasing available data, participatory monitoring promotes community participation and capacity regarding water resources and water quality.

Monitoring activities can range from basic visual observations to collecting complex chemical, physical, and biological data. It can promote education and awareness, community involvement and participation in protecting and evaluating water resources, increase understanding about water resources, and even be used for regulatory purposes.

Monitoring can also be used when there is a particular concern amongst community members - such as a fish kill or dead animal. If the community has the capacity amongst its members to collect such data, the community is empowered to better respond to what it perceives to be impacts to water quality or water quantity. As discussed elsewhere, it is important to document claimed impacts to water quality - and quickly collecting reliable, quality data could be useful to demonstrate impacts.

Figure 8 Xstrata Monitoring Marker above the Antapaccay Mine

Essential elements of a participatory monitoring program may include, but are not limited to:

1. Watersheds processes and water quality
2. Water quality monitoring methods
3. Volunteer monitoring programs
4. Quality Assurance and designing a volunteer monitoring plan
5. Field-based training for testing biological, chemical and physical parameters
6. Monitoring equipment
7. Monitoring database repository

[23] The term is not technical. It may also be called community monitoring or other names. For the purposes of this report it refers to monitoring by community members and people who are potentially impacted by mine impacts.

8. Understanding, using, and sharing data[24]

V. Environmental and Cumulative Impact Analysis

Many people and communities in the Espinar area report concerns about impacts from the area's existing and proposed mines - and express frustration and concern about the lack of ability to approach and resolve these concerns. A combination of environmental impact analysis, strategic impact analysis, and Cumulative impacts analysis should provide the information and tools necessary to approach and resolve many if not all concerns. Because the Tintaya mine is so central to both the mining operations and impacts - and to community concerns - it can provide a central starting point for these analysis that con continue for the decades of mining activities at Antapaccay and Las Bambas (and Coroccohuayco and/or other sites that may advance to mining). This suggestion is not to reinvent or repeat previous environmental activities - but to build upon them in a more developed, structured, and transparent manner.

The first, and most important step to regulating mining in the Espinar Province, and Peru as a country, is to adopt a more substantial Environmental Impact Analysis process that focuses on cumulative impacts. This is necessary for the government and public to evaluate a mine's positive and negative impacts and make regulatory decisions that reflect the needs of Peru and her people.

The discussion below underscores the important elements necessary for a meaningful EIA process and focuses on the importance of cumulative impact analysis to ensure that all of the impacts from mining to the Espinar Province (and elsewhere) can be fully identified and considered by the government and public.

Environmental Impact Assessment

Mining development causes economic, environmental and social impacts everywhere it occurs. Some of a mine's impacts are good and some of mine's impacts are not good. A mine impacts the economy by creating jobs, increasing taxes and/or royalties, and may stimulate the local and regional economy. Mining development potentially impacts the environment by changing the landscape and impacting natural resources, such as water (quality and quantity), soils, and wildlife/fisheries. Development impacts communities by forcing relocation; changing livelihoods away from traditional jobs and lifestyles; and introducing new employees (and others) to the region. While mines cause impacts, many significant impacts can be mitigated *if* regulators fully assess impacts and force mining companies to employ the best methods and highest standards available. This may increase costs to the mine but if the company does not pay then the public could be liable for these costs - whether through actual public expenditures of

[24] Much of this information is based on programs developed by the Montana Watercourse, which promotes knowledge and stewardship of aquatic resources by teaching local volunteers the skills needed to gather accurate, non-biased water quality information. Further information is available at http://mtwatercourse.org/monitoring/. There are other such programs around the world but the Montana Watercourse is presented here because of the similarities between Montana's riparian environments and Peru's (and notably Espinar's) riparian environments. Further, the author has taken Montana Watercourse trainings and seen the effectiveness of the program.

cleanup and mitigation measures or thru lost land and resources and degraded human health (and increased treatment costs to deal with the environmental and health impacts).

The EIA process can evaluate environmental and ecological impacts based on widely accepted, scientific methods. These can provide regulators and the public with reliable information to evaluate a mine proposal and promote sound decision making. The EIA process can evaluate these direct and indirect impacts of mining.

The EIA process can also capture and consider cultural and social impacts related to mining, such as boom and bust cycles; creation of infrastructure that is unsupportable when the mine closes (whether at the end of the ore reserve or from a change in mineral economics, etc.); and the creation of divergent economic classes when a mine hires outside employees for high-paying high-skill jobs and hires local labor for low paying unskilled jobs. Without an EIA process these issues are unlikely to be considered. These issues are also important to consider when comparing the social, economic, and environmental costs and benefits of mining versus existing and other potential land uses.

Recent mining/corporate, political, and social events in Peru underscore that Peru's current mine assessment and regulatory processes are inadequate. For the government and public to make informed decisions the government and public must have sufficient data and processes. There are many examples around the world where data and processes are adequate and almost all are based on an EIA rubric like the one presented below.

The mining company requires substantial data to plan and maximize its operations so it is certain that the company has the data and information necessary to understand the actual impacts occurring and likely to result from a mine. The government also would have data and information from the company but it is unclear whether the government has sufficient data and information to characterize the site and its impacts. For example, the Tambogrande and Yanacocha EIAs were deficient and incomplete - contributing to significant social and environmental impacts. Finally, the public has very limited data; largely summary and general reporting that is insufficient to independently review the sites or assess the full/actual costs versus benefits of a proposed mine or mine expansion. To ensure that the government and public have sufficient information to independently evaluate the mines and mining impacts the government and public should engage more closely in intensive environmental impacts analysis, strategic impacts analysis, and cumulative impacts analysis. Individually these can ensure mining impacts are properly assessed. Together these can ensure that the full impacts to human health and the environment are considered and can help guide governmental decision-making.

Policy makers, the public, and regulators have to evaluate the trade-off between what is *suggested today* (jobs, money, data, or mine promises that there will be no degradation to the environment or human health) against impacts that will occur later in the mining process and after project closure. There are countless examples of mining problems from around the world that have caused tens or hundreds of millions of dollars to fix. The EIA process allows the government and public to better evaluate the actual impacts and costs associated with a mine *before* impacts occur.

Mining company promises alone are insufficient to evaluate a mining proposal. Evaluation by the government and public requires extensive technical, scientific data - which the mining company possesses - and should supply to the government and public to ensure that the government and public are on equal footing with the company in terms of assessing impacts.[25]

The EIA process helps ensure that there is adequate:

- Data and information to support informed consideration by the government and public.
- Communication and coordination between the government, the company, and the public. This is essential to ensure the process is credible.
- Resources and technical capacity to regulate the project before, during and after mining.
- Accountability: The EIA process allows the government to track the project and progress/impacts - essentially to compare the proposed project (what the mine proposed and analyzed in the EIA) with the actual results of the project.
- The process can also establish processes and regulations to make data available to the public and promote public participation. This is particularly important, as evidenced by recent social unrest around and about Peruvian mines.

To pay for the analysis, the mine proponent should provide to the government the funds necessary for the government to regulate potential impacts. The company seeks to profit from the nation's resources and its regulation should be a cost of doing business.

Examples of common issues and problems at mines - to which only the mining company has data to support or demonstrate - include, but are not limited to:

- Geochemical data may indicate that waste rock will cause deleterious leachate or that acid or base metal contamination is probable.
- The tailings may contain excessive cyanide that will not photo-degrade - resulting in cyanide contamination to ground water.
- Geologic data may indicate likely subsidence.
- Hydrologic data may suggest that contaminated ground water from the pit will be hydrologically connected to local streams.
- Contingency and emergency planning are usually necessary and should be required.
- Transporting chemicals and materials to and from the mine may cause problems at or far from the mine.
- Social and cultural issues may necessitate special actions or protections at the mine.

The government may not have the resources to evaluate for every possibility, but with the company's data the government and public are in a reasonable position to assess impacts and propose alternative methods, require representative monitoring, etc. An example of genuinely transparent data sharing and availability is the Stillwater Mine, located in south central Montana,

[25] It is recognized that some mine-related data could represent "trade" or private information about the resources in the company's holdings. It is therefore acknowledged that some data may appropriately be withheld from the government to ensure companies are not harmed by required EIA disclosures. But in reasonable practice this data should be fairly limited.

USA. Providing data to the public has reduced public objection, increased public interest/participation and protected human health and the environment - while also promoting mining.[26]

In improving the existing Peruvian environmental analysis process, the following "Decisions" should be considered (this is not an exhaustive list but seeks to identify the overarching topics that must be included). They are common to most International EIA processes and provide the minimum topical considerations.

1. What decisions need to be made?
    a. Who is making these decisions?
    b. How does the government ensure that decision makers have adequate information to make good decisions?
2. What data is needed?
    a. Who has this data?
    b. What resources are needed to:
        i. Evaluate the data for accuracy and completeness, and
        ii. Manage, assess, and access the data?
3. What gaps exist in the data - qualitatively and quantitatively?
    a. Identify gaps/problems between field researcher and data producer and the decision maker. Need an adequate capacity to bridge these gaps… particularly if the data is coming from the company.
    b. Ensuring that data is appropriately shared between regulators, regulatory agencies, specific decision makers, and the public.
4. What is a reasonable timeframe to promote mining development AND fully regulate mining activities?
    a. Ensure that the regulatory process does not hinder the interest in mineral exploitation.
    b. Ensure that the time allowed for the regulatory processes is adequate for complete regulatory oversight and reasonable public participation. Cultural and civil unrest in Peru have resulted from failing to ensure there is meaningful public participation and engagement in mining decisions.
        i. Public participation is sometimes viewed as a "negative" process because it can be viewed as anti-mining. This may be true at times but public participation can supplement government processes to the benefit of government regulators and mining companies - by providing helpful review and by providing predictable public engagement (*thereby avoiding demonstrations, strikes, and unrest*).

[26] At that mine, the company established a partnership with citizens and communities in the area and nongovernmental organizations. The voluntary agreement, called the Good Neighbor Agreement promoted platinum and palladium mining while extending protections beyond state requirements to protect land, water, and area communities. A major component of the Agreement is data sharing, which provides for community access to data, thereby allowing independent analysis. Of special note is that under the Agreement the mine provides local communities and the public with access to critical information about mining operations - which provides the opportunity to address potential problems before they occur. http://www.northernplains.org/the-issues/good-neighbor-agreement/.

ii. In much of the world, public participation provides useful supplemental analysis and review of the EIA processes.
iii. Public participation is further necessary elements of a credible government review processes.

5. What management of expertise is needed - what support do Peruvian regulators need, such as from different government agencies, and what support can these agencies offer to other agencies/decision makers?
6. What is needed to ensure that the Peruvian government and regulatory agencies maintain their capacity to credibly regulate mines (staffing, funding, etc.)?

The answers to these questions can help inform the actual, minimum information that should be considered in a mining EIA. These are identified and briefly discussed below.

Water Quality Standards

At a minimum, at the Espinar Mines, and throughout Peru, mine regulators should adopt more rigorous, defensible water quality standards. Current Peruvian standards are often significantly less protective than more recent and scientifically supported standards from elsewhere around the world.

It is strongly recommended that mines in Espinar be regulated by standards at least as protective as those standards currently required by the Environmental Protection Agency/State of Montana, in the United States. These standards are appropriate and reasonable for numerous reasons, including, but not limited to:

- Montana's standards were specifically developed for a mountainous environment similar to that of the Espinar Province.
- Montana, independent of its mountains, has an environment often similar to Peru's mining areas, including general topography, terrain, and water resources and water issues.
- Montana has specific ground water standards, discussed below.
- Montana's population is demographically similar to the Espinar Province, with relatively small clusters of population, or few people, in or around mining areas and large centers of population centered in valleys near or far from the mines.

Equally importantly, Montana's standards were developed according to United States "Clean Water Act" requirements - which require state's surface water standards and regulations standards to be at least as protective as United States/federal standards. United States' standards are amongst the worlds' most studied, most defensible, and most scientifically supported.

Other standards from around the world may be more protective, which should be considered as alternatives. Montana's surface water standards for selected priority pollutants is included in Appendix B.

Ground Water

Figure 9 Ground Water "Well" near Antapaccay Mine

For similar reasons to those above, it is strongly recommended that regulators overseeing mines in Espinar Province adopt regulatory procedures similar to Montana's ground water standards. Peru needs ground water standards to protect ground water resources for the same reason it needs surface water standards. This recognizes not only the connectedness of surface waters and ground waters but also recognizes the importance of both surface and ground water to Espinar Province's - and Peru's - peoples and future.

Many countries that have surface water standards do not have minimum specified ground water standards. These countries without national minimum ground water standards include the United States. Ground water standards are critical for all countries, including Peru. Ground water has both direct and indirect connections to and impacts on surface water. Further, ground water is very often pumped to the surface and used for surface water purposes, such as drinking, irrigation of farmland, industrial uses, etc. -- all of which can be impacted by the ground water's quality.

Montana's Ground Water Standards have a demonstrated history of testing, scientific support, utility, and applicability that are relevant and appropriate to Peru's ground water. These ground water standards are presented for government and public consideration and discourse in Appendix C.

Ground water quantity is also an important consideration. During the Tintaya Mine tour in preparation for this report Xstrata officials reported that little water was pumped from the Tintaya pit, although there was water at the bottom of the pit. Actual amounts (and timing) of pumping was not reported. Mine pits almost always intercept water. Especially in arid areas the mine pit becomes a "sink" for water. As a result, ground water moved into the pit - reducing the ground water table, especially because net evaporation will be high. This underscores the need for the mining company to provide water quantity, evaporation, flow, and water-balance data (both actual and predicted) to the government and public.

Cumulative Impacts

Establishing the existing and historic water quality near the Tintaya and Antapaccay Mines will not only serve the local interests of people/communicates potentially impacted by mine wastes. Establishing the existing and historic water quality near the mines may be used to help develop a picture of the cumulative impacts from all of the mines in the area, including, but not necessarily limited to, Tintaya, Antapaccay, Las Bambas, and Coroccohuayco, and any other mine that can be tied to or between watersheds, airsheds, or social or economic zones.

Figure 10 Tintaya Main Pit Close-up of Workings

Cumulative Impacts (or, cumulative effects) are the impacts to the environment that result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions.[27] The actions and impacts are related, regardless of who is taking the action and regardless of the regulatory entities, if any, that will regulate the activity.[28]

In the US, there are 8 principles for Cumulative Impacts Analysis.[29] All are important to consider when viewing, reviewing, and evaluating cumulative impacts from mining in Espinar Province.

1. Cumulative effects are caused by the aggregate of past, present, and reasonably foreseeable future actions.

[27] Cumulative impacts will occur when activities co-occur and interact with other activities (each other) and have similar impacts. There are four common elements that make up cumulative impacts: Coincidence, Sequence, Addition, and Synergy. Coincident impacts occur when two activities or events happen at the same time and/or at the same location. The closer the events are in time and/or space the greater the coincident impacts will be. Sequence refers to the order of the impacts from the different events. Impacts may be greater or lesser depending on when an impact or a management decision (such as governmental permit issuance) occurs. Addition refers to the additive impacts that may result from multiple, individual impacts. Synergy refers to the interactions between multiple activities resulting in impacts that are more, or less, substantial than they would be if the occurred individually.
http://www.fs.fed.us/psw/topics/fire_science/craft/craft/Resources/Cumulative_effects_analysis.htm#intro.

[28] Cumulative effects may be either additive or interactive. Interactive effects may be either countervailing (net cumulative effect is less than the sum of the individual effects) or synergistic (net cumulative effect is greater than the sum of the individual effects). (From US EPA)
Other primary types of impacts to consider, as both comparison and for completeness, include:

- Direct Effects - are those effects resulting from the action and occurring in the same general time and place as the action.
- Indirect Effects – are those effects resulting from the action but occurring at a later time or at a greater distance from the action.
- Reasonably Foreseeable Future Actions – are potential federal, non-federal, or private actions that have been publicly announced for development with a reasonable likelihood to occur, and which would overlap with the geographic and temporal scope of the cumulative effects analysis. Potential actions which are currently considered speculative would not be identified as reasonably foreseeable. (From US EPA)

[29] *Considering Cumulative Effects Under the National Environmental Policy Act* (DIRS 103162-CEQ 1997).

2. Cumulative effects are the total effect, including both direct and indirect effects, on a given resource, ecosystem, and human community of all actions taken, no matter who (federal, nonfederal, or private) has taken the action.
3. Cumulative effects need to be analyzed in terms of the specific resource, ecosystem, and human community being affected.
4. It is not practical to analyze the cumulative effects of an action on the universe; the list of environmental effects must focus on those that are truly meaningful.
5. Cumulative effects on a given resource, ecosystem, and human community are rarely aligned with political or administrative boundaries.
6. Cumulative effects may result from the accumulation of similar effects or the synergistic interaction of different effects.
7. Cumulative effects may last for many years beyond the life of the action that caused the effects.
8. Each affected resource, ecosystem, and human community must be analyzed in terms of its capacity to accommodate additional effects, based on its own time and space parameters.

The importance of evaluating cumulative impacts cannot be overstated. The individual impacts from the Tintaya Mine, the Antapaccay Mine, and the Las Bambas mine are potentially significant to each of their individual, respective, local geographies. However, their cumulative impacts may impact each of their local geographies, the geographies of their sister mines, and the region as a whole. These individual and cumulative and other mining impacts may also be enlarged by impacts from other existing or new activities, such as agriculture, and other activities.[30] This is critical for technical understanding and possibly more importantly for agency and public decision making. It is impossible to know the impacts mining may have to the region (social, economic, environmental, etc) without government agencies, policymakers, and the public, considering cumulative impacts.

Past, present, and reasonably foreseeable future actions conducted by agencies and private parties should determine whether they were relevant to the cumulative effects analysis for the proposed project. These activities should be reviewed to determine if they have had or could reasonably result in any impacts that potentially could affect the human and natural environment

[30] These impacts may be viewed in two distinct ways - spatially (geography and resources) and temporally (time). The spatial scope for cumulative effects associated with a project varies among the different environmental resources. For example, cumulative effects for soils, vegetation, and wetlands are focused on activities within the mine permit zone or the immediate watershed and adjacent watersheds potentially affected by the project(s). Differently, cumulative effects related to wildlife, marine mammals, native subsistence, and socioeconomics encompass larger geographic areas. The geographic scope for the cumulative effects assessment for each resource should parallel the anticipated range of potential direct and indirect effects for that resource as a result of the proposed project (or project alternatives).
The temporal scope for cumulative effects associated with a mine project varies with the timing of the project, other projects, and their respective durations. A proposed project will estimate a lifespan (e.g. a 25-year life-of-mine) followed by several years of reclamation activity. On that basis, the temporal scope for the cumulative effects analysis will start with issuance of the necessary permits for development and continue through reclamation activities and security/bond release. All past activities in the project vicinity should be considered as part of the existing environment.

of the area or whether their effects on regional population would overlap with workforce requirements for the proposed project.

This will look to and include past actions that have happened in the area and may still be causing impacts and present activities that are ongoing but not necessarily related to the proposed or active mine.

Determination of reasonably foreseeable future actions should screen for a wide array of news articles, permit applications, and scoping comments to assess which potential projects or activities are reasonably likely to occur in region. There is no absolute/standard time period to look forward, but the future period should at least extend into the future an equal number of years of potential mine operations, or 25-35 years, whichever is longer in a manner and location that would result in overlapping effects with the proposed project. The evaluation of reasonably foreseeable future actions also considered the likelihood of the action moving forward.

It is only by reviewing all of these components together that government regulators and the public can identify and understand how multiple mines in the Espinar Province will impact the whole of the province. Without a cumulative impacts analysis, the individual mines may be identified but the synergy between the different mines and activities (and their individual timing, order, and interrelationships will not be considered - with potentially significant results.

As a policy matter, it is essential for the government to ensure that project-specific impacts and cumulative impacts are known and considered. Without such analysis, the actual costs and benefits from mines in the Espinar Province will be largely unknown until those costs and benefits are manifested - leaving the government and public to respond when it may be too late.

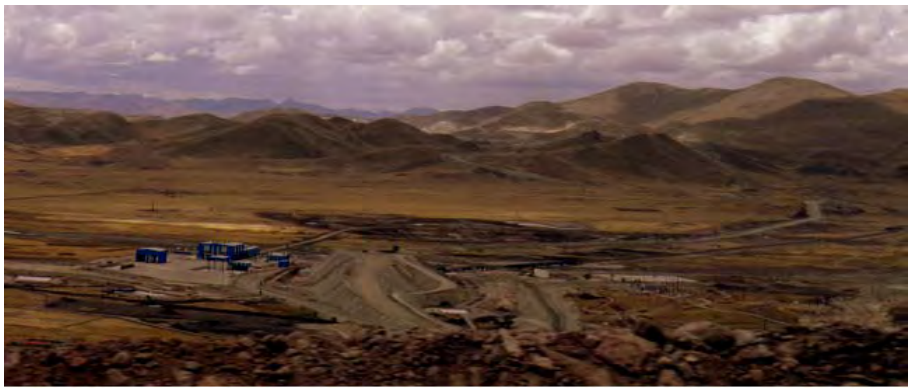

Figure 11 Antapaccay Mine Loading Facility and Conveyor Belt

Infrastructure and Infrastructure Impacts

Infrastructure is a significant and unique are of “impacts” to consider. In addition to the actual mine facilities required for mining, mines require significant related, resources, often grouped together under the name “infrastructure.” These are the roads, power lines, railroad lines, worker and community housing, and other resources that tend to be both on and off of the mine site but dramatically increase the mine’s “footprint” of impacts. When considering infrastructure development associated with a mine it is important to identify and prioritize the different features of infrastructure development in the area (and connecting the mine to other mines or roads, power, water, etc.

Mines may be slowed/delayed because roads, railroad, electric power, and other infrastructure are limited or unavailable - and likewise mines may be sped-up because such infrastructure is readily available. Because infrastructure is comparatively limited in some remote areas of Peru, high minerals prices plus record-expanding exploration pose what may be an unprecedented development threat to many remote or less-developed areas. The existence of one mine tends to facilitate other mines, especially if they are owned by the same company.

For example, a mine that requires electricity may seek to have the government or other entity extend existing power lines/grid to the mine site. This in turn may promote other exploration and mine development. The mine could also promote more or bigger roads and/or railroad (spur) development or expansion. Increased roads and rail access could lead to increased logging or other resource exploitation. An increased mine worker population will likely lead to increased population pressures, such as housing, shopping, and hunting/fishing/recreation. One thing is likely to lead to another, and another, etc.

Many factors will impact how infrastructure is developed, including economics; public support or opposition; local peoples and communities' capacity, interests, participation, and goals; and the lack of a comprehensive development-growth plan.

The Tintaya Mine includes resources that have significantly enhanced Antapaccay Mine development, notably for milling and waste disposal. Likewise, power and transportation at Tintaya have made developing Antapaccay more affordable and quicker for Xstrata. Las Bambas is cheaper for Xstrata to develop because it can send its ore slurry to Tintaya for milling and tailings disposal. These are not necessarily good or bad things - but are important to consider regarding cumulative impacts, mine impacts, and regulatory and environmental assessment.

EIA Process Costs and Benefits

In 2007 the European Union commissioned a study examining the relative costs and benefits associated with implementation of Environmental Impact Assessment in selected countries within the European Union.[31] The study was actually two reports: the first looked at project EIAs and the second looked at Strategic Impact Assessment. The focus here is on project EIAs. The report dispels many myths about EIA processes yielding low results, creating excessive costs, or not having significant benefits. Selected conclusions include:[32]

- Based on the case study findings Project EIA's are usually completed in less than 2 years in the Netherlands and United Kingdom. This timescale is also achieved in Greece and Spain, although there appear to be additional exceptions to the rule.
- EIA studies are usually conducted in 6-12 months. Where the proposed development is located in an environmentally sensitive area, data for a full year of should normally be provided, but this process can be shortened if the information is already at hand.

[31] Institute for Environmental Studies, Frans Oosterhuis. Costs and benefits of the EIA Directive Final report for DG Environment. May 2007. Downloaded from the internet at: *http://ec.europa.eu/environment/eia/pdf/Costs%20and%20benefits%20of%20the%20EIA%20Directive.pdf*.
[32] *Ibid.*

- EIA delays can occur for many reasons but where EIA delays occurred they were largely due to actions or inactions by the developer or consultant (such as lack of proper scoping or failure on the part of the developer, or consultants to undertake a systematic study, and provide relevant, or sufficient, data resulting in the need for supplementary information.

In the majority of the case studies, all the participants confirmed that the EIA process had assisted decision-making, in one or more of the following ways:[33]

1. key environmental issues had been identified in 94% of cases
2. the quality of the project design had been improved in 83% of the case studies
3. higher standards of mitigation had been achieved than would otherwise have been expected in 83% of cases
4. a better framework for preparing conditions and legal agreements to govern future operation of the project had been provided in 72% of cases
5. environmental concerns had been incorporated from an earlier stage in the design process in 61 % of cases
6. better decision- making had been achieved in 61% or more of the case studies due to :
    a. a more systematic and structured framework for analysis,
    b. more objective and credible information,
    c. increased rigor in evaluating environmental information,
7. the environmental credibility of the developer had been enhanced in 61% of cases,
8. environmentally sensitive areas had been avoided through project re-siting or re-design in 56% of cases

The report noted many ways to improve the EIA performance. This and other similar analyses provide Peru with opportunity to learn from other nations' performance and experiences and develop a more complete, vibrant, and successful environmental analysis rubric.

More specifically, these conclusions underscore the value of completing a strategic environmental impact analysis.[34] For the Espinar area this provides a proactive opportunity to enhance decision making in the Espinar area, incorporating cumulative impacts and addressing community concerns. It is particularly appropriate given the central role the Tintaya Mine site will play for decades to come in mining at Antapaccay, Las Bambas, and possibly Coroccohuayco. An EIA to evaluate cumulative effects could be a supplement to, and draw

[33] *Ibid*.

[34] Sadler and Verheem (1996) define Strategic Environmental Assessment (SEA) as the formalized, systematic and comprehensive process of identifying and evaluating the environmental consequences of proposed policies, plans or programs to ensure that they are fully included and appropriately addressed at the earliest possible stage of decision-making on a par with economic and social considerations.
Since this early definition the field of SEA has rapidly developed and expanded, and the number of definitions of SEA has multiplied accordingly. SEA, by its nature, covers a wider range of activities or a wider area and often over a longer time span than the environmental impact assessment of projects.
SEA might be applied to an entire sector (such as a national policy on energy for example) or to a geographical area (for example, in the context of a regional development scheme). SEA does not replace or reduce the need for project-level EIA (although in some cases it can), but it can help to streamline and focus the incorporation of environmental concerns (including biodiversity) into the decision-making process, often making project-level EIA a more effective process.
SEA is commonly described as being proactive and 'sustainability driven', whilst EIA is often described as being largely reactive. From: http://www.cbd.int/impact/whatis.shtml#strategic.

from, existing project EIAs but allow the government, particularly local government, and communities to address existing concerns and the Tintaya Mine changes its operational focus and the Antapaccay mine begins in earnest.

Strategic impact analyses would include reviews of the environmental quality (water, air, soils, ground water, etc.) for each of the mines in the Espinar Province - and the cumulative impacts (see below) that will result from all of the mines and other activities - allowing policy makers and resource managers to better understand what the Province will look like in years to come. Such policy analysis is essential not only for natural resource management but for all aspects of public health, welfare, and social condition.

VI. Ministry of Environment Report

In April 2013 the Ministry of Environment released the summary of results of its Participatory Health and Environmental Monitoring (PHEM; "PHEM Report") which was undertaken to begin to assess Xstrata's mining impacts in the Espinar region. Results included a determination that there is pollution in the Espinar Province, including, but not limited to metals contamination in surface waters and sediments of the Camacmayo, Tintaya and Collpamayo waterways.[35] A related finding was that people living in the communities directly affected by Tintaya are exposed to arsenic, thallium and lead.[36]

The study was commissioned by Peru's government in 2012 following violent protests by local residents and politicians that accused Xstrata PLC's Tintaya copper mine of contaminating water. The company rejected the accusations. Local governments and residents of Espinar also participated in the study, which collected air, water and soil samples at 481 points in the Espinar province.[37]

The Ministry concluded that natural conditions and mining had caused environmental and health contamination.[38] This included, but was not limited to, traces of lead and thallium around mining activities. Because of the importance of the Ministry Report and its conclusions, the summary of its conclusions is presented in Appendix C.

PHEM Report Conclusions

The PHEM Report identifies numerous important and potentially troubling conclusions. These include clear threats to human health and the environment. At 64 of the sites monitored at least one sample exceeded regulatory standards for heavy metals (mercury, arsenic, cadmium and lead) corresponding to water used for human consumption. Surface and ground water in some sites close to Xstrata's mining activities[39] had physical and chemical contamination exceeding standards, suggesting potential impacts by mining.

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[35] PHEM Report.
[36] PHEM Report.
[37] *See* PHEM Report. *See also* http://www.4-traders.com/XSTRATA-PLC-4003779/news/Xstrata-PLC-Peru-Study-Finds-Mixed-Sources-of-Pollution-in-Espinar-Province-16684930/.
[38] PHEM Report.
[39] Tintaya, Tintaya Marquiri, Alto Huancané, Bajo Huancané, Alto Huarca, Huinipampa, Quetara I and Huisa.

Other conclusions suggest contamination from sources not related to mining. Still other conclusions warrant further review and analysis (or study) because the conclusions may not fully eliminate mining as a potential source of contamination or otherwise explain the sources of contamination. It is important that the government identify and explain all sources of contamination, that it use best practices in doing so, and that its activities and results be fully transparent.

Figure 12 Portion of Tintaya's Current Processing Facility (Mill)

Because of the specific public concerns about mining-caused pollution and contamination, particular attention should be placed on determining and differentiating contamination that is caused by Xstrata's mining activities and contamination that is natural or background. The determination that contamination is natural should receive as much review and analysis as determining that contamination is mine-caused. As discussed below, Glencore Xstrata's failure to previously discover and disclose the significant sources of contamination that it calls "natural" (background) underscores that the distinction between "natural" and mine-caused contamination should be carefully scrutinized.[40]

The PHEM Report's Action Plan's proposes Provincial System of Environmental Health Monitoring - which is a good start to determining actual mine-related impacts in the Espinar Province. As discussed below, it should be combined with a larger cumulative impacts analysis to truly create a regional analysis of mining that best answers questions raised by the public and the PHEM Report. The bottom line is that numerous goals should be pursued as follow-up to the PHEM Report. At a minimum, these should include:

- Monitor Environmental Health to ensure that human health is protected.
- Identify sources of background and mine-related contamination, and define the cause-effect relationship based on widely accepted scientific methods and analysis.
- Ensure that the follow-up monitoring is transparent and discloses all information to the public.
- Make previous company and government data available to the public.

[40] This is particularly important when determining an area is outside of the zone of mine impact - because many areas may be hydrologically connected or receive water or air contamination that is not readily obvious, but if undetected would erroneously suggest natural/background. As discussed elsewhere, this is an important distinction particularly because no previous Xstrata (or other mining) data has documented background contamination in the levels and distribution described in the PHEM Report. At the same time, Xstrata has stated that its monitoring is adequate and representative, which now appears problematic.

Glencore Xstrata Response

In response to the PHEM Report, Xstrata concluded that the contamination discovered above environmental standards was only in a few samples and that most of those samples were from outside of the mine's area of influence - concluding that the contamination measured was the result of natural, or "background," metals contamination and not from current or Xstrata mining activities.[41]

Xstrata's immediate assertion that the contamination discovered was natural and "background" - and therefore unrelated to active mining - raises an even larger, and maybe more significant issue: that Peru's regulatory framework is inadequate in terms of requiring mine companies to provide environmental data before and during mining (and probably after mining) to ensure that the government and public is aware of pre-mine conditions and conditions created by mining. At the Tintaya mine, for example, the Xstrata should have documented and disclosed any natural contamination to the government and public.

It is not clear how Xstrata defines the mine's area of influence or how it would be clear from the PHEM Report that the origins of contamination are natural, particularly in light of the statements and conclusions in the report itself. Xstrata's response is troubling because it calls into question the accuracy and precision of Xstrata's monitoring programs and further calls into question Xstrata's disclosure of data and information to the government and to the public.

As the mine operator and permit holder, Xstrata should have known about the contamination discovered by the PHEM Report. However, Xstrata's previously disclosed data and reports fail to adequately identify the collective or individual contamination identified by the government. This underscores the conclusions in this report - that all Xstrata data should be made available for analysis and scrutiny. Xstrata has been mining in Espinar for almost seven years, and continues to expand its mining operations and footprint - but somehow appears to have missed the contamination that the government's one-year examination discovered.

If the government knew about this contamination then it failed in its permitting processes to disclose it to the public - and to take necessary steps to address the health concerns before mining started.[42] Further, if contamination existed before mining - it seems reasonable to be concerned that mining activities could cause further contamination. Alternatively phrased, it seems improbable that natural conditions could cause contamination but that large-scale mining would not cause contamination. In any case, data about pre-mine contamination should have been collected and disclosed to the government and public. That contamination then should have

[41] *See e.g.* http://www.4-traders.com/XSTRATA-PLC-4003779/news/Xstrata-PLC-Peru-Study-Finds-Mixed-Sources-of-Pollution-in-Espinar-Province-16684930/: "Xstrata said in a statement that only a few samples found pollution above the environmental standards and most of those were outside of the mine's area of influence. "This clearly shows that its origin is natural," Xavier Ochoa, the general manager of Tintaya, said. Mr. Ochoa said that Xstrata will work with officials to resolve the problems that have been identified."

[42] As a condition to mining it is not uncommon for the government to require a mining company to help respond to pre-existing conditions. This is generally considered to be equitable because mining activities can generally make these pre-mine conditions worse.

been addressed as part of the mine permitting process. Xstrata's failure to discover background contamination and report it to the government is a failure of both Xstrata's monitoring and Peru's regulatory process.

Ramifications of the Failure to Previously Identify Background Contamination

The Tintaya orebody has been mined since 1985, by Magma Copper Company, BHP Billiton, and currently by Xstrata. This history of mining and government regulation - combined with the new PHEM Report raises a significant problem: If the contamination identified by the PHEM Report is truly natural or background - then why has it taken 29 years of active mining to discover and report the contamination?[43]

This is not a rhetorical question – and raises at least four very significant ramifications regarding:

1. Peru's mine laws and regulation: Independent of whether the contamination existed before mining started in 1985, or was caused by mining, the mine regulatory processes should have ensured that background contamination was identified. The PHEM Report was not particularly comprehensive - and it identified significant contamination. As concluded below, Peru's Environmental Impact Analysis requirements should be significantly expanded to ensure that contamination before, during, and after mining is identified.

2. The government's implementation of those mining laws and regulations: Where contamination is identified, as it has now been identified in the Espinar Province, the government must implement an appropriate regulatory response. This should include fully identifying the sources and extent of contamination; ensuring the transparency of data, information and reports; and ensuring full public participation.

3. Xstrata's past and current monitoring programs: Xstrata has operated the Tintaya mine since 2006 and should have discovered the contamination long before the PHEM Report. Xstrata's monitoring programs should be reviewed to identify why its past or present monitoring activities did not identify the contamination. This is true regardless of whether the contamination is natural/background or is caused by the mine. In response, the government should establish a panel to oversee and review the existing data (the PHEM Report and all of Xstrata's previous data) and consider its completeness, representativeness, accuracy, and precision. The panel should then make recommendations to correct any mine monitoring deficiencies and prevent similar deficiencies in the future.

[43] If there was contamination before mining started it is very likely that the company would want to identify and disclose that contamination to protect the company from being blamed for the contamination after it started mining. This pre-mining disclosure would prevent the mine from being blamed for the pre-existing contamination and would further allow the government and mine to take appropriate mine planning and regulatory steps to ensure to prevent the mine from adding to the natural contamination.

4. Xstrata's disclosure of data and information to the government and public: As discussed elsewhere in this report, the public does not have sufficient access to Xstrata's data to independently confirm that Xstrata's mine operations have not caused environmental contamination. The PHEM Report underscores the breakdown in Xstrata's monitoring programs. The next step is Xstrata to consider the need to significantly increase the level of data transparency: independent review of all of Xstrata's monitoring programs, including raw data, may have allowed the government or public to identify deficiencies in the monitoring program, data collection, data analysis, etc. As part of the response to the PHEM Report, the government should require Xstrata to make all of its data public so that the government and public can independently consider Xstrata's monitoring programs and results. Further, all future company monitoring should be public to help prevent these types of problems in the future.

Final Critical Step

These four concerns logically point to another step in response to the PHEM Report: develop and implement cumulative impact analysis for all mine sites in Peru. This is necessary and appropriate to determine actual background (non-mine) contamination, mine contamination, and the impacts to human health and the environment, plus future monitoring and reporting needs. Regarding Glencore Xstrata, a cumulative EIA should specially focus on Antapaccay and Las Bambas, where mine-related activities have probably not yet contaminated the environment. Completing this Cumulative EIA now will ensure that future contamination will be properly attributed to natural background or the mine's activities.

As a corporate matter, the PHEM Report presents a good opportunity for Glencore Xstrata to affirm its willingness and intent to engage and work with the government and public to develop meaningful answers to questions raised by the PHEM Report and by the public.

VII. Discussion and Recommendations

Xstrata's Tintaya and Antapaccay projects appear to be quite successful and lucrative from the company's perspective. Xstrata PLC's Chief Executive Officer, Mick Davis, has stated:

> "Our acquisition of Tintaya for a headline price of $750 million including the Antapaccay and Coroccohuayco deposits in 2006 repaid its acquisition cost in full within 18 months and the mine has generated over $2.5 billion of EBITDA[44] to date.
> ....
> With an industry-leading capital intensity of less than $10,000 per tonne and total capital cost of $1.47 billion, Antapaccay will double current production at Tintaya, significantly reduce operating costs and provide more than 20 further years of operations. Antapaccay

[44] EBITDA is an acronym for: "earnings before interest, taxes, depreciation, and amortization."

> will earn Xstrata's cost of capital at a copper price of $1.91 per pound over the life of mine."[45]

In other words, the $2.5 billion generated by the two mines to date will only increase and increase at a greater/more profitable rate. Based on this profitability it is therefore suggested that Glencore Xstrata should ensure that it fully addresses questions and concerns about impacts to local communities so that local communities do not unfairly or unreasonably suffer the costs of mining.

Underpinning any effort should be access to complete monitoring data. This is essential to assess and evaluate existing reports and claims by the mining company. At this time there is insufficient data to assess the degree to which the mines have degraded the environment and caused injury to human health, the environment, or other resources, such as livestock.

Answering these questions requires participation by both the company and community members. The company should release all monitoring data related to its Espinar mining projects and activities. This is essential for independent review and evaluation of the sites.

Community members should ensure that their complaints and concerns are in writing and supported, where possible, by evidence of their claims.

Local, sub-regional, and national government entities should ensure that they all participate and oversee both company and community activities to ensure that all activities are transparent and documented. The need for documentation is critical and there is likely no entity available to accomplish this except for the government.

The government should further ensure that Environmental Impact Analysis (including Cumulative Impact Analysis), as described earlier in this report, are implemented and maintained to ensure that government entities, the company, and communities all have access to appropriate data to independently assess mine plans and impacts.

Under this EIA rubric, it is critical that monitoring focus on:

1. Environmental monitoring, including;
    a. surface water quality and quantity,
    b. ground water quality and quantity,
    c. soils,
    d. sediment,
    e. wildlife
    f. human health
    g. animal health, etc.
2. Human health
3. Public Participation and transparency in data collection and full data results.

[45] http://www.xstratacopper.com/EN/MediaCentre/2012PressRelease/Pages/XstrataCopperannouncesplantcommissioningandincreasedMineralResourcesatAntapaccayinPeru.aspx.

With these data limitations in mind, it is recommended that if new data is collected then it replicate the locations and protocols already implemented - and that all data be released to the public and government. This will allow for the corroboration of past data points. New data will not be perfect (it is impossible to replicate the past) but it will help build confidence in past data and begin a new data "set" that is fully available to the public.

This will also complement the past data by possibly demonstrating comparability of results between current samples and past/historic samples.

New data will also help identify what monitoring and data collection are necessary and appropriate in the future to promote public trust in water data and also to assess cumulative impacts of all of the mines in the Espinar region.

Participatory Monitoring

As described above, participatory monitoring is a non-technical term meaning that for the purposes of this report means that members of potentially impacted communities engage in active and on-the-ground monitoring. In Espinar Province participatory monitoring has been ongoing for a number of years as part of various Roundtable Dialogues between Xstrata, government entities and agencies, community groups, and individuals. These efforts have yielded valuable environmental data.

It is recommended that additional participatory and community monitoring be developed and implemented. This recommendation is independent of ongoing efforts, which should be considered and complemented when developing expanded and/or new protocols.

Expenditure of Company Funding

While visiting communities, individuals and groups identified concerns about how funds provided by the company to the government were being expended - which relates closely to Participatory Monitoring. Xstrata has provided funding to various government and community entities as part of framework agreements and/or 'dialogues' to promote effective community participation.[46] The expenditures of these funds appear to be at times controversial and/or unclear. It is therefore suggested that the expenditure of these funds should be fully transparent to ensure that community members know exactly how and when the funds were used and who made the decision(s) about the expenditures. It is further suggested that funds should be expended only on mine-related activities, such as data development; identifying and studying mine impacts and mitigation; mitigating mine impacts; and providing benefits to the community as a whole that offset or balance mine impacts, thereby reducing the net effects of mining.

Data Access

Oxfam America requested detailed data that CSP2 considered necessary to evaluate the mine, and in meetings with Xstrata CSP2 further requested these data. The request focused on

[46] This support is essential to public participation and therefore is appropriate - and Xstrata should be given appropriate credit.

complete, raw data that would allow CSP2 to evaluate the existing company reports that indicate that there is no contamination from the mines at Tintaya or Antapaccay.

The PHEM Report is the first substantive data available to counter the company's conclusions that the mines have not contaminated the environment or degraded human health. Community members have complained and continue to complain about what they assert are mine-contamination caused injuries, including human sickness and animal deaths. In addition to future monitoring indicated by the PHEM Report, CSP2 asserts that it is critical to not only look forward to new data to but to look backwards at existing data and assess its accuracy, precision, representativeness, and completeness.[47]

In response to these requests Xstrata provided data about Las Bambas but not detailed data from Tintaya or Antapaccay. In association with this report another request will be submitted to Xstrata to again request complete data from Tintaya and Antapaccay mines so that the communities can assess impacts for themselves - from raw data as well as summaries and synthesized reports.

The problem with Xstrata's historic data is not that there is known or unknown contamination - it is that the public does not have sufficient access to data to analyze the data itself and draw its own conclusions. Xstrata's reports, fall short of building confidence that company conclusions are accurate. In light of community claims, it should be in the company's and communities' best interests to promote and ensure that data reviews can adequately ascertain whether or not mine activities have degraded the environment. This will then allow the communities and government/regulators to further evaluate whether there has been harm to human health or the environment.

Further, the company, communities, and relevant government agencies (including local government) should consider engaging in cumulative and strategic environmental impact analysis that includes relevant cumulative impacts from all the mines in the Espinar area (notably Xstrata's four active and exploratory operations).

This report seeks to ensure that all mining activities in the Espinar Province, including monitoring and public participation, are consistent with best international practices and protocols. This report does not conclude that Xstrata Copper has not done this. However, persistent community concerns underscores that there is always room for improvement - by the mining company, the government, and the communities and interested parties.

[47] This review should be completed by an independent panel of experts whose process and conclusions are public. The public should further be provided access to all data so it has the opportunity to complete its own independent review.

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Appendix A

Xstrata Company, Glencore Company, Glencore Xstrata PLC

This Appendix describes the newly formed Glencore Xstrata PLC, a company created in May 2013 that combined the former Xstrata PLC and Glencore PLC.

Because Xstrata PLC has been responsible for Espinar mining activities considered by this report (as of June 2013), most of the analysis is based on Xstrata data, policies, reports, etc.

This Appendix describes three corporate entities:

1. The majority focuses on Xstrata PLC because it operated the mines considered and most of the report is based on Xstrata PLC documents and information.
2. General background information is provided about Glencore International PLC notably because Glencore was the majority entity going into the merger.[1]
3. The newly formed Glencore Xstrata PLC is described and selected resources provided for future tracking, research, and engagement.

1. Xstrata PLC

Xstrata PLC was a corporation headquartered in Switzerland and registered in England[2] that operated in approximately 20 countries and employed more than 70,000 people globally.[3] PLC was the primary corporate entity that owned/operated subsidiaries that own other subsidiaries and directly or through further subsidiaries mined various minerals and provided services to mines. Xstrata PLC owned Xstrata Copper, which was a wholly owned subsidiary of Xstrata Corporation that was headquartered in Brisbane, Australia. Xstrata Copper maintained offices in Peru, Argentina, Chile, and Canada and employed over 20,000 people worldwide.

In addition to Xstrata Copper, Xstrata PLC also operated other entities: Xstrata Alloys (produces ferrochrome and vanadium used in the steel industry); Xstrata Coal (exports seaborne thermal coal used to generate electricity and one of the largest producers of coal used to make steel); Xstrata Nickel (produces nickel and cobalt); Xstrata Zinc (produces zinc used to galvanized steel and lead used in large batteries); and Xstrata Technology (provides technical expertise to the global mining industry - notably to Xstrata PLC companies).

Xstrata PLC's corporate policy was to offer decentralized control to its subsidiaries, allowing local offices and mines to exercise substantial control over operations.[4]

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[1] http://www.glencorexstrata.com/about-us/history/. *See e.g.* http://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/newly-merged-glencore-xstrata-promises-aggressive-cuts/article11727789/.

[2] Xstrata PLC Head Office: Bahnhofstrasse 2, PO Box 102, 6301 Zug, Switzerland; Phone: +41 41 726 6070. Registered Office: 1st Floor, Almack House, 26-28 King Street London SW1Y 6QW Registered in England and Wales no. 4345939; Phone: +44 20 7968 2800. Primary corporate website: http://www.xstrata.com. General enquiries at: Email: info@xstrata.com; Phone: +41 41 726 6070. Stock code on the London Stock Exchange: XTA.

[3] http://www.xstrata.com/about/at-a-glance/.

[4] http://www.xstrata.com/about/at-a-glance/.

Like many large corporations, Xstrata maintained various corporate policies and statements intended to guide the corporation's business operations and present the corporation to interested parties, investors, and the public. Like most large corporations, Xstrata also produced annual reports for financial and other purposes (some required by financial laws and requirements; others voluntary and intended for public relations, investor relations, education, etc.). Collectively, these policies, statements, and reports helped describe the company and its operations.

Corporate Policies

Perhaps the most important of Xstrata/'s corporate policies in terms of this reports goals, policy breadth and applicability, importance to communities and people living near and/or impacted by its mining operations, and corporate governance in "core" areas was its Sustainable Development Policy,[5] Sustainable Development Standards,[6] Business Principles,[7] and Corporate Ethics Statement. Xstrata maintains other corporate policies,[8] including but not limited to its Global Policy on Bribery, Fraud and Corruption, Risk Management Policy, and Non-audit Services Approval Policy.

For example, Xstrata explained that it is a large corporation but project control was maintained locally, which is important when considering what part of the company is necessary for answers or assistance. It explained its management structure as:

> Over [the last decade since starting] we have retained a uniquely decentralised management structure that gives our people responsibility and authority at a local level, encouraging innovation and an entrepreneurial spirit and creating strong links between our operations and local communities.[9]

Therefore, if residents of Espinar sought information or assistance they would have been best to start with the local managers. If, however, community member were not satisfied with the answers they received they may have moved higher/further into the corporate hierarchy. But it was, and still is, likely important to first try to get answers locally.

Corporate policies and statements may be particularly useful when evaluating the impacts from a company's project because those impacts can be measured against what the company says it will do or not do - and how it will respond to problems.

While "principles" and "statements" are helpful, sustainability policies[10] often offer the most useful information to measure environmental impacts because sustainability policies often focus

[5] http://www.xstrata.com/content/assets/pdf/x_sus_sdpolicy2008.en.pdf.
[6] http://www.xstrata.com/content/assets/pdf/x_sus_sdstandards2008.en.pdf.
[7] http://www.xstrata.com/content/assets/pdf/x_bp_english_0612.pdf.
[8] http://www.xstrata.com/about/key-policies/policies/.
[9] www.xstrata.com. Accessed January 6, 2013. Unless otherwise identified, all Xstrata internet (World Wide Web; "web") reports and citations in this report were accessed and/or copied on January 6, 2013.
[10] Note that the word "sustainability" and "sustainable" may mean different things to different people. By definition, a mine cannot be sustainable because the mineral resource available in a particular deposit is finite (there is only so much, even if there is a lot of it that may sustain a mine for many years - it will come to an end). Therefore, it is important to understand that a corporate definition may be different from a community's definition

on environmental and social impacts. When reviewing Xstrata's former mines in Espinar and elsewhere in Peru, it is potentially useful to consider the corporate policies.

A key corporate policy is transparency, and as discussed in more detail below, Xstrata has not been as forthcoming with complete data as it should be. As a result, it is impossible to independently conclude that Xstrata's former Espinar Province mines have or have not impacted human health and/or the environment - especially regarding water quality. It is important for the new company (Glencore Xstrata PLC) to release all water quality and environmental monitoring data so that mine impacts can be independently evaluated, assessed, and reported.

Sustainability

Xstrata began its Sustainable Development Standards (and Business Policy) with the common statement:

> We will grow and manage a diversified portfolio of metals and mining businesses with the single aim of delivering industry-leading returns for our shareholders. We can achieve this only through genuine partnerships with employees, customers, shareholders, local communities and other stakeholders, which are based on integrity, co-operation, transparency and mutual value creation.[11]

This underscored that Xstrata is first and foremost committed to its shareholders. There is nothing inherently wrong with this, but it is important to understand that its priority is developing wealth for shareholders. The 2011 Sustainability report did not define "shared value" but described:

> We aim to create shared value from our operations. We understand the importance of creating benefits for the local communities in which we are privileged to operate and also for related industry sectors. We create significant local employment, both direct and indirect, and often provide comprehensive training programmes in the process. We invest in community health, education and other areas. We buy a wide range of products and services from local suppliers, in both the mining and non-mining sector. And we pay substantial taxes and royalties wherever we do business.[12]

Xstrata's sustainable development rubric came in many pieces, which viewed by its Framework,[13] was consistent with many mining industry standards and goal (it is not the intent of this report to compare those policies to the policies of other companies). The elements and topics are sufficiently broad to encompass most major mining issues and concerns.

What was notably missing, even in Xstrata's Sustainability Standards, are specific measurable standards to determine success and failure. By definition, most sustainability standards are

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of "sustainable". Further, it is important to consider the resource to which the word "sustainable" is applied. While the mineral deposit is finite, "water" or "community" should be considered sustainable and therefore be sustained.

[11] Xstrata Statement of Business Principles, 2011. http://www.xstrata.com/content/assets/pdf/x_bp_english_0612.pdf; http://www.xstrata.com/content/assets/pdf/x_sus_sdstandards2008.en.pdf.

[12] Xstrata 2011 Sustainability Report. http://www.xstrata.com/content/assets/pdf/x_sustainability_2011.pdf.

[13] http://www.xstrata.com/sustainability/our-approach/sustainable-development-framework/.

subjective[14] and their application and applicability are therefore subjective. As a result, their value should be "balanced" for any particular situation. For example, based on Xstrata's reports, the company's Espinar mines were operating with minimal and acceptable impacts. However, based on comments heard at public meetings and talking with individuals in/near Tintaya and Antapaccay, the company's Espinar mines were allegedly causing major and unacceptable impacts. This report seeks to interpret and understand the difference between what the company says and what the local public says. The merged company, Glencore Xstrata PLC, has the opportunity to take the best of both company's policies and procedures and promote transparency and disclosure sufficient to help allay public concerns and promote mutual public and corporate goals.

2. Glencore International PLC

Glencore was founded in 1974 as Marc Rich + Co AG. During the 1980s, it expanded operations to include agricultural and energy products. In 1994 the company was renamed Glencore International after a management buyout and it went public in 2011. Glencore International was involved in the production, marketing and distribution of mining, energy, and agricultural commodities. Its head office was in Baar, Switzerland. It and its subsidiaries had operations in 30 countries and employed over 56,000 people.[15]

Glencore Primary Business

Ghad three primary areas of business.

1. Metals and Minerals

Glencore's metals and minerals operations included aluminum, zinc, copper, lead, ferroalloys, nickel, cobalt, and iron. It was directly and indirectly involved in mining and refining and as controlling entity or non-controlling entity was involved in mining projects around the world.[16]

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[14] As compared to objective. An objective standard is measurable against some kind of clear, consistent "standard" whereas something is subjective when it is subject to the interpretation of individuals. Temperature should be objective - a certain temperature is fixed and should not vary based on the individual measuring temperature. Reduce pollution is a very subjective standard - where one person may believe that something is not polluted, or that pollution has been reduced, whereas another person may conclude that pollution is significant and has not been sufficiently reduced. This is important when considering corporate policies because people may read the policy or apply the policy differently from each other.

[15] http://metals.about.com/od/suppliersbyname/a/Company-Profile-Glencore-International-Ag.htm. *See also*: http://www.glencorexstrata.com/about-us/history/.

[16] http://www.glencorexstrata.com/about-us/history/. Its mining holding included: Kazzinc, a zinc/lead/copper/gold production facility in Kazakhstan (50.7% ownership); Mutanda Mining (40% ownership) and Katanga Mining Limited (75.15% ownership), both copper metal mining companies; Mopani, a copper and cobalt mine in Zambia (73.1% ownership) ; AR Zinc, which owned and operated the Aguilar mine, Palpala lead smelter and the AR Zinc smelter in Argentina (100% ownership); Cobar Mine, a copper mine in Australia (100% ownership); Los Quenuales, a zinc and lead concentrate company (97% ownership); Sherwin Alumina, an aluminum refinery in Texas, US (100% ownership); United Company Rusal Limited of Russia, one of the largest aluminum producers in the world (8.75% ownership); the Murrin Murrin nickel-cobalt project in Australia (82% ownership, directly and indirectly); Century Aluminum Co., which produces aluminum in the USA and Iceland (44.4% ownership); Recylex, a lead, zinc and propylene recycling business, with production sites in France, Germany and Belgium (32.2% ownership);

2. Energy

Glencore's energy entities included oil, gas, and coal production and value-added materials such as liquefied petroleum gas, jet fuels, and naphtha.[17]

3. Agriculture

Glencore's agricultural operations included trading and distribution of wheat, corn, barely, rice, oilseeds, meals, edible oils, biodiesel and sugar. These were purchased from a variety of sources ranging from large scale refineries to individual farmers. Glencore was also heavily involved in the storing, processing and handling of these commodities.[18]

Corporate Policies

Glencore's pre-merger business policies and documentation do not appear to have been as extensively developed as those of Xstrata. Its former website is not available but some of its content is available on the new Glencore Xstrata website. That site has only two years of sustainability reports, compared to ten years of reports from Xstrata's former site. This unto itself is not zzz

3. Glencore Xstrata PLC

The merger of Glencore and Xstrata yielded Glencore Xstrata PLC,[19] a very large global natural resource company. It maintains over 90 offices in over 50 countries and employs approximately 190,000 people (including contractors).[20] Its operations include over 150 mining and metallurgical sites, offshore oil production assets, and farms and agricultural facilities.

The company's assets are structured into three major segments:[21]

1. *Metals and Minerals*: This segment focuses on copper, nickel, zinc/lead, alloys, alumina/aluminum and iron ore. It controls or shares control in mining, smelting, refining and warehousing operations.

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and prior to the merger, a 34.4% interest in Xstrata PLC. http://metals.about.com/od/suppliersbyname/a/Company-Profile-Glencore-International-Ag.htm.

[17] http://www.glencorexstrata.com/about-us/history/. Its energy holdings included: Chemoil Energy Limited, a marine fuel supplier (51.5 % ownership); Prodeco Group, a coal mining operation in Colombia (100% ownership), and Shanduka Coal, a coal mining company in South Africa (70% ownership). http://metals.about.com/od/suppliersbyname/a/Company-Profile-Glencore-International-Ag.htm.

[18] http://metals.about.com/od/suppliersbyname/a/Company-Profile-Glencore-International-Ag.htm. See also: http://www.glencorexstrata.com/about-us/history/. Its Agriculture holdings included: A sun-seed crushing plant in the Ukraine (80% ownership); Moreno Group of Argentina, which includes silos, an export elevator, and four crushing plants (100% ownership); and farms in Australia, Paraguay, Russia, Ukraine, and Kazakhstan. http://metals.about.com/od/suppliersbyname/a/Company-Profile-Glencore-International-Ag.htm.

[19] Glencore Xstrata has its primary listing on the London Stock Exchange (GLEN) and a secondary quote on the Hong Kong Stock Exchange (HKEx; 805). ISIN: JE00B4T3BW64

[20] http://www.glencorexstrata.com/about-us/at-a-glance/.

[21] http://www.glencorexstrata.com/about-us/at-a-glance/.

2. *Energy Products*: This segment focuses on focusing on oil and coal. It controls or shares control in coal mining and oil production operations and investments in strategic handling, storage and freight equipment and facilities.
3. *Agricultural Products*: This segment focuses on grains, oils/oilseeds, cotton and sugar. It controls or shares control in storage, handling and processing facilities in strategic global locations.

Glencore Xstrata espouses policies that seem consistent with reasonable goals towards human health and the environment. Its policies include a Values document and a Code of Conduct document.[22] Its corporate Values and Code of Conduct are relatively straightforward and simple. However, like Xstrata's individual policies, the joint Glencore Xstrata policy statements include very few actual measurable against which success (or degrees of success or failure) may be measured. Without such measurable, the policies may be viewed largely as without substance or force and should not be used as a measure of whether the company is achieving or not achieving measurable success or improvement (to itself or to people-areas it operates).

As a new corporate entity, Glencore Xstrata does not have joint performance, sustainability, or compliance reports as of the date of this report (June 2013). The joint company's first sustainability report as a combined company is slated to report on its joint performance during 2012 and will be available in the second half of 2013.[23]

Conclusion

The real test of corporate policies and reports is how the corporation responds to problems, concerns, and criticism. As discussed in the main portions of this report, Xstrata's Espinar mines have caused apparent contamination problems that are inconsistent or unexplainable by previous Xstrata PLC reports and statements. How Glencore Xstrata responds to the current concerns and questions will indicate more about the company's policies, practices, and intentions than any corporate document, website, or press release.

[22] http://www.glencorexstrata.com/about-us/policies/.
[23] http://www.glencorexstrata.com/sustainability/performance/. Xstrata PLC's 2002-2011 sustainability reports are available at: http://www.glencorexstrata.com/sustainability/sustainability-reports/xstrata-sustainability-reports/. Glencore's 2010-2011 sustainability reports are available at: http://www.glencorexstrata.com/sustainability/sustainability-reports/glencore-sustainability-reports/.

Appendix B - Montana's surface water standards for selected priority pollutants

EPA RECOMMENDED NUMERIC WATER QUALITY STANDARDS

(Values in ug/l - unless otherwise noted)		Freshwater Aquatic	F/N [2,3]	Human Health	F/N [1]	Saltwater Aquatic	F/N [2,3]
PRIORITY TOXIC POLLUTANTS							
Antimony	(Sb)	-		**5.6**		-	
Arsenic	(As)	150		**10 / 18**	12	36	
Beryllium	(Be)	-		4		-	
Cadmium	(Cd)	**0.25**	4	5		8.8	
Chromium (III)	$(Cr)^{+3}$	**74**	4	100		-	
Chromium (VI)	$(Cr)^{+6}$	**11**		100		50	
Copper	(Cu)	9	4,18	1,300	13	**3.1**	
Lead	(Pb)	**2.5**	4	15	13	8.1	
Mercury	(Hg)	**0.77**		2 / 0.3	6	0.94	
Nickel	(Ni)	**52**	4	610	12	8.2	
Radium $_{226/228}$	(Ra)			**5** pCi/L			
Selenium[7]	(Se)	**5**	5	50		71	
Silver	(Ag)	**3.2**	4	100	14	1.9	
Thallium	(Tl)	-		**0.24**		-	
Uranium[17]	(U)	-		**30**		-	
Zinc	(Zn)	120	4	7400 / 2000	12 / 14	**81**	
$Cyanide_{Free}$	(CN)	5.2		200		**1**	
Fluorine / *Fluoride*	(F) / [F^-]	-		**1100 / *4000***	12	-	
NON-PRIORITY POLLUTANTS							
Aluminum	(Al)	**87**		50	10	-	
Barium	(Ba)	-		**1,000**		-	
Iron	(Fe)	1,000		**300**	12	-	
Manganese	(Mn)	-		**50**	12	-	11
Hydrogen Ion Concentration	(pH)	6.5 - 9.0		5.0 - 9.0		6.5 - 8.5	15
Ammonia	(NH_3)	f(pH,T)	15	30000	14	f(pH,T)	
Chlorine / *Chloride*	(Cl_2) / [Cl^-]	11		4000		**7.5**	
Nitrates + Nitrites	(NO_3, NO_2)			**10,000**	12	-	
Nitrate	(NO_3)			**10000**	9		
Nitrites	(NO_2)			**1000**			
Sulfide, Hydr. Sulfide	(S^-, H_2S)	**2**		-		**2**	
Sulfate	(SO_4)	-		250,000	10	-	
Suspended Solids	(TSS)	**20,000**	8	-		-	
Total Dissolved Solids	(TDS)	-		**250,000**	12	-	
DRINKING WATER STANDARDS and HEALTH ADVISORIES							
Cobalt	(Co)	not regulated		-		-	
Molybdenum	(Mo)	-		**80**	14	-	
Strontium	(Sr)	-		**4000**	14	-	

Sources:

1) Surface Water Criteria: National Recommended Water Quality Criteria 2002, EPA-822-R-02-047, November 2002

2) Groundwater Criteria: 2002 Edition of the Drinking Water Standards and Health Advisories, EPA 822-R-02-038, Summer 2002

Footnotes (F/N)

[1] includes Drinking Water MCL's and Human Heath Criteria for Consumption of Water and Organisms

[2] Chronic Criteria

[3] measured as Dissolved

[4] calculated based on 100 mg/l hardness ($CaCO_3$) - the maximum hardness allowed under 40 CFR 131.36(c)(4)(i) is 400 mg/l.

[5] measured as Total Recoverable (can also be measured as Dissolved)

[6] Methyl-mercury, Organisms Only, measured as mg/kg

[7] assumes inorganic selenide (Se-). *{Toxicity for inorganic selenate (SeO4 ±) = 760 ug/l }*

[8] New Source Performance Standards - metal mines (20 mg/l average, 30 mg/l daily max)

[10] Secondary Maximum Contaminant Concentration Levels (MCL's) – not enforceable

[11] For open ocean waters where the depth is substantially greater than the euphotic zone, the pH should not be changed more than 0.2 units from the naturally occurring variation or any case outside the range of 6.5 to 8.5. (Red Book, P. 181)

[12] EPA "Human Health Criteria" calculated with a Carcinogenic Risk Factor of 10^{-6}

[13] EPA "Treatment Technique Action Level"

[14] EPA "Health Advisory"

[15] Ammonia actual value depends on Temperature and pH. Maximum NH_3 concentration @ 0 degress C, pH = 6.5, is 6.67 mg/l with fish early life stages present, 10.8 mg/l with fish early life stages absent

[17] Uranium Drinking Water Standard effective 12/8/2003

[18] EPA recommends, but does not require, the use of the Biotic Ligand Model for determining the freshwater copper standard

Appendix C

Government Report Conclusions

This appendix presents the Conclusion chapter from the government's 2013 report.

X. CONCLUSIONS

The Participatory Health and Environmental Monitoring (PHEM) allowed for preparation of an assessment of environmental quality in Espinar and identification of risk situations for health that require the attention of authorities.

The Report's General Conclusions underscore the need for further study and analysis. It is critical that this analysis be transparent - meaning that the data and its evaluation are fully open to the public.

The Reports General Conclusions include, but are not limited to the following:

1. Of the 313 sites where surface water, ground water, water for human consumption, soil, air and sediments were monitored, 165 (52.71%) registered at least one parameter that did not comply with standards, classifying them as critical sites. In addition, the evaluation of these 165 sites produced 266 test results that exceeded standards (2.2% of a total of 12,069). Of these, 64 test results, or 0.56% of the total, corresponded to heavy metals. In other words, while slightly more than half of the sites monitored were classified as critical, less than two parameters in each of them exceeded the standards, which can be seen in the following chart:

Chart 36: Sites sampled and test results exceeding standards

Component	Sites sampled	Sites exceeding standards	% of sites that exceed standards	Total test results	Results exceeding standards	% of results exceeding standards
Surface water	163	92	56.44	7,940	137	1.72
Ground water	2	0	0	144	0	0
Water for human consumption	58	41	70.6	2,688	83	3.11
Air	22	1	4.54	558	1	0.17
Sediment	41	23	56.09		35	
Soil	27	8	29.62	759	10	0.39
Total	**313**	**165**	**52.71**	**12,069**	**266**	**2.2**

Source: Environment Subgroup, February 2013

2. Of the 165 critical sites identified, 38.78% (64) contain at least one heavy metal (mercury, arsenic, cadmium and lead). With respect to the total number of sites monitored, 20.44% represent critical spots where at least one heavy metal exceeded

the standard. Independent of the origin of the metal found, this implies in general terms that there is a moderate environmental risk, according to the assessment in the MINAM's Evaluation Guidelines for Environmental Risks (see the following chart).

Chart 37: Sites with at least one heavy metal exceeding standards	
Component	**Number of sites**
Surface water	5
Ground water	0
Water for human consumption	30
Air	0
Sediment	24
Soil	4
Total	**64**

Source: Environment Subgroup, February 2013

3. Of the 64 critical sites with at least one heavy metal exceeding the standards, 46.87% (30 sites) correspond to the water for human consumption component. This means that conditions exist that pose health risk.

Chart 38: Locations where water for human consumption exceeds at least one MPL parameter established in Supreme Decree 031-2010-SA and the Category 1-A1		
Basin	**Location**	**Parameters exceeded**
Cañipia	Alto Huarca	Mercury, Ph
	Huisa	Mercury, phosphorus, pH
	Huisa Collana	Arsenic, mercury, total coliforms, thermotolerant coliforms, chlorine residual
	Yauri	Iron ore, mercury, total coliforms, thermotolerant coliforms
Salado	Huano Huano	Arsenic, aluminum, mercury, lead, total coliforms, thermotolerant coliforms, chlorine residual
	Pacopata	Mercury
	Huini Ccorocohuayco	Mercury
	Alto Huancané	Aluminum, mercury, lead
	Bajo Huancané	Arsenic, aluminum, chlorine, phosphorus, lead, total coliforms, pH conductivity
	Antacollana	Arsenic, aluminum, mercury, Ph
	Suero y Ccama	Arsenic, phosphorus, lead, total coliforms, thermotolerant coliforms
	Tintaya Marquiri	Arsenic, total solids, chlorine, lead, conductivity, turbidity

Source: Environment Subgroup, February 2013

4. Mercury levels at the Virgen de Chapi water treatment plant exceed the MPL at both the intake and outtake, with the highest concentrations at the outtake. The plant's water source is the Huayllumayo Dam, located in the microbasin with the same name, which is outside the direct area of influence of the mining activities

evaluated. Digesa, in coordination with Diresa Cusco, has been carrying out actions for required confirmation.

5. The quality of surface and underground water is influenced by the geochemistry of the soil in the Cañipia and Salado river basins, according to the evaluations of the National Water Authority (ANA), Environmental Oversight and Evaluation Agency (OEFA) and Mining and Metallurgical Geological Institute (Ingemmet). This means that the mineral content in water is related to the naturally occurring mineralization of the soil.

6. Surface and ground water in some sites close to the mining activities of Xstrata Tintaya S.A. contain a concentration of metals and other physical and chemical elements above environmental quality standards (water for vegetable plots and livestock). These conditions are found in Tintaya, Tintaya Marquiri, Alto Huancané, Bajo Huancané, Alto Huarca, Huinipampa, Quetara I and Huisa. This implies an association between these levels and zones with mining activity that needs to be examined with greater depth in the monitoring activities of the Short-Term Action Plan.

7. The need for complementary environmental studies in specific zones to define the cause-effect relationship is based on the detection of levels that exceed standards in areas away from the mining zone (specifically in zones in Yauri, Mamanocca, Suero y Ccama, Paccopata, Huano Huano and Huini Ccorocohuayco communities). Along the same lines, sites were identified in the area of the mine's influence that comply with environmental standards.

8. The results from air quality monitoring reveal that limits do not exceed the environmental quality standards for air, with the exception of a site located in the urban zone (Yauri) concerning particulate matter below 10 micrometers (PM10).

9. The results of the Censopas-INS tests indicate that residents examined in Huisa and Alto Huancané are exposed to heavy metals. This is a health risk the magnitude of which has yet to be determined.

10. The results of the monitoring justify the importance of implementing a Provincial System of Environmental Health Monitoring, which is included in the Action Plan.

11. The result of the toxicological testing in dead animals in Espinar revealed that the concentration of metals detected were not the cause of the death of the animals provided by residents in the province for examination.

A. <u>Specific Conclusions</u>

Each of the institutions that took part in the development of the MSAP arrived at technical conclusions based on their competencies and functions, which support the general conclusions.

1. *National Water Authority (ANA)*

1.1 Water quality in the Cañipia River basin

- Magnesium was found in two sites in the Cañipia River basin, in the headwaters of the Putespunco River and in the lower part of the basin before it joins the Salado River. The contents of heavy metals in other tributaries of the Cañipia River did not exceed the environmental quality standard (EQS) for Category 3 (irrigation of vegetables and drinking water for livestock);
- Phosphorus levels that exceed the EQS for Category 3 were found at the midway point of the Cañipia River (before the Suchuiñahui intake, Chipta Huisa sector). The water does not present a salinity content, but there is a certain level of basicity at the midway point of the basin;
- Water in five springs located at the midway point of the basin does not contain metals or metal-like substances above the environmental standard. The low level of oxygen found is a result of stagnation. Only the Laccopujio spring, located five kilometers below the city of Yauri, Espinar, presented a low level of acidity.
- The water discharged from the Quetara canal comes from filtrations from the neighboring hill and does not exceed the EQS for Category 3 (used as a reference) in any of the parameters evaluated (physical, chemical and microbiological). Only in the area of electric conductivity does it present levels above the EQS.

1.2 Water quality in the Salado River basin

- The water of the Salado River has a naturally high level of salinity due to the presence of sodium, which is expressed through high conductivity. It also shows a slight basicity. The concentration of arsenic in the Chaquella River, in the upper part of the Salado basin, exceeds the EQS for Category 3.
- The water quality varies in the tributaries (ravines and rivers) that form the Salado River. There is a slight basicity in the Huallapogio ravine and in the Sorocohuayco, Occoruro and Pallpatamayo rivers. Iron ore and magnesium are found in the Ccamacmayo ravine; iron ore, magnesium and nitrates in the Qqaquincura River; iron ore and magnesium in Alto Rancho; iron ore in the Churuhuayco ravine; iron ore and basicity in the Colpamayo River; and iron ore in the Pausamayo River. All of these concentrations exceeded the EQS for Category 3.
- Regarding spring water, the water of the Cinijapugio and Pararani springs met EQS standards. Huano Huano spring, however, revealed a level of basicity, while calcium was found in the Paccpaco spring; phosphorus, aluminum and iron ore in the Chararairo Pujio spring; nitrates in the Lechepugio spring; magnesium in the Muyotera spring; and arsenic in the Ccoñepujio spring. The levels of these components exceeded the EQS for Category 3.

- Wetlands around a spring in the Huinimayo sector had magnesium levels in excess of the standard. The spring itself had basicity levels and phosphorus above the water EQS for Category 3.
- The presence of heavy metals, metal-like substances and electric conductivity in the basins evaluated are associated primarily with the geochemical nature of the zone. The presence of nutrients (nitrates and phosphorus), on the other hand, are associated with human activity.

1.3 Sediment quality in the Salado River basin

- The concentrations of some metals in sediments in ravines and rivers in the Salado basin exceed the Probable Effect Level (PEL), the value established in Canadian Environmental Quality Guidelines (CEQG). These concentrations were found in the following sites: Ccolpaccoto ravine (zinc); Chaquella River, which is at the headwaters of the basin (arsenic and mercury); Tintaya River (zinc); Colpamayo River (arsenic); Ccamacmayo ravine (arsenic and copper at two sites, cadmium at a third site); and the Huayllapugio ravine (arsenic and cadmium).
- Concentrations of metals in sediments were found at levels above the Interim Sediment Quality Guideline (ISQG), but below the values established by the PEL. These were found in the Ccolpaccoto ravine (arsenic); Chaquella River (cadmium and zinc); four sites in the Ccamacmayo ravine (arsenic, cadmium and copper); Paccpaco ravine (arsenic, cadmium and copper); Salado River (arsenic, cadmium and copper); Tintaya River (arsenic, cadmium and lead); and in Colpamayo River, Curo ravine and Paccpaco spring (cadmium).

1.4 Sediment quality in the Cañipia River basin

- Sediment samples with levels exceeding those used as a reference (PEL) were found in the following sites: San Martín River, at the headwaters of the Cañipia River basin (copper); Putespunco River, also at the basin's headwaters (lead); Ccoloyo ravine (arsenic and mercury); and Choquepito spring (zinc).
- Sediment samples with levels exceeding the ISQG, but below the PEL, were found in the following monitoring sites: Leccenomahuaco River, at the headwaters of the Cañipia basin (cadmium); Putespunco River (arsenic and cadmium); Ccoloyo ravine, located below the Huinipampa tailings dam (cadmium, lead and zinc); and the Choquepito spring in the mine's area of influence (arsenic).

2. Environmental Oversight and Evaluation Agency (OEFA)

2.1 COMPONENT: WATER

a. Tintaya mining unit

The results from the 11 sites approved for environmental certification in the Salado and Cañipia River basins revealed concentrations of metals below the limits established by the General Water Law for Class III – "Irrigation for vegetables consumed raw and water for livestock."

However, the sites proposed by the Municipality of Espinar, as well as those included in the report by the Sicuani Prelature's Solidarity Vicariate, located in the vicinity of the Tintaya mining unit showed the presence of metals, such as magnesium and iron ore, in surface water (springs) and magnesium in underground water. The concentrations exceeded the EQS for Category 3.

In addition, the sites located in the Salado River above the Tintaya mining unit and in the Paccpaco ravine registered levels of alkalinity. Sites near springs and wells in the Huinimayo sector, located below the Ccamacmayo tailings dam, had slightly elevated levels of acidity. The water in the Salado River below the unit maintains its alkalinity. Samples from these sites did not meet the EQS for Category 3.

b. Antapaccay mining unit

The sites evaluated in the vicinity of the Antapaccay mining unit were approved within the framework of the environmental certification. They are located along the Cañipia River and its tributaries. The Cañipia presented basicity characteristics in the upper part of the basin, while its tributaries registered acidity characteristics. This did not alter the basicity of the Cañipia, which was probably due to its low volume of water. The acidity and basicity levels do not meet the EQS for Category 3.

The evaluation of metals in these sites found concentrations below the EQS for Category 3. Only one site along the Cañipia River, located below Yauri, registered a level of magnesium above the EQS.

c. Ccorocohuayco mining project

The basicity found in the vicinity of the Ccorocohuayco project exceeds the EQS for Category 3. The remaining parameters evaluated, including those for heavy metals, complied with the standards.

d. Quechuas mining project

Samples from the Quechuacalla ravine revealed acidity levels and those in the Allahualla River had a slight basicity levels. The levels did not meet the EQS for Category 3. The remaining parameters evaluated, including those for heavy metals, did not exceed the standards.

2.2 COMPONENT: MINING-METALLURGICAL EFFLUENTS

The sites where mining-metallurgical effluents are discharged from the Tintaya mining unit, approved in the environmental certification, were not operating when the inspection was conducted because it was the dry season. Effluent samples were not taken.

2.3 COMPONENT: SOIL AND SEDIMENT

The soil and sediment tests were done at sites indicated in the report from the Sicuani Prelature's Solidarity Vicariate. The chemical parameters examined included heavy metals, analyzed for total concentrations using the ICP-MS methodology.

The soil samples taken in the zone of influence of the Tintaya unit and Antapaccay project contain molybdenum, copper, selenium and thallium, and arsenic metalloid in amounts that exceed parameters used for reference (CEQG—soil for agricultural use).

With respect to the sediment component, concentrations of metals including cadmium, copper, selenium and arsenic metalloid at levels above the CEQG-PEL were found in the area of influence of the Tintaya unit. The concentrations of zinc, thallium and arsenic exceed levels in the area of influence of the Antapaccay project.

2.4. COMPONENT: AIR QUALITY

The sites evaluated correspond to those approved in the environmental certification of Xstrata Tintaya S.A. for its Antapaccay mining project.

The concentrations of environmental gases (CO, SO2 and H2S) did not exceed the EQS for air.

The concentration of total suspended particulates (TSP) was 258 µg/m3 in the site located in the city of Yauri. This level is close to the standard set by the U.S. Environmental Protection Agency (EPA), 260 µg/m3 for 24 hours, used as a point of comparison.

The concentrations of particulate matter below 10 micrometers (PM10) were 190.1 µg/m3. It is the only measurement that exceeded the EQS for air.

It is important to note that the concentrations of metals obtained in the samples were lower than the Ontario, Canada Ambient Air Quality Criteria (AAQC) that was used as a point of comparison.

3. *General Environmental Health Bureau (DIGESA)*

3.1 COMPONENT: WATER FOR HUMAN CONSUMPTION

- The monitoring carried out in 15 communities in the province of Espinar found that the population consumes water directly from surface sources, springs and/or piped water, without the corresponding potable treatment, which represents a potential health risk for the population.
- Monitoring of water sources and storage systems for human consumption found that the parameters for aluminum, arsenic, iron ore, total dissolved solids, chlorine, mercury, phosphorus and lead did not meet the EQS for water or the maximum permissible levels established in current norms.

The evaluation of sanitary quality of water for human consumption found the following:

Chart 39: Locations where water for human consumption exceeds at least one MPL parameter established in Supreme Decree 031-2010-SA and the Category 1-A1

Basin	Location	Parameters exceeded
Cañipia	Alto Huarca	Mercury, Ph
	Huisa	Mercury, phosphorus, pH
	Huisa Collana	Arsenic, mercury, total coliforms, thermotolerant coliforms, chlorine residual
	Yauri	Iron ore, mercury, total coliforms, thermotolerant coliforms
Salado	Huano Huano	Arsenic, aluminum, mercury, lead, total coliforms, thermotolerant coliforms, chlorine residual
	Pacopata	Mercury
	Huni Ccorocohuayco	Mercury
	Alto Huancané	Aluminum, mercury, lead
	Bajo Huancané	Arsenic, aluminum, chlorine, phosphorus, lead, total coliforms, pH conductivity
	Antacollana	Arsenic, aluminum, mercury, Ph
	Suero y Ccama	Arsenic, phosphorus, lead, total coliforms, thermotolerant coliforms
	Tintaya Marquiri	Arsenic, total solids, chlorine, lead, conductivity, turbidity

Source: Environment Subgroup, February 2013

- Of the 58 established monitoring sites, 41 sites registered at least one parameter that exceeded the established norm. This is equivalent to 70%.

Chart 40: Critical sites with respect to a parameter that exceeds the norm

Origin	Sites monitored	Critical sites	% with respect to origin
Sources of surface water	13	7	53
Springs	33	24	72
System components (communal taps, reservoirs, piping system and treatment plant)	12	10	83

Total	**58**	**41**	

Source: Environment Subgroup, February 2013

- The components of the water supply system have the highest percentages of critical points (83%), followed by springs (72%). This demonstrates the high risk represented by the lack of proper treatment systems for water for human consumption.
- Of the 58 sites, including water sources and components of the supply system, monitored, 22% show high concentrations of arsenic, 39% mercury and 10% lead.
- At the Virgen de Chapi water treatment plant, located in the province of Espinar, mercury levels exceed the maximum permissible level both in output (0.0059 mg/L) and intake (0.0034 mg/L), which means that the plant is inefficient when it comes to removing contaminants and there needs to be additional monitoring to identify if this situation corresponds to a particular event, given that the Huayllumayo microbasin that feeds the plants is not located in an area directly influenced by the mining activities monitored. Digesa, in coordination with Diresa Cusco, is carrying out the pertinent confirmation activities.
- Regarding sanitation services, the majority of the locations analyzed have latrines. Only Yauri has a sewage system, but it empties directly into the Cañipia River.

3.2 COMPONENT: SANITARY QUALITY OF SURFACE SOILS

- The surface soil sampled in the Espinar province shows concentrations of arsenic above the referential levels in Alto Huarca, Huisa and Alto Huancané. In the case of copper, the limits were exceeded in Alto Huarca, Huisa and Tintaya Marquiri. This represents a risk to the health of residents in the zone.

3.3 COMPONENT: SANITARY QUALITY OF AIR

- In the sites evaluated by Digesa, particulate matter below 10 micrometers (PM10) complies with the levels established in the Air EQS (150 µg/m3 for 24 hours). The zone with the highest presence of particulates is the city of Yauri, Espinar, which is explained by vehicle emissions and the lack of paved streets.
- The level of concentration of heavy metals in particulate matter (PM10) complies with the criteria of the Ontario, Canada Ambient Air Quality Criteria (AAQC) for 24-hour averages for metals.

4. <u>Mining and Metallurgical Geological Institute (Ingemmet)</u>

- The studies carried out by Ingemmet did not find concentrations of mercury above EQS for Category 3 and EQS for Category 1-A1 at any of the sites where surface and ground water were analyzed. While Ingemmet found

mercury in the sediment samples it took, the levels never exceeded amounts included in the Environmental Council of the Andalucía, Spain that was used as a reference.

- In the vast majority of cases, the underground water, surface water and sediments from ravines tested show a strong geological profile, which means that geology determines the water quality. For example, the surface and underground water tested in the Cañipia basin indicate calcium, magnesium and sodium bicarbonates that are tied to the limestone in the substrata and volcanic rocks dotting the surface. These rocks influence the pH of water, which oscillate between neutral and slight alkalinity.

  The testing in the Salado River basin revealed the presence of sulfites in addition to bicarbonates. The sulfites come from the geology of the chain of hills around Tintaya that supply the calcium sulfate component typical to this context and often related to copper, molybdenum, gold and iron ore (porphyry and skarn) mineralization. This is also the origin of some sites where pH levels show slight acidity.

  Underground water coming from volcanic rocks of the Cañipia basin show low electric conductivity, with the exception of some specific points in the Quetara wetlands, located 1.3 kilometers from the Huinipampa tailings dam and separated by rock outcroppings. This wetland is fed by unground water from porous fluvial aquifers in the Cañipia basin and Ferrobamba limestone, which explain the electric conductivity levels.
- Some elements, such as magnesium, iron ore, copper, cadmium and selenium, with levels above the EQS for Category 3 (used as a reference) in surface and underground water are found in specific locations associated with porphyry mineralization of Tintaya, Ccorocohuayco, Quechuas and Antapaccay and are due primarily to natural causes.
- The sediments found in ravines are related to geology and show relatively high quantities of copper, moderate quantities of molybdenum and arsenic, and low levels of thallium, which can be explained by the presence of the mineral beds in the test zone. Mercury was found throughout the zone in natural concentrations between 0.03 ppm to 0.39 ppm. The levels are well below the referential levels (1 ppm). In the headwaters of the Cañipia and Salado Rivers, mercury levels (~1 ppm) are related to volcanic rock that shows evidence of alteration and mineralization containing epithermal gold and silver (normally associated with volcanic centers).

5. *National Center for Occupational Health and Environmental Protection for Health (Censopas-INS)*

   - The results of the study show that the population in Alto Huancané and Huisa are exposed to lead, mercury, cadmium, thallium, magnesium and arsenic.

- The study represents a baseline for exposure of the population to metals and will serve in the future as a comparison to evaluate the impact of new interventions.
- The presence of these metals in urine samples implies a risk for developing disease, and not necessarily the diagnosis of a disease.
- Providing the laboratory results to individuals should be done within the context of holistic medical attention through the service networks to guarantee continuity.

National Agricultural Health Service

- The results of the toxicological testing of the tissues taken from dead animals (sheep, cattle, alpacas) in Espinar show the presence of metals, but the levels found do not reveal chronic intoxication or a specific severe intoxication that would lead to death.
- The levels of lead found in samples taken from farm animals (muscles in sheep and waste from cattle) are lower than the maximum permissible levels established by the FAO's CODEX Alimentarius regarding safety of food for human consumption. The levels of cadmium found in the samples do not exceed maximum limits established by European legislation that were used for comparison for sheep and cattle.