REGIONAL ACTION PLAN FOR THE PREVENTION AND CONTROL OF MERCURY CONTAMINATION IN AMAZON ECOSYSTEMS

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I. INTRODUCTION

Mercury is a metal whose unique characteristics and uses have fascinated humankind for milleniums. Unfortunately, such fascination has entailed a quite cruel lesson due to the metal's toxicity. There is ample literature about it, from the point of view of both human and environmental health. Today, after all the amassed scientific evidence and the factual events connected to this metal, as shown by its own history, everyone takes as absolute truth the nature of toxicological and ecotoxicological risks derived from the uses of mercury. Therefore, society demands that official authorities come up with safe and clear risk vigilance and prevention measures.

Thus, a **Regional Action Plan for the Prevention and Control of Mercury contamination in the Amazon Ecosystems**[1] (which, for the sake of simplicity, we shall from now on call **Mercury Action Plan – MAP**) is an uncontested attitude in defense of life quality and a purpose attuned to the several regional initiatives under the coordination of the Amazon Cooperation Treaty Organization (ACTO).

As for the specific issue of mercury contamination and the search for solution mechanisms connected to it, there has been a partnership between ACTO and the Ministry of Environment, Brazil, aimed at ensuring elements for the planned attainment of guaranteed environmental quality in the region.

MAP is part and parcel of a broader proposal which defines the prevention and control principles of contamination by chemicals and the enforcement of the Precaution Principle to reduce risks associated with dangerous chemical substances, ensuring the international agreements and initiatives by the countries in the Amazon Basin as regards chemical safety.

ACTO's proposal to promote chemical safety in the Amazon Basin's influence area brings the following strategies:

- to develop activities to reduce the risks of using toxic substances, taking into account the complete life cycle of a given product to be used domestically or for export;

- to develop regulatory and voluntary policies and measures to detect and reduce exposure to toxic chemicals, replacing them with less toxic ones so that their use may be gradually and definitively minimized, a use hard to safely control if we consider the complexity of the Amazon system.

[1] The unique significance of the Amazon Basin points to the patent fact that a broader Action Plan, which would include all forms of expressive chemical contamination deriving from human activities, should be worked on simultaneously, for the sake of achieving a true regional chemical safety. We have opted, however, to focus this document on mercury, mostly because, despite the existence of other contamination sources, the focus in gold extraction is still restricted to mercury.

There could be a separate plan for each contaminating chemical, justified by their specifications and considering: the region's natural legacy, the climatic, geographical and environmental conditions, the social and cultural conditions, as well as the region's economic and technological potentials and its infrastructure.

MAP was designed by a consulting staff chosen with the support of MMA-Brazil, and aims at fulfilling an ACTO demand in relation to the mercury contamination in the Amazon Basin and the repercussions of this phenomenon on the basin's influence areas.

MAP's general objective is to contribute to a new development model for the Amazon region, which considers:

- proper handling of chemicals,
- use of clean technologies,
- dynamic, competitive and sustainable economic development of gold's production chain,
- social inclusion, respecting cultural diversity,
- natural resources' sustainability, keeping the ecological balance of the countries' legacy, and
- welfare of communities integrating the Amazon Basin.

MAP also reflects the need to reinforce joint commitments by the Amazon Basin countries, drawing inspiration from their work in collaboration, consolidating political, economic, administrative and environmental agreements, considering policies and laws enforced in the several countries, the region's infrastructure difficulties, technical, scientific and administrative limitations, and, in view of all these factors, adopting a regional perspective for the Amazon initiatives.

MAP expects a broad consultative process to ensure the participation of all interested actors, so as to define programs, projects and specific goals, which will enable the support and fulfilment of commitments and assignments shared among the Amazon countries.

II. INITIATIVE'S HISTORY

Justifying MAP

MAP is justified when we consider the gravity of environmental and human mercury contamination in the Amazon Region. It is justified for both ethical and pragmatic, economic reasons.

From the ethical point of view, it is nothing less than unacceptable the fact that human and wild animal populations are subject to such a risk.

From the economic point of view, it is enough to reflect on how much the disease caused by mercury may cost, meaning not only the loss and/ or jeopardy of human lives (workforce) but also the direct expenses the public health system may have in order to treat the intoxication. As for biodiversity in the Amazon region, once wild animals are exposed to chronic contamination, this situation may be irreversible.

So, MAP should constantly articulate a close and fruitful exchange between ACTO Member Countries acting on the mercury issue in mining and placer mining. This will ensure the information and knowledge flow that is imperative for the global management of mercury risks, since the metal's mobility in the environment knows no barriers. Besides, good results achieved in a country may be successfully replicated in another.

ACTO and MAP'S chronology

One of the purposes of the Amazon Cooperation Treaty Organization (ACTO) is to contribute to the development, application and exchange of experiences between the Member Countries, not only using tools already applied by each country but also fostering and developing social-environmental management instruments shared between the countries, so as to reinforce the region's strategic value for environmental, social/cultural and economic sustainability, at national and international levels.

Considering the complexity and continental extension of the Amazon Basin, special attention should be paid to the areas of mineral and timber exploration, phytotheraupeutical substance exploration, pharmaceutical industry development, agribusiness, among other interests by the governments of countries in the region. It is a recognized fact that the Amazon development, due to its multiboundary feature and the potentiality of its natural resources, is greatly able to propitiate productivity on the basis of environmental services, integration and regional equity.

Therefore, MAP's implementation should contribute to encourage horizontal cooperation between the countries and institutional exchange by national and

international researchers and technicians, as well as to integrate their communities' local knowledge by means of social and educational participation projects, prevention and control of the use of mercury in the placer mining activity and in small scale gold extraction.

Aiming at furthering in this discussion proposal and obtaining the support of the Member Countries, the Permanent Secretariat of the Amazon Cooperation Treaty Organization (in collaboration with the Ministry of Environment, Brazil) held two regional meetings, whose objective was to set a cooperation strategy and define subsidies for a plan to control the issue of mercury contamination in the Amazon ecosystems.

Rio de Janeiro, Brazil

The 1st Meeting for Regional Cooperation on Mercury contamination in the Amazon Basin was held in Rio de Janeiro, Brazil, from December, 1 to 3, 2004, and resulted in the identification of the following priorities:

1. creation of a work team to elaborate an Action Plan to manage risk of mercury contamination and other aspects related to the indiscriminate use of this metal;
2. identification of financing sources to implement the regional Action Plan;
3. institutionalization of an information exchange network;
4. elaboration of a proposal for a Certification Program for Mercury Analysis Laboratories;
5. forwarding to the Member Countries a questionnaire on the use, sources, pertaining legislation and situation of mercury contamination, to be responded e returned to ACTO;
6. institutionalization of a permanent group of experts in order to keep a state-of-the-art update on mercury in the region;
7. interaction with the Andean Community (CAN);
8. holding a preparatory meeting for the Administration Board of the United Nations Environment Program (UNEP).

In the Rio de Janeiro meeting, ACTO requested the Member Countries to indicate people to act as a focal point in dealing with the issue. The country representatives agreed to the need for creating and operating a technical exchange network, based on the indicated focal points to further implement MAP.

The meeting recorded reports, by members of the scientific community and representatives of international institutions, on both the present state of mercury contamination in the region and its antecedents.

Lima, Peru

The Second Meeting took place between February, 1 and 3, 2005 in Lima, Peru.

The agenda covered the following issues:

- revision of the first meeting's results;
- presentation, analysis and discussion of the Plan's first draft;
- collection of basic information on the issue from ACTO Member Countries;
- presentation of the basic concept for a strategic proposal to inform and divulge information related to mercury and MAP, possibly evolving into a Portal (characterized as an information system with internet access).

The first **Action Plan draft,** based on different documents[2] and including an initial analysis of the questionnaires responded and forwarded by four Member Countries to ACTO, namely, Ecuador, Guiana, Peru and Suriname, was organized with the following components:

1) financial equation;
2) integration mechanisms;
3) program for institutional integration and strengthening;
4) socioenvironmental management program;
5) professional training program.

The representatives of countries participating in the meeting recognized the significance of counting on regional solutions and agreed that the Action Plan implementation should be a priority in the scope of ACTO.

The discussion on the Action Plan's first draft resulted in presenting the suggestion of increasing the universe of questions in the questionnaire and clarifying some questions which proved difficult to interpret. For that matter, a new questionnaire version was elaborated (Annex III) during the meeting itself and submitted to discussion. After some specific remarks in relation to the interpretation of some questions, the questionnaire was approved by the Member Countries' participants and reforwarded by ACTO to the countries. The participants agreed that the responded questionnaire would be sent to ACTO by April, 14, 2005. Information from the questionnaire responses by the countries would be of utmost significance to subsidize MAP's reformulation.

The questionnaire, modified as a result of the many suggestions made by those taking part in the Lima meeting, was then responded, by October, 2005, by the following countries: Bolivia, Brazil, and Suriname.

[2] i) Report on Meeting I, Rio de Janeiro-Brazil, December, 2004; ii) Recommendation Document from the Rio de Janeiro Meeting (ACTO-MMA/Brazil); iii) Cooperation Milestone Convention for Adoption of Measures whose Objective should be to Prevent and Control Contamination of the Amazon Water Resources and their Hazardous Effects; iv) ACTO's Strategic Plan 2004-2012.

Regarding the portal, the participants agreed that it is a fundamental element for the social communication on the issue, and they emphasized the importance of a study of technical and financial feasibility to support its implementation. Such study should consider:

- the need to take advantage of existing information, internet pages and databases;
- the difficulty to collect much of the information described in the concept behind the Portal and the resulting time and cost implications;
- the need to adjust the Portal contents to the existing information availability, as well as the need to collect information within a short time in order to turn the Portal into a reality;
- the possibility for it to be fed in as new information is available.

III. CHARACTERIZATION OF THE MERCURY CONTAMINATION IN THE AMAZON ECOSYSTEMS

III.1. Mercury (Hg)

Toxicology, cycle and occurrence in nature

For centuries, the toxicology of mercury has brought about intense curiosity and research, and the more time goes by and the better risks associated with the uses of the metal are known, the more is written about it. The technical and scientific bibliography dealing with the issue is multiple, diverse, inexhaustible and updated each day (AMOUROUX et al, 1999; AZEVEDO, 2003; AZEVEDO, RAMOS, 1993; AZEVEDO, RAMOS, 1994; FADINI, JARDIM, 2001; HACON et al., 2003; HACON et al., 2005; MALM et al., 1995; MALM et al., 1997; MAURICE BOURGOIN et al., 1999; ROULET et al., 1995; ROULET et al., 1998; WASSERMAN et al., 2003). All the forms of mercury, depending on the kind and way of exposure, are toxic to the human being and may lead to serious consequences.

Hg is rarely found as a free element in nature. It is widely spread, in low concentrations, all over the earth's crust. In its elementary form (Hg^0), it stands as number 16 in the rank in relation to abundance in nature, and its reserves are estimated to be around 30 billion tons.

Its most important sources are those of cinnabar ore (HgS), found in rocks in the surroundings of recent volcanic activities, in seams or mineral fractures, and in areas close to thermal water sources. The mines of Almadém, in Spain, have been in operation since 400 AD. Besides them, other mines of note are in Mount Amianta, Italy, Idria, in Yugoslavia, several in Russia, and Mexico, North America, Japan, the Phillipines, Canada, China, Turkey, Ireland (BIESTER et al., 1999).

The chlorine-alkali industries, those of electrical equipment and mercury-based paint are reported to contribute to about 55% of the total Hg production (WHO, 1989). The most significant natural sources of mercury are the degasification of the earth's crust, volcano emissions, and evaporation from bodies of water (WHO, 1991). It is admitted that natural emissions amount to 25 thousand to 125 thousand tons/ year. The earth's crust is an important source for the contamination of natural bodies of water. A portion of the mercury found in water is of natural origin, although it may be partially of atmospheric origin and thus it may also have been generated by anthropogenic activity. Therefore, it is hard to quantitatively evaluate contributions related to the anthropogenic activity and to the natural one regarding the mercury compounds which suffer leaching from the soil to the water.

Production

Mercury alloys are extracted by mining processes, from low depth underground stores usually not deeper than 800 meters, from mercury sulphide, HgS, an ore named cinnabar. After the extraction, the metallic mercury is separated from the ore through heating in a rotary furnace at temperatures varying between 500 e 600^{o}C.

According to KORRINGA and HAGEL (1974 - apud WHO, 1978), the Hg world production was 4 thousand tons a year between 1900 and 1940. In 1968, production rose to 8 thousand tons, and, in 1973, 10 thousand tons. This data suggests that the average increase rate from the 1950s was 2% a year. In the late 1970s, environmental issues related to the use of Hg began to become more prevalent, giving rise to an awareness process in several places in the globe, and propitiating stabilized production rates for this metal, now tending to decrease. The commercial value of Hg also fell, for in 1966 the price of a 34.5 kg Hg flask was US$ 452, while in 1969 the price rose to US$ 510, dropping drastically to US$ 202 in 1972 (WHO, 1978; WHO, 1989).

THORNTON (1996), when evaluating data from the U.S. Bureau of Mines, found out that the Hg world production has been going through constant changes since the 1930s, when it amounted to 3,800 tons. In 1950, 1980, 1985 and 1990, productions amounted to 4,900, 7,100, 6,800 and 5,100 tons, respectively.

Uses

Mercury is used mostly as a catalyst in the electrolytical production of chlorine and caustic soda in the chlorine-alkali industry. It is also used in domestic batteries, in several kinds of lamps, including the fluorescent ones and those of high density discharge, in switches, rectifiers and electric thermostats, in mercury steam diffusion pumps, manometers, barometers, and other kinds of pressure, measurement and calibration instruments used in analytical laboratories, in laboratories of chemical, physical and biological researches, in X ray tubes, radio

valves, sailing devices, in tooth amalgams, in pigments, as a catalyst in polymeric reactions, in explosives, in medication and chemical applications, in treating gold and silver ores and for refining metals, in the production of acetic acid and acetaldehide from acetylene, in taxidermy, in photography, in painting and in the production of artificial silk (CHEMINFO, 2000).

Organic and inorganic mercury elements have been employed as medication, fungicides, insecticides and herbicides, in seeds, bulbs, plants, fruit and vegetables.

In Brazil, the use of mercury in mining, estimated by data from DNPM (National Department of Mineral Production), Ministry of Mines and Energy, 2000, shows that the national gold production in 1999 was about 41 tons. 1995, 1996, 1997 and 1998 had official productions of 63.1, 60.2, 57.9 and 49.6 tons, respectively. Production from placer mines repeated the weak performance of the last years, representing 21.7% of the placer mining production in 1998. This data hints to the consumption of Hg, for each kilo of gold produced 2kg of Hg is utilized. Still in Brazil, other sources admit the large use of mercury in the production of gold amalgam, with an estimated yearly release of metallic mercury into the environment amounting to at least 50 to 70 tons in the several mining sites (PFEIFER et al., 1990).

Natural sources of environmental contamination

Hg is found in every sort of rock, but more frequently in calcareous rock, sandstone, serpentine, andesite, basalt, alkaline feldspar and quartz. As mentioned before, it is obtained almost solely from HgS, in which about 86.2% of mercury is found, though it may occur in other ores in its elementary form (CLAYTON, 1982).

According to FAO (Joint FAO/WHO Expert Committee on Food Additives) experts, the earth's crust degasification produces from 25 thousand to 150 thousand tons Hg/year (WHO, 1976).

Fossile fuels, mainly petroleum, tend to be one of the most significant causes of environmental contamination, mostly air contamination, which later leads to the contamination of other elements, such as soil and water. In relation to these fuels, variations were detected of 10 to 8,530 ppb of Hg in coal from sites where the soil naturally had higher Hg contents. In crude oil 20 to 2 thousand ppb were detected; in non-refined petroleum from sites where the soil naturally had higher Hg contents, from 1,900 to 21 thousand ppb; in bitumen, in hydrocarbon and in asphalt: 200 to 900 mil ppb (JONASSON, BOYLE, 1979).

According to CANADY and collaborators (1997), based on discussions held in a painel at ATSDR (Agency for Toxic Substances and Disease Registry), Georgia, U.S.A., on Hg availability in soils, considering at 100% the relative Hg availability in contaminated soils is an excessively conservative approach.

However, what is known up to now is not enough to make statements that may definitely determine the relative Hg availability in soils. So, until this is set, availability tests in specific sites, preferably using testing animals or validated *in vitro* techniques, must provide a better approach when evaluating mercury availability in soils.

In 1998, in Siberia, VASILIEV and collaborators assessed anthropogenic and natural Hg emissions and concluded that the former amount to 340 tons/year while the latter, around 70 tons/year, with a deposition in soil around 40-70 tons/year.

To ALLAN (1997), the yearly proportion of natural and anthropogenic Hg emissions into the atmosphere is a crucial issue. The estimates of Hg natural emissions in the 1970s are based on analyses from glaciers in Greenland, besides other sites in the world. New sample collection techniques and new analysis techniques of metal in water were implemented in the 1980s. Thus, more recent estimates admit a 50/50 proportion for global natural/ anthropogenic emissions. Although the mining and metal refining processes have become more sophisticated, the basic causes for pollution by metals due to these processes have remained the same. Mining is a process whose own nature involves the removal, processing and disposal of large volumes of stone and waste. A typical mine uses more water by weight when producing the metallic concentrate than the weight of the ore itself. In mining, metal losses through water take place mainly when metal is directly released in the extracting and polishing process and when emissions are released in the concluding phase.

Anthropogenic sources of environmental contamination

In the United States, the estimate of 272 tons of Hg emissions from several anthropogenic sources is comparable to the findings in global inventories: a rank of 240 to 333 tons (PRASAD et al., 2000). It is worth highlighting the significance of the contribution of burning coal, oil and natural gas in cement production; treatment of sulphur ores; burning of garbage; and waste disposal from metallurgic processes. Despite its high density, liquid mercury has high steam pressure, so activities involving its handling and transport entail a good chance of loss to the environment. Contamination is detected in environments far from the emission sources, such as in ice from Antarctica and Greenland and in oceans, where mercury concentrations above levels deemed normal can be found. These findings confirm the importance of the mercury transport processes in the environment (WHO, 1991).

World scale mercury mining activities are estimated to involve from 7 thousand to 10 thousand tons a year, bringing about losses to the environment and direct emissions into the atmosphere. In chlorine-alkali industries, emissions amount to 450g of Hg/ton of produced caustic soda. The total Hg release due to anthropogenic activities, though hard to be precisely evaluated, amounts to something around 3 thousand tons/ year (WHO, 1991).

The use of mercury in gold mining

For many years, Hg has been used in gold mining to form the amalgam that helps separating the noble metal from the rest. In producing 1 gram of gold, approximately 2g of mercury are used and, out of these, 50% go to rivers as suspension in the effluents. Brazilian researchers have shown that serious contamination occurs to the sediments of rivers and waters in the mining zones, besides the evidence of contamination of carnivorous fish in the region where they are eaten by the riverside population. High human exposure to Hg is also seen among miners and gold sellers, mostly as a result of burning the Au/Hg amalgam (PFEIFFER et al., 1990).

According to VILLAS BÔAS (1997), there is no alternative for extracting gold from alluvium ores other than the Hg amalgam process – a process used by placer miners all over the Amazon region. Other possibilities – such as the cyanide process (a danger *per se*), the use of waxes and the extraction with halites – are either impractical economically or unsuitable for the types of operation and techniques usually employed in secondary ore stores. The amalgam process has then been the practical alternative. This process includes three Hg release stages into the environment. The first takes place right after the concentration phase, when the Hg added to the ore goes through the process known in the region as "cobra fumando" – a wooden device which removes the gold particles when the sediment goes through a flow of water – or after the amalgam is formed when Hg is added to it. In both processes, something like a pool is formed that retains the discharged material. The second release stage may take place when the amalgam is heated and volatilizes in an open or closed system. The third release process may occur in gold selling shops, where the metal is bought from the placer miners.

According to MEECH and collaborators (1997), the pollution of the Amazon region is a serious environmental issue, for 70 to 170 tons of the metal are released yearly due to gold mining informal activities, besides fires, in which the burned vegetation stands as a primary source of Hg emissions into the environment. This large quantity of metal suffers methylation, accumulating in fishes of the food chain. The metal's oxidation, which enables its better dissolution for the posterior methylation of the mercury's soluble species, ensuring its stability in water environments, has been evaluated through thermodynamic and electrochemical analyses. As detected, in the presence of organic acids, an Hg organic complex is formed. Although the methylation of these Hg soluble species has not been totally elucidated, the formation of such complexes in river waters should contribute to an increased Hg availability there.

Air mercury contamination

As shown by studies conducted in the Almadén mines in Spain, the mercury steam is also issued from soils rich with the metal, and the emission rate depends on the temperature, being influenced by the vegetation. Plants growing in these

soils accumulate mercury in two different ways: by means of the roots, soil and leaves and by direct absorption of mercury steam (SCHLUTER, 2000; WHO, 1991).

NAKAGAWA (1999) studied the mercury emissions from active volcanoes in order to evaluate the contribution of this kind of emission to the concentration in the atmosphere. Figures detected in more active places, which release sulphureous smokes, varied from 1.8 to 7,810 g/m^3, the geometrical average being 39,7g/m^3. As revealed by the analysis, 1.4 tons of Hg were released into the environment, the contribution of these sources in Japan amounting to 2%.

LACERDA and MARIN (1997) assessed the Hg emissions into the atmosphere in Brazil, using consumption and production parameters for each sector, and technologies actually employed in the country. The total atmospheric emission of mercury was about 116 tons/year. Chlorine-alkali industries contribute with just 12 tons a year, representing 10.1% of the total, though until the 1970s this had been the most important source of environmental contamination in Brazil. Paint and electric-electronic industries, and the production of energy from petroleum, correspond to less than 0.5% of the total. Pyrometallurgy of lead, zinc, and mainly cadmium corresponds to 3.9% of the total of 4.6 tons/year, while steel and iron productions issue 12 tons/year, corresponding to 10.4% of the total. The burning of natural vegetation to form pastures or agricultural farms may represent an Hg diffuse source amounting to aroud 8.7 tons/year, 7.5% of the total. Gold mines are the major source of Hg contamination into the atmosphere, with emissions of 77.9 tons/year, this figure representing 67.3% of the total emissions. This last source of contamination is practically restricted to the Amazon region and results in approximately 16g/km^2, with an atmospheric deposition greater than in industrial regions.

Water mercury contamination

A considerable portion of the mercury used in anthropogenic activities ends up reaching the water systems. Part of this Hg goes back into the atmosphere, this being a significant source of atmospheric mercury (WHO, 1976).

It is admitted that the Hg emissions through anthropogenic sources between 1800 and 1995 was from 115 to 259 tons just into the atmosphere, and 327 to 448 tons when considering release into sewers and effluents. Assuming that only 0.2% of these discharges became part of the currents' recycled fraction, 570 to 900 kg/year are estimated to have settled only in the Canadian seas due to anthropogenic activity. Present emission sources contribute with at least 405 kg/year to the deposition of 1.71 tons in provinces such as New Scotland, 735 kg/year being for natural sources and contaminations. These estimates await confirmation (HSDB, 2000).

The average value of 0.03 µg/L of Hg in sea water was confirmed, in 1934, in the surroundings of Helgoland, Canada. In studies conducted in the Pacific, the

concentration of mercury in water was found to increase according to the depth. Thus, the concentration in shallows was 0.11 µg/L, whereas it was from 0.15 to 0.27 µg/L at a 3 thousand meter depth. For the sake of comparison, it is worth mentioning that the mercury concentration in Minamata Bay's waters, in Japan, when receiving the waste from the plant that caused the Minamata disease, varied from 1.6 to 3.6 µg/L (QUEIROZ, 1995).

The flow of mercury from the continents into the oceans by rivers and ice melt ($3.8x10^3$ t/year) is much smaller than the contribution of that of the continents into the atmosphere (2.5 to $15x10^4$ t/year). These figures depend on the composition of the water system and the sediment, besides the oxi-reduction potential, pH, temperature, presence of annealing substances, quantity of sediments in suspension, and existence of water biota. An average figure of 0.03 µg/L was estimated (QUEIROZ, 1995).

As observed by PFEIFFER and collaborators (1989) in the Rondonia mining region, concentrations in the waters of forest tributary rivers varied from 0.1 to 8.6 µg/L, while in the sediment they would reach 19,800 µg/L. In the eatable portion of fishes from these rivers, mercury concentration would reach 2,700 µg/g of dry weight, five times what is recommended by the Brazilian legislation for human consumption.

Bolivian mining regions in the basin of the Madera River were also studied. Concentrations measured in shallows varied from 2.24 to 2.57 ng/L in the glacial waters of the Zongo River, rising to 2.25 to 6.99 ng/L in Porto Velho, in the region of alluvial gold exploration, up to 9.49 to 10.86 ng/L in its confluence with the Amazon River (MAURICE-BOURGOIN et al., 2000).

Not always do mining activities lead to contamination. IKIGURA and AKAGI (1999) assessed the environmental levels in gold mining regions at Lake Victoria, in the Nungwe Bay region, Tanzania. The Hg concentrations found in fish were low, between 1.8-16.9 ppb, with a 7 ppg average. The Hg contents in hair of the region dwellers were of 156-5,433 ppb, a 947 ppb average, compatible with the reference levels usually found in the population in general. The authors comment that, in that region, the mining activity did not cause an increase of methylmercury available for bioaccumulation in the water organisms from the food chain.

In the oceans, Hg settles in the sediment, in the form of highly soluble mercury sulphide (WHO, 1991).

As reported by SUNDERLAND and CHMURA (2000), the metal Hg has for several years been a Canadian concern due to the marine contamination of fish and birds. They also admit that this Hg is considerably associated with the anthropogenic release. In the past, the most significant sources of contamination were chlorine-alkali, paint and pharmaceutical product industries, but nowadays the use of petroleum and the disposal of garbage stand as the most relevant

sources. Atmospheric emissions in the maritime regions of Canada reached their peaks in 1945, 1965 and 1970, with contents higher than 1,750 and 2,600 kg/year.

MARINS and collaborators (1998), analyzing Hg in the sediment of Sepetiba Bay, Rio de Janeiro, observed a 10 time increase in comparison to what was found as normal in the environment, and they admit that the Hg availability potential in sediments depends on biochemical processes that affect the metal after its deposition.

In the sediments of Minamata Bay, Japan, where the Minamata disease took place, the mercury concentration at the time reached up to 2,010 mg/Kg (dry weight), in the confluence of the discharge channel from the Chisso plant, which released CH_3Hg^+ (D'ITRI, 1990, apud QUEIROZ, 1995).

The approximate concentration of all forms of Hg in the earth's crust amounts to 80 ppb.

Effects of human exposure to methylmercury

According to the International Program for Chemical Safety, methylmercury is one of the most dangerous metals for human health (IPCS, 1991). Serious events of human exposure to methylmercury have shown its toxic effects, among them neurotoxicity being of special note. In man, the effects of methylmercury differ in terms of dose, reaction and symptoms. Children, fetuses and pregnant women are the most vulnerable groups to methylmercury exposure (US EPA, 1995). Methylmercury goes past the blood barrier – the brain – and reaches the central nervous system. In adults, methylmercury levels in the brain are approximately six times higher than Hg levels in the blood (Magos, 1987). The fetus is particularly sensitive to methylmercury exposure, whose effects in a child's development have been associated with high methylmercury levels and neurobehavioral effects (Gilbert and Grant-Webster, 1995).

Clinical symptoms of intoxication by methyl-Hg in children and adults include: paraesthesia (numbness in body ends and around the mouth), ataxy (walking difficulties), dysarthritis (speaking difficulties), narrowed visual field, deafness, trembling, intellectual deficiency and, in some cases, motor paralysis (WHO, 1990). Epidemiological studies in Japan and Iraq have shown how methyl-Hg damages the fetus' central nervous system and its effects on its development. These damages primarily imply the neuron migration and how the cortical structure is organized (Choi, 1991). Methyl-Hg also affects the proliferation of neuroepithelial cells' mitotic activity, entailing symptoms such as: brain paralysis, microcephaly, and severe and motor damages. Blindness and deafness are effects usually associated with other effects (WHO, 1990; Choi, 1989).

Potential mercury exposure and toxicity means in man

Since HG occurs naturally in nature, people in general may be exposed to very low Hg concentration on the air, in water, and in food. However, even in low concentrations, Hg may be considered potentially toxic to the human organism (Hursh et al., 1980; ATSDR, 1989). Isolated individuals or individuals inside a group may be under exposure of high Hg levels through ingestion of fish contaminated with methyl-Hg, this being a significant contamination means for environmentally-exposed groups. Hg concentrations in meat and grains are from 100 to 1,000 lower than those in carnivorous fish, whose concentrations are in the concentration rank of 0.1 to 0,9 µg/g (Lindqvist, 1991).

In the Amazon region, inhalation of Hg steams takes place in different stages of gold production. However, it is difficult to diagnose intoxication by mercury because its symptoms are similar to those with other signs and symptoms and attributed to other causes, mainly malaria, which is endemic in placer mining regions. Another difficulty regarding this diagnosis is the lack of conditions for the local health agents to differentiate a diagnosis for intoxication by mercury (clinical, biochemical and toxicological tests) from other pathologies in the region (Branches et al., 1993; Camara et al., 1996).

Human exposure to high metallic, organic and inorganic Hg concentrations may permanently damage the brain, the kidneys, as well as jeopardize fetal development. Absorption, distribution, metabolism, excretion, and consequently toxicity depend on its oxidation state and the chemical form in the organism (ATSDR, 1994). In the human organism, Hg is converted into different chemical forms and oxidation states, which will act in a differentiated way in terms of toxicity and adverse effects. By means of enzyme processes, elementary Hg may be oxidated into inorganic forms, as much as the organic Hg compounds may be converted into inorganic Hg in the organism (ASTDR, 1994).

Oral exposure

The main means by which methyl-Hg enters the human organism is through the ingestion of fish, in which organic Hg represents about 95% of the total Hg (WHO, 1990). Organic compounds are more toxic and more easily absorbed in the gastro-intestinal tract. The methyled form is soluble in lipids, easily spreading through the biological interfaces, such as blood-placenta and blood-brain. Due to methyl-Hg's high affinity with the sulphide groups, it rapidly incorporates into the critical organs. The main critical organ for methyl-Hg is the central nervous system. The methyl-Hg effects on the fetal stage differ quantitative and qualitatively from those observed in adults and children (WHO, 1990). The methyl-Hg absorption incorporated by oral means, in humans and animals, is over 80%. Methyl-Hg half-life in the human organism is of about 70 days, with some studies showing that women tend to excrete Hg faster than men (Young, 1992; Clarkson, 1990). Excretion means are urine, feces, saliva, maternal milk, bile and sweat.

As for the inorganic compounds, there are but a few studies available in

relation to oral exposure. If metallic Hg is ingested in liquid form, it is not easily absorbed in the bloodstream (< 0.10). However, the ingestion of an acute dose, varying from 10 to 42 mg Hg/ kg of bodily weight for a 70 kg adult, is considered lethal for the ingestion of mercury salts (ATSDR, 1989).

Exposure by inhalation

The inhalation of steam Hg is associated with the systemic toxicity in humans and animals. About 80% of steam Hg is absorbed by the lungs and rapidly reaches the bloodstream, due to its high diffusibility and hyposolubility, being distributed into the organism (WHO, 1991). Hg absorption through inhalation is a very efficient process in the human organism, but the retention time of steam Hg in the organism is limited, being oxidated at Hg+2 in the tissues and behaving in the same way as mercury Hg (Belin, 1986). Hg in its particulate form is absorbed through the respiratory tract. However, its toxicity depends on the particle's size and its solubility in biological fluid (Foà et al., 1986). Mercurous salts (Hg+1) are less toxic than mercuric salts (Hg+2).

Chronic exposure to Hg steams has as its critical organs the kidneys and the central nervous system. The steam Hg half-life varies from 35 to 90 days, being of about 40 days for the inorganic salts (Goyer, 1991). Acute exposure directly reaches the respiratory, cardiovascular and gastro-intestinal tracts. Known effects of exposure to Hg steams are restricted to occupational activities, in which the magnitude, the exposure intensity and the microenvironmental conditions are known. As regards environmental exposure, connected to anthropogenic activities, there is basically no information.

The main symptoms of acute intoxication by Hg steams in the respiratory tract are: dyspnea, coughing, compression in the chest, pain and burning sensation in the chest (Bluhm et al., 1992). In more severe cases, respiratory anguish, pulmonary edema, pneumonia, fibrosis, and dyscalation of the bronchial epithelium are common. These effects are registered in workers accidentally exposed to high concentrations of steam Hg, that is, over 44 mg/m3 in a period of 4 to 8 hours everyday (Taueg et al., 1992).

The gastro-intestinal symptoms of acute intoxication by steam Hg are well documented and are mainly characterized by severe gastro-enteritis (by corrosion of the digestive tract's mucous membrane), along with strong abdominal pains, diarrhea, digestive hemorrhage, stomatitis, nausea, and vomiting (Karpathios et al., 1991).

The renal system is sensitive to mercury exposure due to the high Hg accumulation rate in the kidneys. The concentration of inorganic Hg in the kidneys is, on average, 15 times higher than the total Hg concentration in the human body (ICRP, 1980). Exposure to high steam Hg concentrations results in effects varying from increased proteinuria in urine to renal syndrome, with tissue necrosis (Rowen

et al., 1991).

As documented by several studies on workers, there are neurological effects from acute steam Hg inhalation in high concentrations. These symptoms and signs are characterized by a wide variety of motor, cognitive, sensory disorders and changes of personality. The most prominent symptoms include trembling (initially affecting the hands and sometimes other parts of the body), irritability, often along with agressivity, insomnia, memory loss, neuromuscular changes, muscular contraction, muscular atrophy, and some polyneuropathies, such as paresthesia, hyperactivity of the tendon's reflexes, among others (Adams et al., 1983 Bluhm et al., 1992; Jaffre et al., 1983). As changes in cognitive functions (such as attention, concentration) are very subtle symptoms, it is necessary to use very sensitive tests when evaluating them. Some of these effects have been documented by Adams et al. (1983) in workers exposed to high Hg levels in urine, amounting to 100 µg Hg/g of creatine. However, some of these effects seem to be reversible once the exposure stops.

The neurological effects of chronic exposure to Hg steam result in trembling, which may be mild or severe depending on the exposure degree, memory deficiency, anxiety, irritability, difficulty to concentrate, dimmed sight and paresthesia. Trembling is associated with occupational exposure levels of 20 µg/m3. Most of the studies suggest that the motor system disorders are reversible, when exposure stops, while effects related to cognitive functions may be permanent (Hanninen, 1982; Miller et al., 1975).

As suggested by recent studies using sensitive tests for evaluating psychomotor skills, trembling, and the function of the peripheral nerve, adverse effects may be associated with Hg steam exposures, estimated at 25 µg/m3 within a daily 8-hour period. Significant effects related to the cognitive functions and/or trembling have been diagnosed in work environments, with exposure levels varying from 14 to 76 µg/m3 (ATSDR, 1994).

Chronic intoxication due to Hg steams initially points to non-specific symptoms, such as weight loss and muscular weakness, anorexy and various pains and asthenia. Depending on the exposure's magnitude and intensity, gastro-intestinal signs and symptoms are characterized by metal-like taste, gingivitis, teeth loosening and falling out, dysphagia and pain from chewing, intestinal colic, high or low digestive hemorrhage, hepatomegaly, metal-like taste, gum and palate spots, and ulcerated oral mucosa, among others (ASTDR, 1994). Studies on workers regarding chronic exposure, in which Hg steam concentrations varied from 30 µg/m3 to 75 µg/m3, within an average 6-year period, have reported increased heartbeats, high incidence of hypertension, and cerebrovascular diseases among the workers (Bluhm et al., 1992a; Soni et al., 1992; Schuckmann, 1979; Barregard et al., 1990a). Symptoms may be intensified and become irreversible if exposure remains and/ or the concentration goes up. Most of the occupational studies discuss chronic exposure for a pondered average concentration in terms of exposure time, generally never going past 8 hours a day.

III.2. Present panorama

In the general scenario of environmental mercury contamination in the Amazon Basin and its influence areas, two major dimensions overlap:

- the metal's great toxicological and ecotoxicological complexity;
- the grandeur of the basin, its nature, and the intricate web of inner relationships connected to it.

The toxicology of mercury has been preliminarily and briefly dealt with in item III.1.

The Amazon Basin, with about 6.2 million Km^2 and 7.100 Km of extension of rivers from its source, in Peru, to its mouth, in Brazil, is the biggest in the planet.

The Amazon River is part of the four great water systems, which produce 70% of fresh water discharges in Latin America and 16% of superficial fresh water discharges in the world (www.otca.info). The water volume drained from this basin is of 6700 Km^3/year, carrying 830 to 930 tons of sediments yearly (www.siamazonia.org.pe, 26/5/2005).

The Amazon waters are subject to different degrees of environmental impact. Theses impacts come from several sources and, consequently, they have different characteristics: mineral water drunk in the region but from urban zones and big cities, chemical contamination by toxic agricultural products and mercury, which add to social problems that may result in health problems potentialized due to the specific vulnerability of individuals exposed to the contamination and the socioenvironmental vulnerability of the Amazon region

In several countries of the Amazon Basin, mining companies, as well as minor placer mining operations, bring serious socioenvironmental implications due to the poverty conditions of those who are paradoxically engaged in these activities, what to speak of the lack of sanitary infrastructure along with that mining activity's low technological level. Every country in the basin has a history of using metallic mercury in the gold production processes, in lesser or bigger scales.

The impact of mercury contamination on the local fauna's ecological niches may be described by the serious problem of its bioaccumulation in the trophic chains, affecting, through this mechanism, both the riverside and urban

populations. Mercury concentrations in the muscles of many species of carnivorous fish are above the permissible top limits established by the World Health Organization (WHO).

According to organizations acting in the mineral sector – and researchers investigating the issue of mercury contamination in the basin – it is not possible to precisely estimate the mercury load released by the countries into the Amazon system over the last 25 years. Some attempts have been made towards finding a reliable approximate figure, but the basin's stretch, associated with the environmental and mineral sector's precarious, and in many cases nonexistent, inspection, make it difficult to expect a more precise diagnosis of how much mercury contamination has affected the region.

It is believed that, over the last 25 years, only for the Brazilian portion of the basin, about 2,500 tons of mercury have been released into the region's ecosystems by the placer mining activity (MALM, 1998), having reached its peak in the 80s and into the mid 1990s. In Brazil, the placer mining activity lost ground in the 90s, and that remains the same up to now. This activity is believed to have left a representative negative environmental asset in the Brazilian Amazon region, and it keeps generating mercury contamination.

Studies conducted in the late 1990s raised the hypothesis that pre-anthropogenic sources would be contributing to the present high levels of mercury in the Amazon basin (BOURGOIN et al., 1999; ROULET et al., 1995, 1996).

The Amazon's biogeographical development is characterized by a very peculiar history of geological, hydrological and climatological events, which undoubtedly played a relevant role in structuring the flora and fauna's biogeographical standards and their evolution. The present knowledge about these processes, along with the knowledge of how mercury's biogeochemical cycle behaves, are certainly still too superficial for us to understand how mercury contamination has grown over the last 25 years in the Amazon Basin.

However, it is important to recognize the need to conduct researches on the cycle, transport and destination of mercury in the Amazon Basin. The knowledge thereof may contribute to our understanding the biogeochemical factors of contamination by the metal, as well as contribute to natural resource preservation policies and sustainable development proposals for the basin. A complete diagnosis of the situation is not available yet, but this is considered to be a dynamic process, and available information should be constantly updated, even as an aspect of the management cycle. The major counterpart of the countries when negotiating to collect resources could be adopted exactly as the information approach for a continuous elaboration of a systematized diagnosis of the situation of contamination and risk.

All the possible endeavors, both at the governmental and social levels, should be made towards mapping risk areas and those areas with an extensive

negative environmental asset. For that matter, the aspects of local environmental conditions should be considered in relation to the mercury's process of chemical transformation, including the natural and extralocal processes.

The zone's ichthyofauna, mainly the ichthyophagous fishes, is quite affected by the mercury contamination, representing a contamination risk potential for the communities relying on that kind of food as their major source of protein. The ichthyofauna's contamination may also affect informal fishing projects and/ or fishing programs/ projects in the region.[3]

Still focusing the 'Present panorama', after analyzing the questionnaires, forwarded by the Amazon basin countries (Annex III), we can take the Brazilian response to question 18 as a probable paradigm to all the countries in the region. Brazil registers the following issues related to mercury in the gold extraction activity in the Amazon region:

- Conflicts between placer mines without environmental license (and still using mercury) and the inspection.
- Growing unemployment rates, inverting the migratory flow from the cities to the placer mining areas.
- Existence of areas with mineral substances of high unitary value and high contents, enabling rudimentary tillage.
- Indigenous reserves vs. placer mines (conflicts between Indians and placer miners).
- Environmental pollution and degradation caused by gold extraction activities vs. environment.
- Conflict at international borders with placer mining areas.
- Conflicts of occupation or invasion by placer miners in areas where mining companies hold research permits or mining decrees.
- Contrary to the previous situation, research permit and mining decree granted in regions where the ore occurs and which were found by placer miners.

Bolivia's report on the same question (18) is extremely illustrative of the complexity of mercury's dynamics in the environment, and of how a single gold exploration operation can spread contamination into a large area, even reaching regional contours:

"Communities living in the low lands are affected whenever mercury is being used in the high lands, from where sediments with mercury contents are washed down through water courses into places where riverside dwellers drink water and

[3] A map of the basin is suggested to be introduced herein, identifying affected areas with minor gold mining operations and, if possible, with negative environmental assets. This will depend on the countries' sending information with the due georeference of affected areas.

eat fish. It was found that this affected their health and, according to some data, children were found to have a mercury percentage at the same level or even higher than that of their parents. Therefore, it may be said that there are problems in soil water, in sediments and in human beings."

On the other hand, in Colombia, as informed in the Lima meeting, for 14 years they have been trying solutions to 14 gold mining regions, each one with their own peculiarities and two of them working with international support. Such endeavors have led them to conclude that part of the solution is in identifying the cause of the problem (as is happened in Bucaramanga). Thus, fighting the cause should be incorporated into MAP, this cause being gold extraction along with its social, political and economic elements. In that country, this was done by means of pilot projects designed along with the mining authority and the worker, and, in some cases, results were generated that improved the production processes. It is our plan to hold meetings in order to exchange experiences. As the Colombian experience points out, the governments on their own, in the role of environmental authorities, face serious limitations when trying to reach solutions to the problems. The country has been trying to propose economic instruments for the environmental management.

In Peru, there is an Amazon Basin network which may be linked to other existing or to be created networks. Also under way is a project, financed by Finland, for the making of maps – they are considering broadening this project's benefits. The zoning of mining areas is practically concluded, and limnological information for mercury and arsenic is being organized. The country has made the political decision not to allow new gold mining companies.

Suriname's reality is different from the rest of the region because there are several ethnic groups there, which makes it difficult to prepare, for example, information programs. Cultural aspects, such as theater and music, must be taken into account.

In Venezuela, the last 10 years have witnessed how the minor gold mining activities have ignored soil arrangement guidelines in the territory. This activity has developed in areas of National Parks, Natural Monuments, Forest Reserves, bushes and protected areas. According to information from the site www.casmite.org, up to now a comprehensive evaluation of the region's soil, bodies of water and humans is unknown. Despite the endeavors made in the past, with the initiatives by the Gold Recovery Centers, which used mercury under controled conditions, it is general consensus in the region that the problems mentioned point to the need of a more effective mining policy. The country implemented a project with UNIDO, which enabled them to become familiar with the reality concerning mercury contamination.

It is important to identify which financial resources now available in the countries (treasury and/ or multilateral sources) could be allocated, directly or indirectly, to MAP's activities, without meaning losses to national actions under

way. It should be pointed out that, in responding to the second questionnaire, both Brazil and Bolivia have mentioned they have no access to information regarding national investments directly applied to control and mitigation actions against pollution by mercury in placer mining and mining in the Amazon area. Brazil says: "Budget is worked on by large programs, and thus it is difficult to set aside expenses to specific actions."

III.3. Studies conducted in the Amazon Basin

For MAP to be structured, it is imperative to know what has already been produced in terms of studies on the issue, results achieved and main knowledge gaps, in order for us to advance and support a proposal for managing mercury contamination in the region's ecosystems.

An exhaustive survey was made on the scientific production and its technical reports for the 1990-2005 period. The Medline, Lilacs, Scielo bases were used, as well as databases from the Member Countries' governmental organizations (HACON et al., 2005).

From a preliminary analysis based on the information sources used, it can be inferred that during this period Brazil advanced the most in conducting studies in the basin and in the number of publications in scientific magazines, with a total of 245 articles, followed by the French Guyana, with 14 articles, and Suriname, 7. In every country, the environmental matrices (soils, sediments, biota and water) have been the major study focus. Figure 1 shows a comparative table of the ACTO Member Countries' technical-scientifc production and that of French Guyana.

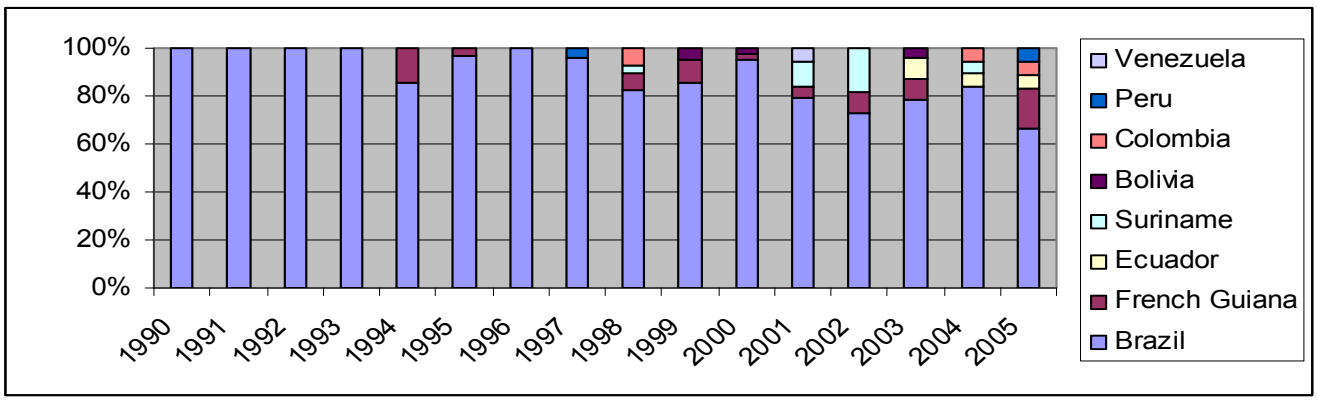

Figure 1. Comparison of the technical-scientific production between the Amazon countries, from 1990 to July, 2005
Source: HACON et al., 2005

Although Brazil has excelled in the research area on mercury in the Brazilian Amazon region, Colombia has been achieving relevant results for improving gold extraction processes, while reducing occupational and environmental exposure to

mercury. These are small scale projects, but can be applied to the local reality of several countries in the Amazon basin.

The major results from that research survey point to the following tendencies:

as for the analytical aspects

- increased qualification for analyzing mercury in the Member Countries, including organic mercury analysis. The environmental matrices (air, soil, sediment, biota, except water) can already be routinely analyzed in some laboratories in the countries.
- increased and improved infrastructure of mercury analysis laboratories, with state-of-the-art equipment, mostly in Brazil. Mercury quantitative analysis in urine, blood and hair are already conducted in almost every country in the basin.
- countries have gathered more qualification in terms of quality control. Most of the countries are connected to intercalibration programs with national and international institutions;

as for the research

- increased number of research groups with multi and interdisciplinary approach projects, privileging the socioecological and participative focus, as in Colombia, Peru, Brazil, reflecting a greater – and fundamental – integration of knowledge areas with the social actors involved in the environmental contamination processes;
- in Brazil, increased number of research groups developing research projects with international groups/ institutions;
- significant knowledge, on the part of researchers from some Amazon countries, of exposure levels, considering fish consumption and mercury levels in riverside dwellers' hair;
- increased number of studies in humans related to the neurological effects of exposure to mercury;
- increased number of studies related to the mercury's methylation process in some rivers of the Amazon basin.

as for the institutionality

- undoubtedly, a greater integration between governmental and non-governmental institutions;
- a growing participation of financing institutions on the international level, fostering inter-institutional projects.

The technical and scientific advances observed in some of the Amazon countries still do not fulfil all that is needed for a better understanding of the processes of mercury contamination taking place in that environmental system.

There is record of a reasonable number of environmental studies, involving the matrices: water, sediments, fish and soil. But such studies are not sufficient yet to explain mercury's biogeochemical behavior in the Amazon Basin. The same is true in relation to the studies on health hazards deriving from exposure to methylmercury, due to a high consumption of fish and the presence of gaseous mercury. The latter situation is worse in the countries where the amalgam process still entails mercury losses to the inner and outer environment.

IV. MAP'S CONSTITUENT ELEMENTS[4]

IV.1. Theoretical milestone

The theoretical milestone behind MAP's idea, as well as its source of inspiration, is founded on the belief in deep ecology and its ethics, which entails the possibility of harmonious and balanced nature, even in face of the human presence and their inherent need to change the environment in order to ensure their maintenance and survival.

It is believed that the mining and/or gold placer mining activity in the Amazon Basin may be carried out in such a way as to ensure the worthy survival of the populations depending on it, mainly the riverside ones, without necessarily bringing about a strong environmental impact, with destroyed river banks and bottoms and chemical pollution by mercury.

A way to reconcile economic activity and forest maintenance in peaceful coexistence is through the political effort to incorporate the following aspects:

- preventive and technological education provided to all the population involved,
- process implying continuous technological evolution,
- proper training at all levels and to everyone involved,

[4] From analyzing the available documentation and information, even though there may be record of other potential sources of mercury contamination in the Basin, this Plan focuses on the process of pollution by mercury deriving from the mining and/ or gold placer mining activity.

- permanent sanitary and epidemiological vigilance, inspection and environmental monitoring,

- effective, efficient and actual social communication

IV.2. Objectives

MAP's overall objectives are as follows:

Political objectives

1. to define, propose and encourage institutional integration and interaction mechanisms for managing mercury contamination in the Amazon Basin and its influence area;
2. to define integrated action priorities for environmentally managing mercury contamination between the Amazon Basin Countries and their influence area;

Vigilance and control objectives

3. to keep a precise and ever updated cartographic base to serve as a reference milestone for an intervention plan;
4. to reinforce the ability to manage and inspect the use of mercury;
5. to prevent the illegal use of mercury, to analyze the possibility of creating barriers against importing mercury, to strengthen recycling;
6. to gradually and significantly reduce environmental mercury contamination in the Amazon Basin;
7. to investigate, reduce and control human exposure to mercury in the Basin's influence area;
8. to implement a System for Communication of Risks of exposure to mercury;

Research objectives

9. to investigate the actual contribution of the placer mining activity to the mercury load present in the Amazon Basin and influence area;
10. to map, measure and evaluate environmental negative asset areas in the region and their contribution in terms of active mercury load into the Amazon system;
11. to evaluate the environmental impacts and effects on human health deriving from mercury contamination;

Objectives related to awareness, environmental education and social communication

12. to foster and support the development of educational projects in the region, integrating the theme mercury contamination in the school syllabus;
13. to foster the development and use of clean technologies in the region through social participation programs;
14. to create and operate a website on the environmental issue of gold placer mining and mercury contamination, linked to information systems from different governmental and non-governmental agencies and institutions in the countries involved;

Economic objectives

15. to create competitiveness mechanisms for gold exploration integrated to the product's cycle;
16. to support recovery and mitigation actions and appreciation of sustainably using negative environmental asset areas abandoned by the placer mining activity;
17. to create incentives for those using good practices and ecologically-correct exploration in the minor placer mining and mining activity.

On the basis of the survey on the scientific production over the last 15 years, including articles published in national and international magazines and technical reports (not necessarily published in indexed magazines), it should be pointed out that the studies in the health area are still timid when compared to the need of better understanding the actual effects of exposure to methylmercury on vulnerable sub-regional groups.

In face of this set of needs, it is urgent to propose, approve and adopt a plan with programs aggregating them, so as to make the actions operational, taking into account the technical, scientific and infrastructural reality, the extension and intensity of mercury use, and each country's political will to fight the issue.

Based on this diagnosis, a set of interventions is proposed that may reflect a medium and long term commitment, shared with regional endeavors to convey information, good technological practices and the national ability to suitably manage the mercury issue.

It is also expected that the countries commit themselves to encouraging participation and vigilance, to modelling, investigating and promoting technological development on the basis of socioenvironmental management, so that the decision-maker is duly founded and may exercise their responsibility in carrying MAP on.

IV.3. Contents

It is assumed that, in order to formulate and implement MAP, the eight Member Countries have gone through the preliminary task of collecting and providing all the local scientific knowledge available, for such levelling is essential for them to realistically and efficiently define how much knowledge has already been gathered and how much they still have to survey and research in order to found the Plan, increasing its achievement prospects.

Despite the already existing ample literature about the different Amazon countries, mercury's local biogeochemical cycle is not known satisfactorily yet, and therefore more associative researches must be developed, mainly with the evaluation of real ecotoxicological risk and human population exposure (as previously pointed out).

Although this does not mean MAP cannot be formulated and implanted, it would be more than convenient, on the contrary, if the Plan induced regional and local Science & Technology and Research & Development institutions to fill this knowledge's main endogenous gaps.

MAP covers five major structure and development axes:

1. **Program for the Integration and Interaction between Countries**
2. **Institutional Strengthening Program**
3. **Program for Environmental, Social and Technological Management**
4. **Social Communication Program**
5. **Knowledge Management Program**

IV.3.1. Program for the Integration and Interaction between Countries

Nowadays it is general consensus that: i) there is insufficient level of communication between each country's official organisms and their civil society; ii) there is insufficient level of communication between the countries regarding the issue; iii) there are few multinational projects under development to integrate the Amazon countries.

Since MAP is characterized as a regional plan – in other words, it involves several countries in the same issue because the economic activity of obtaining gold by using mercury in the Amazon systems obeys no boundary restrictions and thus the hazardous effects of a local action spread far and wide and do not respect each country's territorial limits –, international integration and interaction mechanisms are imperative.

Objective

In view of this verification, this Program's direct objective is to create, by means of several converging projects, the necessary conditions for greater,

permanent and productive integration and interaction between the countries when dealing with the issue.

Projects

The following projects are to be implemented:

A. Setting up the system of integration and interaction. For that matter, a group of managers/ experts, indicated by the countries, should be formed to analyze, suggest, create and foster the integration and interaction mechanisms, for example, the Portal, shared Database System, Information Bulletin, etc. (corresponding to item 5 of the 1st Meeting's Recommendantion Document).

B. Setting mechanisms for divulging and strengthening projects under way in the different countries.

C. Promoting the exchange of experiences between the countries, from projects under development and/ or developed in the region.

D. Installing and maintaining in the countries, along with ACTO, an inter-governmental and multiprofessional Work Team authorized to follow up and deliberate on the issue.

IV.3.2. Institutional Strengthening Program

It has also been clearly diagnosed that, although in many countries the institutions – whether they are in gold extraction, in environmental management, or in research – have evolved and qualified over the last years, they still lack a lot in terms of personnel improvement and general infrastructure in order to truly face the delicate and complex issue of mercury use and its negative consequences.

Objective

Therefore, this Project aims at identifying and supporting mechanisms so that institutions in the different countries somehow or other linked to the mercury issue (that including the very entities connected to gold exploration) may satisfactorily play their role, with safety, credibility and continuity, and may permanently communicate with each other, exchanging their findings and setting a synergic network for the fast evolution and maturation of knowledge regarding the mercury issues and their solutions.

Projects

The Program shall implement the following projects, among others:

A. Equipping of the organs (functions) of: environmental planning, environmental management, environmental inspection, elaboration and application of the legislation, laboratory background (chemical, food, toxicological and clinical analyses), at regional, national, sub-national levels, mainly aiming at joint actions.

B. Implanting regional and shared Database.

C. Implanting computerized, normalized, georeferenced and networked management systems.

D. Implanting Standardized Operational Procedures.

E. Implanting and operating a laboratory network, with permanent warranting and laboratory intercalibration system.

F. Strengthening regional solutions focused on logistic facilitation of access to and communication with areas of interest.

IV.3.3. Program for Environmental, Social and Technological Management

Although this is not the only relevant aspect as regards minimizing, preventing and remedying mercury contamination in gold placer mining and mining areas, undoubtedly managing the issue, and all that unfolds from it, is perhaps the most relevant item when it comes to the possibility of attaining success, that is, efficiency, effectiveness and consolidation in the fight against the situation.

Objective

This Program aims at discussing and highlighting every aspect of management, taking into account the social, environmental, economic and technological factors (gold extraction technologies and the consequent use of mercury in the amalgam process), which directly affect the actual situation of using mercury and mercury contamination in gold placer minings and minings.

Projects

This Program should cover the following projects, among others:

Environmental Management

A. Defining, setting up and operating Management Systems attuned to the organ involved in environmental management (at national and local levels), computerizing and automating all its processes and linking them to data systems, with output to all the necessary uses and critical process feedback. Prior to it, there must have been institutional

diagnosis on its degree of computerization/ automation and quantity of information about placer mining available in this version.

B. Present inventory of active and passive mercury emission sources, from georeferenced and typified register/mapping of the placer mining regions and placer mines, regardless of the size and movement of these placer mines/ placer miners, with predefinition of priority areas for management actions (item I from the Recommendation Document, Rio Meeting).

C. Laboratory survey of chemical mercury contamination in environments indicated beforehand by the Inventory and definition of environmental vigilance systems.

D. Update on the national diagnosis with the small scale mining (gold placer mining) tendencies and their implications, with the following topics, among others: i) mapping with extension, georeferenced identification and quantification of negative environmental assets deriving from the use of mercury and the possibilities of rehabilitating and/ or recovering these areas; ii) delineation characteristics of the production processes, setting up gold's production chain for each case, and including the economic balance of the activity's cost-effectiveness; iii) estimated mercury load released into the environment per year and its dynamics; iv) estimated contamination in the different environmental segments, including humans; v) active population involved (miners, burners, etc.); vi) total passive population involved and risk groups. In the same way, it is worth developing a common methodology to all the countries, to be used regionally and to enable the quantification of mercury used in the amalgam process, as well as how much is lost, how much is recycled in the processes and the products.

E. Environmental inspection of the gold extraction activity through the use of mercury, strongly emphasizing the preventive and educational aspects, without, however, failing to zealously enforce each country's pertaining legislation. There shall be a permanent endeavor towards inspection and monitoring integrated actions, using environmental indicators of contamination and human exposure of the "sentinel" kind.

Social Management

F. Epidemiological Vigilance – it also involves food safey aspects and populational epidemiology. Therefore, a permanent need is predicted of close synchronization between the publich health organs and those of environmental management.

F. Legislation – the environmental control legislation, in all its aspects, even those of fomentation, should, as far as possible, be continuously improved and integrated among the eight Member Countries.

Technological Management

G. Fostering qualified management practices in the production chain, by means of obtaining and applying recognized environmental management systems, such as ISO 14,000.

IV.3.4. Social Communication

The communication process takes place from the involved actors' perception level and should be fed with channels and mechanisms to ensure a free flow of information.

When it comes to Communication, it is essential to choose and use suitable and reliable indicators. Once these indicators are there, information should be raised, but not without carefully using scientific criteria to both obtain it and divulge it, avoiding the use of information that is not backed up by confirmed scientific foundation. The managing of information should be considered strategic. Besides, local staff should be correctly disseminating information.

These are communication strategies: compulsory involvement of all government levels and spheres and actual comparative strengthening of the local level; identification of the true leaders in local communities and partnership with them.

Objective

The Program aims at conceiving and ensuring the permanent spread of information and news regarding the use of mercury in placer mining and mining, as well as the risks to the Amazon socioenvironmental system deriving from such use. Communication shall be in suitable frequency and language so as to ensure the understanding of the target-public, including local, national and regional public authorities.

Projects

Projects related to Social Communication shall be:

A. Mercury Portal.

B. Publishing and disseminating didactic literature and episodic or periodic literature, in accessible language and speech, in the form of printed material or by electronic means.

C. Use of media: specialized and pertaining programs on radios, television channels and in local newspapers.

D. Projects and studies in partnership with local associations and cooperatives, among which theater and music projects, and partnerships with well-known local artists.

E. Local events and lectures conducted in accessible language with technical explanations and videos.

F. Environmental Education for the Citizenship – strategic for Social Communication in order for it to actually gain ground is the simultaneous existence of a competent project of Environmental Education for the Citizenship, which should take place in formal and informal educational networks and be focused on the placer mining population and other risk populational segments, involving adults and children of both sexes who go or do not go to public and/ or private schools. This educational process should approach and divulge, among other items: i) risks of using mercury (and cyanide) and their consequences; ii) technological alternatives to minimize the risk of using mercury (and cyanide); iii) possible medium and long term economic alternatives for each region.*

G. System for managing contingencies and crises – a Permanent International Committee (PIC) could be created to assist in dealing with this kind of emergency.

As for the Portal, there should be discussion on its contents, functionality and the aspects of communication and information technology (CIT), as per what is preliminarily outlined in Annex I.

IV.3.5. Knowledge Management Program

Considering that a scientific basis is the fundamental platform for any action, the goal behind this Program is the genesis of local specific knowledge on the issue and the construction of personal and institutional capabilities, without forgetting the absolute obligatoriness of transfering developed technologies and methodologies to be shared between the Member Countries, thus creating an atmosphere of permanent auspiciousness for knowledge growth and command.

Objective

To permanently induce and support conditions in order for the search of safe and critical knowledge about the issue, environmental mercury contamination to be conducted and shared among the countries and peoples in the Amazon region.

Projects

These are some of the pressing needs for studies and actions, so that the Amazon Basin countries reflect and define priorities:

A. Mercury's environmental behavior

1. deepening studies related to the transport, transformation and destination of mercury in the Amazon Basin. These studies will enable a better understanding of how mercury behaves in the region's water, air, soil and sediments;
2. determining the role of microbial communities in the methylation processes in sediment/water;
3. deepening the understanding of mercury's biogeochemical cycle in the basin, considering different kinds of soil and sediment; and how the ecological processes interact in the region;
4. identifying a sentinel indicator for the Amazon Basin's water biota that may enable comparing the mercury levels and a better management and vigilance of mercury contamination between countries;
5. developing empiric models that may contribute to the interaction of variables affecting methylmercury's bioaccumulation in the Amazon ecosystems;
6. deepening and better clarifying the contribution of natural mercury load versus anthropogenic mercury in the Amazon basin;

B. Human health

7. epidemiological studies of different groups' exposure to gaseous mercury and organic mercury, focusing the complexity of the Amazon system, that is, its differentiated socioecological, economic, sociodemographic, cultural and ethnic characteristics;
8. deepening and simplifying health studies concerning exposure and effect indicators, in order for them to be used in health units to assist reference diagnosis on intoxication by mercury;
9. investing in epidemiological studies of neurological evaluation in children under low exposure, to be compared between the countries in the Amazon ecosystems, mainly riverside dwellers' children and children of workers occupationally exposed to mercury;
10. investigating the effects of organic mercury on the endocrine and immunological system of groups under exposure in the region, considering the region's endemics;

C. Animal health

11. developing studies on the mercury exposure of wild animals in the basin, mainly birds and mammals;

12. improved understanding of mercury's ecological impact on wild animals;

D. Technology

13. fostering the adoption of new technologies to reduce mercury emissions in the basin;
14. promoting the investigation on the rehabilitation of areas contaminated by mercury;

E. Cooperation and communication

15. promoting the exchange of experiences between countries and miners;
16. fostering the exchange of experiences between countries in the field of good technological practices and scientific research;
17. fostering programs for finding and communicating risks to the ecosystem and human health;
18. following up on aspects of gold commerce and its impact, in the different sub-regions, on the extraction cycle and the environment;
19. comparing examples of cooperation already existing and under way, such as the south-south initiative, the Amazon initiative itself, etc..

In this context, it is unquestionable that there will be no or little advancement if the intellectual capital is not constantly promoted. This implies fostering and offering a menu of courses and training opportunities in order for the skilled staff to act safely and competently, always practicing whatever is state-of-the-art-like on the subject.

Thus, by means of circumstantial analysis, courses and training opportunities should be offered, on a planned and regular basis, respecting the limitations and needs of each site and its specifications.

The following courses are important, among others:

A. Specialization level

It is proposed that, by integrating countries, their needs and strengths, one single course is structured which may be replicated in each country, having or not having a fixed head office, conducted by at least one university in each country, that is, eight universities in partnership for the sake of a common Program, and granting the participant a university degree as a specialist in mercury risk management and possibly developing into a professional master's degree course that may serve as one of the main bases for permanently feeding and criticizing the knowledge, research and development network and the Portal's network.

B. Update level (fast and replicatable courses)

1. Updating and homogenizing knowledge about mercury ecotoxicology for the governmental staff in the action front.
2. Updating and homogenizing knowledge about Risk Analysis and Management, objectively aimed at environmental management.
3. Updating laboratory practices for sampling, identification and quantification of mercury in different matrices.
4. Updating monitoring techniques and applying the results in environmental management actions.
5. Updating Statistical Analyses applied to the evaluation of secondary data.
6. Updating Environmental Legislation and Law, focussing the basic cut-off point (common to all the countries) and the specifications of each country.
7. Updating the use of information technology aimed at structuring and analyzing database.
8. Updating the technological aspects of the process of exploration grant and gold production, and technological alternatives.

Therefore, in order for there to be Knowledge Management, it is imperative to foster research and development. MAP points to a set of research subjects that must be strengthened and developed, so as to subsidize actions of management, inspection, monitoring, vigilance, and information communication. For that purpose, the use of Research Project Edicts is indicated, taking as reference the Brazilian CNPq (National Research Center) Edicts and/or international entities' edicts, for example, CYTED (Latin American Program for the Development of Science and Technology), so as to widen the regional researchers' critical skills, partnerships between countries as regards subjects still not consolidated by the international literature, and to increase the participation of international research groups in the partnerships. The Edicts shall give priority to knowledge gaps already pointed out in the analysis conducted under this document.

MAP's modelling and integrating projects and activities are presented in Chart 1.

Chart 1. Regional Cooperation Action Plan on the Prevention and Control of Mercury contamination in the Amazon Ecosystems –MAP

PROGRAM	OBJECTIVES	PROJECTS
Integration and Interaction between the Countries	This Program directly aims, by means of several converging projects, at creating the necessary conditions for permanent, productive and greater integration and interaction between the countries when dealing with the issue.	**Establishment** of an integration and interaction system. For that matter, a group of managers/ experts should be formed, under indication of the countries, to analyze, suggest, create and foster integration and interaction mechanisms; for example,the Portal, shared Database System, Information Bulletin, etc. (this corresponds to article 5 of the Meeting I Recommendation Document). **Establishment** of mechanisms for divulging and strengthening projects under way in the different countries. **Promotion** of the exchange of experiences between the countries, from projects under development and/ or developed in the region. **Setting up** and maintaining in the countries, along with ACTO, an inter-governmental and multiprofessional Work Team empowered to follow up and deliberate on the issue.
Integration and Institutional Strengthening	This Program aims at identifying and supporting mechanisms so that institutions from the different countries somehow related to the mercury issue (including the very entities related to gold exploration) may satisfactorily play their role, with safety, credibility and continuity, and may communicate permanently, interchanging their findings and setting a synergic network for fast evolution and maturation of the knowledge related to the mercury issues and their solutions.	**Equipping** of the following organs (functions): environmental planning, environmental management, environmental inspection, elaboration and enforcement of legislation, laboratory background (chemical, food, toxicological and clinical analyses), at regional, national, subnational levels, mainly aiming at joint actions. **Implantation** of regional and shared Database. **Implantation** of computerized, normalized, and georeferenced and networked management systems. **Implantation** of Standardized Operational Procedures. **Implantation** and operation of laboratory network, with a system of accreditation and permanent laboratory intercalibration. **Strengthening** regional solutions focussed on logistics for accessing and communicating with interest areas.

continued

PROGRAM	OBJECTIVES	PROJECTS
Social, Environmental and Technological Management	This Program aims at discussing and highlighting all the management aspects, taking into account social, environmental, economic and technological factors (gold extraction technologies and the consequent use of mercury in the amalgam process), which directly affect the actual use situation and mercury contamination in mining and gold placer mining.	*Environmental management* **Definition,** establishment and operation of Management Systems suitable for the organ involved in environmental management (national and local level), with computerization/ automation of all its processes and their link to data systems, with output to all the possible and necessary uses and critical feedback on the process. Prior to it, there should have been the institutional diagnosisof its degree of computerization/ automation and the bulk of available information on placer mining in this version. **Present inventory** of active and passive mercury emission sources, from georeferenced and typified recording/ mapping of placer mining regions and placer mines, regardless of the size and movement of these placer mines/ placer miners, with predefined priority areas for management actions (article I from the Rio Meeting's Recommendation Document). **Laboratory survey** on chemical mercury contamination in environments preindicated by the Inventory and definition of environmental vigilance systems. **Updated** national diagnosis along with the tendencies of minor mining (gold placer mining) and its implications, with the following topics, among others: i) mapping with extension, georeferenced identification and qualiquantification of environmental negative assets deriving from using mercury, and rehabilitation and/ or recovery possibilities for these areas; ii) typification/characteristics of the production processes, along with setting the gold production chain in each case, including the activity's cost-effectiveness economic balance and its effectiveness; iii) estimated mercury load released into the environment every year and its dynamics; iv) estimated contamination in the different environmental sectors, including the human sector; v) active population involved (miners, burners, etc.); vi) passive population involved – by total number and risk groups. In the same way, the development of a common technology is recommended to the countries, for regional use, that may enable the quantification of mercury used in the amalgam process, as well as how much is lost and how much is recycled in the processes and the products. **Environmental inspection** on the gold extraction activity by using mercury, strongly emphasizing preventive and educational aspects, without however failing to zealously apply the legislation pertaining to each country. There should a permanent endeavor

		towards inspection and monitoring integrated actions, by utilizing "sentinel"-like environmental indicators of contamination and human exposure. **Construction of indicators.** Epidemiological vigilance and environmental monitoring will serve as the basis for constructing "sentinel-like" integrated health and environment indicators. *Social management* **Epidemiological Vigilance** – it also involves aspects of food safety and populational epidemiology. The permanent need is predicted, therefore, of a close synchrony between the public health organs and those of environmental management. **Legislation** – the legislation of environmental control, in all its aspects, including those of fostering, should be continuously improved and integrated, as far as possible, between the eight Member Countries. *Technological management* **Fostering** qualified management practices in the production chain, by means of granting and applying recognized environmental management systems, such as ISO 14000.

PROGRAM	OBJECTIVES	PROJECTS
Social Communication	The Program aims at conceiving and ensuring the permanent spread of information and news related to using mercury in placer mining and mining, and the risks deriving from it to the Amazon socioenvironmental system. Communication should be in suitable frequency and language so as to ensure the understanding of the target-public, including local, national and regional public power.	**Mercury Portal** **Publication** and dissemination of didactic literature and episodic and periodic literature, in accessible language and speech, in the form of printed material or by electronic means. **Use of media**: specialized and pertaining programming in radio stations, TV stations and local newspapers. **Projects** and studies in partnership with local associations and cooperatives, among which theater and music projects, and partnerships with locally well-known artists. **Holding** local events and lectures in accessible language with explanations and technical videos. **Environmental Education** for the Citizenship – strategic for Social Communication, in order for it to actually gain ground, is the simultaneous existence of a competent project of Environmental Education for the Citizenship**,** which should take place in the formal and informal education networks, focused on the placer mining population and in populational segments under risk, involving adults and children of both sexes and who go or do not go to public and/ or private schools. This educational process should, among other issues, address and divulge: i) the risks of mercury (and cyanide) use and its consequences; ii) the technological alternatives for minimizing the risk of mercury (and cyanide) use; iii) possible middle and long term economic alternatives for each region. **System** for managing contingencies and crises – a Permanent International Committee (PIC) could be created to assist this kind of emergency.

continued

PROGRAM	OBJECTIVES	PROJECTS
Knowledge Management	To permanently induce and support conditions so that the search for knowledge related to the issue environmental mercury contamination, this knowledge being reliable and critical, may take place and be shared among the Amazon countries and peoples.	A. Mercury's environmental behavior **deepening** studies related to mercury's transport, transformation and destination in the Amazon Basin. These studies will enable us to better understand how mercury behaves in the region's water, air, soil and sediments; **determining** the role of microbial communities in the methylation processes in sediment/water; **deepening** our understanding of mercury's biogeochemical cycle in the basin, considering different kinds of soil and sediments; and the interaction of the ecological processes in the region; **identifying** a sentinel indicator for the Amazon Basin's water biota which may enable us to compare the mercury levels and to better manage and watch mercury contamination between the countries; **developing** empiric models that may contribute to the interaction of the variables affecting methylmercury bioaccumulation in the Amazon ecosystems; **deepening** and better clarifying the contribution of natural mercury load versus anthropogenic mercury in the Amazon basin; B. Human health **epidemiological studies** of the exposure of different groups to gaseous mercury and organic mercury, that may cover the Amazon system's complexity, that is, its differentiated socioecological, economic, sociodemographic, cultural and ethnic characteristics; **deepening** and simplifying health studies as regards exposure and effect indicators, so as to use them, in the health units, to assist the reference diagnosis for mercury intoxication; **investing** in epidemiological studies for the neurological evaluation of children under low exposure, comparing them between the Amazon ecosystem countries, mainly children of riverside dwellers and workers occupationally exposed to mercury; Investigation of the effects of organic mercury on the immunological and endocrine systems of exposed groups taking into account endemic disease in the region. C. Animal health **developing** studies of mercury exposure related to wild animals in the basin, mostly birds and mammals; **improving** our understanding of mercury's ecological impact on wild animals; D. Technology **fostering** the adoption of new technologies to reduce mercury emissions in the basin;

		promoting the investigation on the rehabilitation of áreas contaminated by mercury; E. Cooperation and communication **promoting** the exchange of experiences between countries and mining workers; **fostering** the exchange of experiences between the countries in the field of good technological practices and scientific research; **fostering** programs for detecting and communicating ecological risks and risks to human health; **following up** on aspects of gold trade and its impact, in the different sub-regions, on the extraction cycle and the environment; **making comparisons** with the examples of cooperation already existing and under way, such as the south-south initiative, the very Amazon initiative, etc.

V. PLAN PERFORMANCE EVALUTATIONS

Once MAP's priorities are defined, each project and its activities should define their pertaining follow-up and performance indicators, so as to measure and evaluate how actions are progressing and how relevant they are – this will serve as a permanent feedback and rectification/confirmation mechanism for the process.

Indicators should be qualitative and quantitative and, as far as possible, universal, reproducible, and comparable for the several countries. They should also enable us to evaluate the implementation of specific instruments, such as the policies to be proposed and activated as part of MAP.

VI. FINANCIAL EQUATION AND FINANCING SOURCES

For the feasibility of such a significant Plan with its characteristic nature, compatible financial resources are required. Therefore, it is fundamental to conceive of a good equation to finance the actions involved.

This equation would necessarily have to count on:

- a portion of its own resources from the countries involved, in the proportion of their capabilities and the dimension, complexity and gravity of their risks derived from mercury;
- possible resources from international sources, by means of suitable diplomatic approaches, and formulation of competent technical projects. Among others, the following organizations could be contacted: IBRD, IDB, CYTED, GTZ, IDRC, and the private sector as one of the major buyers of gold from the countries, as well as the resources from traditional financing systems through research grants, with priority for the mercury issue in the Amazon region.

It is our proposal to develop studies and basic discussions so as to:

- systematize already existing public investments into a single accounting arrangement, only for the sake of knowing how much is being invested in the basin and for eventual purposes of financing counterparts;
- emphasize, in each ACTO Member Country, the search for creative solutions for resource collection, for example, a "Financing Fund for Studies and Actions Fighting Chemical Contamination", or similar mechanisms. Such Fund would support pertaining actions in the country itself and a certain percentage would be yearly allocated to the care of ACTO to finance common interest actions;
- evaluate a possible flexibility to manage resources from the financing sources;

- record and permanently interact with multilateral financing agencies and with public and/ or private foreign donators in order to collect financial resources, a task which could be led by ACTO.

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VIII. ANNEXES

ANNEX I – Mercury Portal

ANNEX II - Report – 1st Meeting for Regional Cooperation on Mercury Contamination in the Amazon Basin, Rio de Janeiro/Brazil

ANNEX III – Questionnaire on mercury, modified in the Lima/ Peru meeting
ANNEX IV – Memories from the Lima/ Peru Meeting

ANNEX I

The Mercury Portal

It should be highlighted that the implementation of the Mercury Portal does not have to be simultaneous for all its components. It can be implemented gradually to fulfill the most pressing needs and/ or to take advantage of any available financial resource input, as well as to adjust to any new adhesion. What really matters is the process start-up because everyone sees the Portal as a great coalescing element for MAP.

As for contents, among other information sets, the Portal should have and/or provide access to:

A. Set of strategic information for mapping and using soil and economic aspects.

- Cartographic base with Amazon georeferenced data, highlighting its water system and conservation unit areas[5];
- Population map, including: indigenous, traditional, placer mining, "quilombola (former slaves)", agrarian reform settlement populations, , etc.[6];
- Database of placer mining and mining companies operating legally (or legally registered) by country, basin, sub-basin[7];
- Database of gold production and trade and mercury trade in the region, by country[8];
- Agricultural activity map with information of use of chemical products;

[1] absolute priority
[6] idem
[7] idem
[8] idem

- Mapping of areas with negative environmental assets (by mercury contamination and physical degradation of environments), with quantification in terms of exposure magnitude;
- Database of deforestation and burned-over land;

B. Set of operational information

- Database of national and local public policies having an interface with the issue;
- Database of actions for management, environmental inspection, environmental monitoring, and epidemiological vigilance
- Database of governmental authorities from the eight ACTO Member Countries
- Database of professionals related to the issue: scientists, researchers, teachers, experts from public organs and private institutions, consultants, etc.
- Database of Intoxication Control Centers;
- Database of Laboratories for Chemical and Toxicological Analyses;
- Register of a possible Portal's Scientific Advisory Committee;

C. Set of technical-scientific information

- Glossary with concepts, definitions and standardized terms and measure units;
- Bibliography with the articles, theses and works by authors from the eight countries (Amazon Mercury Bibliography), and by authors from other centers and countries;
- Database of results from georeferenced monitoring – by country, basin and sub-basins, environmental sector, matrix, etc., with mapping of environmental risk and mapping of populational risk groups;
- Database of limnological information;
- Information base on meteorology;
- Database of gold extraction and production technologies, and minimized mercury use;
- Database of concluded projects and projects under development, with existing summary and results, both the successful and the unsuccessful ones;

D. Set of legal information

- Standing and pertaining legislations from each country;
- List of possible model actions that have proceeded or are proceeding in court;

E. Set of educational information

- Technologies and environmental education products;
- Record of socioenvironmental communication initiatives, actions, subjects etc.;
- Training Centers for subjects pertaining to the mercury issue;
- Catalogue of courses and training events;

F. Set of financial information

- National budgets for the issue, with application chronogram and institutional budgets addressing the issue;
- Multilateral agencies and agencies from other countries, with their profiles, authorities and financing lines;
- Information on the gold placer mining's economic aspects;

As far as functionality is concerned, the following must be noted:

- the Portal should be in English, Portuguese and Spanish;
- consultations to the Portal should be free of charge;
- the Portal should provide links to as many other correlative sites as possible and to the sites of the national and regional public organs involved;
- the Portal should allow communication between duly registered people;
- the Portal should allow that chat groups by subject of interest are formed;
- the Portal should be constantly updated and critically revised;
- an alternative to be discussed is that the Portal could take specific consultations by users by means of advance pay for the service, so as for it to become totally or partially sustainable.

ANNEX II

Report – 1st Meeting for Regional Cooperation on Mercury Contamination in the Amazon Basin, Rio de Janeiro/ Brazil

REPORT

1st Meeting for Regional Cooperation on Mercury Contamination in the Amazon Basin

Rio de Janeiro, December, 3-5, 2004.

TABLE OF CONTENTS

1.0 INTRODUCTION

This report presents the results from the 1st Meeting for Regional Cooperation on Mercury Contamination in the Amazon Basin that took place in Rio de Janeiro, December, 1-3, 2004, on the initiative of the Ministry of Environment –MMA, Brazil and the Amazon Cooperation Treaty Organization – ACTO, with the support of the U.S. Embassy Department of Environmental Issues.

The event's opening table was attended by Edmund Atkins, U.S. Consul in Rio de Janeiro, Vitor Zvibil, Secretary for Environmental Quality in Human Settlements, Ministry of Environment, Henrique Brandão Cavalcanti, from the Chemical Safety Forum, and

Rosalia Arpiaga Serrana, ACTO's Secretary General. The opening table members highlighted the significance of the event and the urgent need to accomplish joint actions to face environmental contamination and human health jeopardy.

The meeting aimed at mobilizing delegates from the ACTO Member Countries and institutions studying the theme in order to deepen existing knowledge and set joint strategies to face the mercury contamination issue in the Amazon Basin and human health jeopardy.

Sharing a climate of great commitment to the issue, the participants developed tasks and reflections of major significance for forwarding the necessary solutions to facing the issues under consideration.

Neusa de Castro Zimmermann
Rosana Carneiro Ferreira Medeiros
WG Moderators

2.0 INITIAL CONSIDERATIONS

The event was attended by 57 people, representatives from the ACTO Member Countries, namely: Brazil, Colombia, Ecuador, Guiana, Peru, Surinam and Venezuela, besides U.S. entities.

Delegates and researchers on the theme participated through lectures that provided them with the opportunity to have a rich interchange of experiences and to deepen scientific knowledge. On a second stage of the workshop experts and other participants made up two Working Groups – WGs in order to set joint strategies to face the issue.

At the end of the workshop institution representatives and country delegates discussed and approved a recommendation document that will set the guidelines for future joint actions on mercury contamination in the Amazon Basin and health jeopardy of human populations.

3.0 WORK DYNAMICS

The first part of the meeting was developed through three panels which addressed:

Situation in the Amazon Basin: Regional context of the Amazon Basin; Mercury – its contamination sources and ecotoxicity; Epidemiological and human health aspects related to exposure to mercury; Brazilian context of the Amazon Basin;

Perspectives of the Amazon basin countries (Ecuador, Peru, Surinam and Bolivia): scope of the problem and control programs adopted: Perspectives of the Amazon Basin countries (Colombia, Guiana, Brazil and Venezuela): scope of the problem and control programs adopted;

International, national and regional experiences, programs and existing instruments (legislation and projects): PNUMA; PAHO; UNIDO and USA; DNPM; TEM; PUC-RIO and CETEM.

In the second part, two working groups were formed that reflected on specific themes from guiding questions:

WG1 - Joint strategies to reduce mercury contamination in environment and health jeopardy in human populations.

Guiding questions

Which challenges should be overcome to reduce mercury loads into the environment and to mitigate/avoid health jeopardy in human populations?
Which actions should be jointly developed in order to overcome the pointed out challenges?

GT2 – Cooperation in the vigilance, monitoring and enforcement of laws.

Guiding questions

Which challenges should be overcome for cooperation actions in vigilance, monitoring and enforcement of laws to be carried out?
Which actions should be jointly developed to overcome the pointed out challenges?

With the support of the method of *Visualização de Tarjetas*, the participants presented their individual considerations on what they understood as the main challenge to be faced in each theme. After a detailed discussion, the WG participants reached consensus on which challenges should be faced. After that, the participants formed subgroups to discuss the strategy proposals and the entities to be invited with their respective representatives

The conclusions of each WG were presented in a final plenary session, when the participants' considerations and suggestions were at once added to the document through datashow. Also in this plenary session, a recommendation document, elaborated by a ACTO/ MMA group, was submitted to all the participants for consideration, approval and signature.

4.0 ACHIEVED RESULTS

RESULTS FROM THE WORKING GROUPS

The main challenges pointed out by the Working Groups (WGs) for each theme were the following**:**

WG1 – Joint strategies to reduce mercury release into the environment and mitigate the impact on human populations.

Challenge 1: Apply safe and appropriate technology;
Challenge 2: Measure contamination levels;
Challenge 3: Raise awareness of the problem**.**

WG2 – Cooperation in the monitoring, vigilance, and execution of laws related to contamination by mercury.

Challenge 1: Information management;
Challenge 2: Education of miners and rural communities on the dangers of mercury contamination;
Challenge 3: Needed measures, which involve regional cooperation and the transfer of technology adopted;
Challenge 4: A regional and complete monitoring network developed and in operation;
Challenge 5: Efficient and constant inspection of mining and other human activities near rivers and natural resources;
Challenge 6: Harmonize the regional legal orientations**;**
Challenge 7: Seek available and sufficient technical and financial cooperation from multilateral organizations**.**

Challenge 8: Consider the populations' point of view (miners, Indians, Amazon inhabitants). Citizens' participation.

Each WG established actions and methods of implementation for each challenge and is as follows:

WG1 – Joint strategies to reduce mercury release into the environment and mitigate the impact on human populations.

Challenge 1: Apply safe and appropriate technology;

ACTION 1

- ❖ Put together a summary on the traditional methods of mercury use in production activities

HOW:

- ➢ Creating an information system.

ACTION 2

- ❖ Develop applied research on methods to better use mercury and treat the residue produced by gold mining and other activities.

HOW :

- ➢ Establishing strategic alliances with research institutes and universities.

ACTION 3

- ❖ Draft and put into action pilot plants and laboratories with common techniques and methodologies.

HOW :

- ➢ Installing a pilot plant and a mining-metallurgical laboratory in each country.

Challenge 2: Measure contamination levels;

ACTION 1

- ❖ Carry out a regional survey of mercury emission**.**

HOW :

- ➢ Identifying mercury sources**.**
- ➢ Quantifying emissions.
- ➢ Developing risk maps**.**

ACTION 2

- ❖ Transfer of knowledge and experiences between the Amazon countries**.**

HOW :

- ➢ Establishing an information exchange network.
- ➢ Developing capacity-building programs.
- ➢ Promoting the exchange of professionals**.**

ACTION 3

- ❖ Standardization of low-cost laboratory techniques**.**

HOW:

- ➢ Developing a common protocol for laboratory procedures.
- ➢ Validate laboratory techniques.
- ➢ Certifying laboratories.
- ➢ Carry out an inter-calibration of laboratories in the region.

Challenge 3: Raise awareness of the problem**.**

ACTION 1

- ❖ Establish awareness-raising programs in all sectors of the population.

HOW :

- ➢ Implement one or two demonstrative pilot plants in each country to examine the feasibility of mercury-free operations.
- ➢ Conform and consolidate mining associations.

ACTION 2

- ❖ Exchange technology, information, and research through a network.

HOW :

- Distribute education material throughout each country on the impacts of mercury on human health and on the environment.
- Explore mercury-free technologies through pilot programs with the participation of the miners.

ACTION 3

- ❖ Generate a consensus on strategies for informal mining and adopt joint measures when necessary.

HOW :

- Identifying experiences in the region and discussing problems related to informal mining.

ACTION 4

- ❖ Create and implement information programs for the population with respect to mercury in fish.

HOW :

- Carrying out information programs in focal areas based on World Health Organization standards**.**

TRANSVERSAL STRATEGIES

- Build the capacity of personnel and governmental and private institutions.
- Constitute common and steering Working Groups for technical assistance and public health.
- Constitute an Interministerial Working Group to elaborate policies on small-scale mining, including informal mining, in a national and regional context.
- Permanently exchange knowledge and experiences on improved techniques for gold mining and other activities.
- Jointly manage human, logistic, technical, and financial resources.

WG2 – Cooperation in the monitoring, vigilance, and execution of laws related to contamination by mercury.

Challenge 1: Information management;

ACTION

- ❖ Define short, medium, and long-term information.

HOW:

- ➢ Evaluate existing data
- ➢ Identify common indicators and those involved
- ➢ Optimize the exchange of information among the countries of the Amazon region
- ➢ Define priorities: technology, services, and analyses
- ➢ Amazon regional information system
- ➢ Capacity-building
- ➢ Strengthening human, organizational, administrative, and alliance (institutions, countries) resources

ACTION

- ❖ Elaborate a base assessment by country (Hg, Amazon and mining)

HOW:

- ➢ Validation of the system
- ➢ Define focal points: local, regional, and national
- ➢ System functioning
- ➢ Define resources (human, technological, financial, other)
- ➢ System feedback

Challenge 2: Education of miners and rural communities on the dangers of mercury contamination

ACTION:

- ❖ Introduce environmental education in school curriculum (in mining regions)

HOW:

- ➢ Elaborate and implement capacity-building programs in the Amazon region, for the management of mercury.

ACTION:

- ❖ Implement cooperation in education among the Amazon countries (universities and businesses) – capacity-building

HOW:

- ➢ Exchange of experiences to strengthening education (Hg, among others)

ACTION:

- ❖ Generate environmental education tools (guides, manuals, publications) in the Amazon region

HOW:

- ➢ Continuous risk communication and dissemination among the population locally, nationally, regionally

Challenge 3: Adopt needed measures, which involve regional cooperation and the transfer of technology adopted;

ACTION:

- ❖ Define technology as: concept and practice

HOW:

- ➢ Standardize management technology
- ➢ Disseminate amongst groups of interest cheap, feasible, clean, and sustainable alternatives.

ACTION:

- ❖ Identify and evaluate the methodology available and its acceptance in the Amazon region

HOW:

- ➢ Bibliographical research/joint coordination fields/dissemination of successful experiences

ACTION:

- ❖ Develop and disseminate technologies with all groups of interest

HOW:

- ➢ Technical and institution workshops to deal with topics of interest

ACTION:

- ❖ Promote and transfer environmentally-sustainable technologies

HOW:

- ➢ Through ACTO/Amazon Countries Mercury Network/Virtual Library

Challenge 4: A regional and complete monitoring network developed and in operation;

ACTION:

- ❖ Organize a monitoring network

HOW:

- ➢ Analyze the current situation of laboratories
- ➢ Define analytical and demonstrative protocols
- ➢ Exchange experiences among national and international laboratories

ACTION:

- ❖ Ensure permanent financial sources

HOW:

- ➢ Applying financial compensation mechanisms
- ➢ Integration of existing monitoring networks

ACTION:

- ❖ Establish communication mechanisms

HOW:

- ➢ Creating a permanent communication group for those involved locally
- ➢ Inspection

Suggestion from Guyana representatives not included during the final plenary:

Challenge: "Monitoring must be done across the region, in countries and for individual mining operations"

Action:

"That includes regional, national monitoring and monitoring of individual operations. Some countries (such as Guyana) will need assistance in establishing and implementing their monitoring programs".

Comments by Marília Pacheco:

- There is a need to define a quality standard to be accepted at a regional level;

Other comments:

- Need to build the capacity of actors for the process of joint monitoring.

Challenge 5: Efficient and constant inspection of mining and other human activities near rivers and natural resources;

ACTION:

- ❖ Create an infrastructure, which will allow for an effective vigilance of activities related to mercury

HOW:

- ➢ Establish commitments with the 8 countries to count on infrastructure and logistics

ACTION:

- ❖ Define mechanisms and procedures for inspection

HOW:

- ➢ Jointly draft a Regional Procedures Manual

ACTION:

- ❖ Socializing procedure proposals and draft agreements to be applied

HOW:

- ➢ Working meetings/ manage the political decision of the authorities

ACTION:

- ❖ Exchange and enrich experiences

HOW:

- ➢ Seminars / field visits and trips / publications

Challenge 6: Harmonize the regional legal orientations**;**

ACTION:

- ❖ Develop a common environmental impact evaluation

HOW:

- ➢ Evaluate environmental impacts
- ➢ Consult with actors (community, government, mining industries, and miners)

ACTION:

- ❖ Regulate mining activities

HOW:

- ➢ Regulate illegal mining activities
- ➢ Review the legal and normative aspects of the Amazon region countries
- ➢ Develop a strategy for the normative management of Mercury in the Amazon countries

ACTION:

- ❖ Regulate the use of mercury to reduce human exposure

HOW:

- ➢ Develop environmentally-friendly alternatives and techniques
- ➢ Develop consultations for the use and effects of mercury
- ➢ Regulate the import and export of mercury
- ➢ Capacity-building for the ratification of laws

ACTION:

- ❖ Capacity to comply with laws

HOW:

- ➢ Development, training, and exchange of technical assistance programs(implementation and application)

Challenge 7: Seek available and sufficient technical and financial cooperation from multilateral organizations**.**

ACTION:

- ❖ Seek funds and resources in international organizations (governmental and non-governmental)

HOW:

- ➢ Create a group (under ACTO coordination?) to elaborate the requests
- ➢ Cooperation with international agencies (U.S. EPA, Europe, and others), mainly Amazon region countries

ACTION:

- ❖ Identify the economic activities benefited by gold

HOW:

- ➢ Understand the chain of gold production in each country

ACTION:

- ❖ Support and decide on the use of resources
- ❖ Establish actions on "taxation" within the context of each country

HOW:

- ➢ Create Groups in each country - interministerial

ACTION:

- ❖ Create an information network with access to data banks. Maintain network.

HOW:

- ➢ Cooperation with International Agencies (U.S. EPA, Europe, PAHO, and others) – Mainly Amazon region countries

Challenge 8: Consider the populations' point of view (miners, Indians, Amazon inhabitants). Citizens participation.

ACTION:

- ❖ Coordination by ACTO of the Strategic Plan of action of the governments consistent in terms of legal and administrative jargon with respect to vigilance,

monitoring, and inspection of mercury use in the region and its reduction and gradual elimination

HOW:

- Structure ACTO in order to chop-down the Strategic Plan into projects with defined deadlines and costs.
- Harmonize regulation, procedures, and objectives of the several governments in order to carry out vigilance, monitoring, and control.

ACTION:

- ❖ Promote strengthening of an environmental municipal management with intense support/involvement of federal and state governments

HOW:

- Approve federal financial resources/locate resources/build capacity and find municipal personnel.

ACTION:

- ❖ Implement and operate a communication system with local language and specificities, exposing responsibilities and action of each government and identifying local reactions (feedback)

HOW:

- Establish the needed infrastructure. Formulate adequate programs.

ACTION:

- ❖ Harmonize and implement state/federal actions as promoters/disseminators of social and citizenship values

HOW:

- Political decisions. Integration among levels. Formulation of content.

5.0 FINAL CONSIDERATIONS

To conclude the tasks in the 1st Meeting, the participants analyzed a recommendation document proposed by a staff formed by ACTO and Ministry of Environment (Brazil) members who proposed the creation of a Working Group, formed by high level officers, aiming at regulating and suitably and environmentally

managing the use of mercury, as well as the elaboration of a proposal for an Action Plan for Regional Cooperation on Mercury Contamination in the Amazon Basin. The full document is in Annex 3 of this report.

Participants were given a form whose objective was to raise detailed information on the theme mercury pollution at regional level. The collected data was forwarded in time, so as to subsidize ACTO's position in the next PNUMA meeting.

ANNEXES

ANNEX 1 – WG PARTICIPANTS

GROUP 1

NAME	ENTITY	CITY
Alberto da Rocha Neto	Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis – IBAMA	Brasília
Alexandre Trajano de Arruda	MME	Brasilia
Anabell Arvelaez	Ministério del Ambiente y de los Recursos Naturales	Venezuela
Glenn Gemerts	Ministry of Natural Resources	Suriname
Diego Gonzáles Madrin	PAHO / OMS	Brasil
Fausto Antonio de Azevedo	Consultant	Salvador
Fernado V. Sobrinho	FUNDACENTRO	São Paulo
Freddy Hernán Pantoja Timarán	Corporacion Autonoma Regional de Nariño	Colombia
Gilson Spanemberg	MS / SVS / CGVAM	Brasil
Jke Antonius	Ministry of Foreign Affairs	Suriname
Jean Noe Weaver	US Geological survey	EUA - Washington
John Gray	US Geological survey	EUA -Denver
José David Hurtado Fudinaga	Direccion de Desarrollo Sostenible	Peru
José Vicente Garcia	Ministério del Ambiente y Recursos Naturales	Venezuela
Karen Livan	Geology And Mines Comission	Guiana
Khoenkhoen	Ministry of Labour, Technological Development and Environmet	Suriname
Santiago B. Salazar C	Ministerio Del Ambiente	Equador
Saulo Rodrigues	CETEM – Science and Technology	Brasil
Sebastão Freitas da Silva	Instituto de Meio Ambiente do Acre – IMAC	Acre
Sthephen Hoffman	Enviromental Protection Agency – EPA	USA - Washington

GROUP 2

NAME	ENTITY	CITY
Allegra Viviane Yallouz	Centro de Tecnologia Mineral - CETEM / MCT	Rio de Janeiro
Cecília Zavaris	MTE/DRT/SP	São Paulo
Gilson Spanembergq	MS/SVS/CGVAM	Brasilia
João Bosco Costa Dias	Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis – IBAMA	Brasília
Reinaldo Calixto de Campos	PUC	Rio de Janeiro
Reinaldo Pelena	UFPA	Santarém
Sandra Hacom	FIOCRUZ	Rio de Janeiro
Sérgio M. D' Oliveira	IPAAM/SDS	Brasília
Terezinha Maria Cid de Sousa	UFPA	Pará
Vera Mª da Costa Nascimento	ANA/MMA	Brasília
Zuleica Carmen Castilhos	Centro de Tecnologia Mineral - CETEM / MCT	Rio de Janeiro
Jaime Eduardo Matute Piñedo	Consejo Nacional del Ambiente	Lima
Segundo Fausto Roncha Vergara	Dirección General de Salud Ambiental	Lima
Juan Andres Salvador Muñoz	Ministerio de las Relaciones Exteriores	Colombia
Santiago B. Salazar C	Ministerio del Ambiente	Ecuador
Eliza Florendo	Environmental Protection Agency	Guyana
Peggy Mc Lennan''	Ministry of Foreign Affairs	Guyana
Chiquita C. Resomardono	National Institute for Environment and Development	Suriname
Elaine Woode	Ministry of Foreign Affairs	Suriname
Rachel Pollack	Geological & Mining Dept.	Suriname
Edgard R. Ibarra Zuniza	Ministério del Ambiente y Recursos Naturales	Venezuela
Sthephen Hoffman	Enviromental Protection Agency – EPA	USA - Washington

ANNEX II – Agenda

FIRST MEETING FOR REGIONAL COOPERATION ON MERCURY CONTAMINATION IN THE AMAZON BASIN

Rio de Janeiro, December 1 to 3, 2004

Day one (12/01/2004)	
09:30.-10:00	Reception and participant registration
10:00 - 10:30	Ceremony kick-off
	Edmund E. Atkins, Consul General of the United States Consulate in Rio de Janeiro Victor Zular Zveibil, Secretary for Environmental Quality in Human Settlements for the Ministry of Environment – Brazil (MMA) Dr. Rosalía Arteaga Serrano, Secretary General of the Amazon Treaty Cooperation Organization (ATCO)
PANEL 1 **10:45 - 12:45**	**THE CURRENT SITUATION IN THE AMAZON BASIN**
10:45 - 11:15	Enrique Elías Castilla - Amazon Treaty Cooperation Organization (ATCO) *The Regional Context of the Amazon Basin*
11:15 - 11:45	Reinaldo Pelleja, Para Federal University *Mercury, sources of contamination, ecotoxicity*
11:45 - 12:15	Volney Camara, Rio de Janeiro Federal University *Epidemiological and human health aspects related to mercury exposure*
12:15 - 12:45	Naziano Filizola, Agencia Nacional de Aguas (ANA/BRAZIL) *Brazilian context in the Amazon Basin*
12:45-13:00	Debate
13:00 – 14:30	Lunch break

Day one (12/01/2004)	
PANEL 2:	
14:30 - 15:50	**PERSPECTIVES FROM THE COUNTRIES IN THE AMAZON BASIN (Equador, Peru, Suriname, Bolivia): THE SCOPE OF THE PROBLEM AND CONTROL PROGRAMS ADOPTED -** Each presentation shall last 20 minutes
14:30 to 14:50	Ecuador
14:50 to 15:10	Perú
15:10 to 15:30	Surinam
15:30 to 15:50	Bolivia
15:50 – 16:05	Debate
16:05 - 16:25	Coffee Break
16:25 - 17:45	**PERSPECTIVES FROM THE COUNTRIES IN THE AMAZON BASIN (Colombia, Guyana, Brazil, Venezuela): THE SCOPE OF THE PROBLEM AND CONTROL ADOPTED -** Each presentation shall last 20 minutes
16:25 to 16:45	Colombia
16:45 to 17:05	Guyana
17:05 to 17:25	Brasil
17:25 to 17:45	Venezuela
17:45- 18:00	Debate
19:30	Welcome Reception **-** Petronius Lounge – 2nd Floor

Day two (12/04/2004)
PAINEL 3

EXPERIENCES AND EXISTING TOOLS (ENFORCEMENT, LEGISLATION): INTERNATIONAL, NATIONAL AND REGIONAL- Each presentation shall last 20 minutes

09:00 to 09:20	UNEP
09:20 to 09:40	PAHO
9:40 - 10:00	Coffee Break
10:00 to 10:20	DNPM
10:20 to 10:40	USA
10:40 – 10:55	Debate

EXPERIENCES AND EXISTING TOOLS (ENFORCEMENT, LEGISLATION): INTERNATIONAL, NATIONAL AND REGIONAL - Each presentation shall last 20 minutes

10:55 to 11:15	Brazilian Ministry of Labor
11:15 to 11:35	Rio Catholic University
11:35 to 11:55	CETEM
11:35 to 11:55	CETEM
12:15 to 12:35	USA
13:00 – 14:30	Lunch Break
14:30 – 18:00	Break into Working Groups

1) Joint strategies to reduce mercury release in the environment
2) Public health and social programs in mitigating the impact on the human population
3) Cooperation in law enforcement, vigilance, and execution

15:30 – 16:00 Coffee Break

Day three (12/03/2004)	
9:00 - 12:30	**WORKING GROUP PRESENTATIONS**
	1) Joint strategies to reduce mercury release in the environment 2) Public health and social programs in mitigating the impact on the human population 3) Cooperation in law enforcement, vigilance, and execution
10:30 - 11:00	Coffee Break
12:30 – 14:00	Lunch Break
14:00 – 16:00	Conclusions
16:00	Closing ceremony

ANNEX 3 – Recommendation DOCUMENT

I Meeting for Regional Cooperation on Mercury Contamination in the Amazon Basin
Rio de Janeiro, December 1-3, 2004

Following an invitation by the Amazon Treaty Cooperation Organization (ATCO) and the Brazilian Ministry of the Environment, representatives from the Ministries of Foreign Affairs, Ministries of the Environment, Ministries of Health, Ministries of Labor, Ministries of Mines and Energy, Ministries of Education, and Focal Points in the Intergovernmental Chemical Safety Forum (ICSF) from the governments of Brazil, Colombia, Ecuador, Guyana, Peru Suriname, and Venezuela, as well as staff from international entities that work with the environment, met in Rio de Janeiro December 1-3 during the First Meeting for Regional Cooperation on Mercury Contamination in the Amazon Basin. The U.S. Department of State provided technical and financial support during the event.

The complete list of participants is included in Attachment I.

Delegates of the ATCO Country Members who attended the event elaborated the following recommendations:

1. Propose to their government, through ATCO, the creation of a Working Group, composed of high-level officials responsible for the environmentally adequate management and regulation of mercury use, in order to elaborate and propose an Action Plan for the Regional Cooperation on Mercury Contamination in the Amazon Basin, which should take into account the following:

- Lines of action for risk reduction, including the activities related to inventories on mercury use and emissions, adverse effects, contaminated sites, monitoring and vigilance programs, inspection, capacity-building and training programs (education and awareness of the risks of indiscriminate mercury management), developing and adopting adequate technology, among others; and,

- Regulatory or voluntary measures and policies.

2. Request that ATCO identify the possible sources of financing and cooperation that will allow the implementation of an Action Plan for the Regional Cooperation on Mercury Contamination in the Amazon Basin.

3. Propose to the government of the Amazon Basin countries, through ATCO, the establishment of a Network for the Exchange Information, Experiences, and Research on Mercury in the Amazon Basin, allowing to share the actions taken by each of the eight countries on good practices, legislation, among others.

.

4. Propose the creation within the ATCO of a Regional Program on Analytical Quality, Certification, and Regulation of laboratories (public, university, and private), for all types of Mercury analysis (technical, species, and matrix).

5. Propose the implementation of a permanent expert group of each country, so that a "state of the art" document may be drafted and updated through various types of documents produced in the region.

6. Request that the ATCO – in compliance with the Memorandum of Understanding established with the Community of Andean Nations (CAN) – forward the results from this First Meeting, and that this document be used as a stepping-stone for the elaboration of an Andean-Amazon Strategy of Water Resource Management.

7. Propose to the ATCO Country Members to rekindle the discussions initiated during the V Chancellor Meeting (Lima, 1995) on the Agreement for Zero Contamination of Amazon Basin Rivers.

8. Call to ATCO to hold a regional meeting preceding the twenty-third session of the Administrative Council for the UNEP/Ministerial Level Environmental Forum, to discuss the progress seen since the beginning of the regional cooperation initiative for the mitigation of mercury contamination in Amazon rivers and elaborate a joint agreement to be presented in the UNEP meeting mentioned above.

ANNEX III

**Questionnaire on mercury,
modified in the Lima/Peru meeting**

II MEETING FOR REGIONAL COOPERATION ON MERCURY CONTAMINATION IN THE AMAZON BASIN
(LIMA, PERU, FEBRUARY 1-3, 2005)

QUESTIONNAIRE [*]

COUNTRY: INSTITUTION: NAME: POSITION: TELEPHONE:
FACSÍMIL:
E-MAIL:

A. About Mercury Use and Sources

1. WHAT ARE THE USES OF MERCURY IN YOUR COUNTRY, WHICH COULD RELEASE IT INTO THE ENVIRONMENT, PARTICULARLY INTO THE AMAZON ECOSYSTEMS?

( ) in small gold mining;
( ) in industrial gold mining;
( ) in artisanal mining;
( ) in odontology;
( ) in the equipment industry (thermometers, barometers, lamps, etc.);
( ) in the chemical industry;
( ) in pesticides; or,
( ) If there are other uses, please specify

2. IN THE AMAZON ECOSYSTEMS OF YOUR COUNTRY, WHAT ARE THE SIGNIFICANT SOURCES OF MERCURY RELEASE, FOR:

[*] Includes the modifications presented by the delegations during the II Regional Meeting.

SOURCES	ENVIRONMENTAL ORIGINS			
	AIR	WATER	SEDIMENTS	SOIL
SMALL GOLD MINING				
ARTISANAL MINING				
INDUSTRIAL GOLD MINING				
USE IN ODONTOLOGY				
IN THE EQUIPMENT INDUSTRY				
IN THE CHEMICAL INDUSTRY				
USE IN PESTICIDES				
IN THE OIL INDUSTRY				
BURN OF FOSSIL FUELS				
DEFORESTATION				
DREDGING				
BIOMASS BURNING				
MINING OF OTHER METALS:				

3. IS THERE MERCURY PRODUCTION THROUGH PRIMARY MINING IN YOUR COUNTRY, FOR ECONOMIC PURPOSES?

Yes ( ) No ( )

(IF YOUR ANSWER IS YES, WHAT AMOUNT IS PRODUCED ANNUALLY?)

4 . WHAT DATA IS AVAILABLE ON GOLD PRODUCTION USING MERCURY IN YOUR COUNTRY, ESPECIALLY IN THE AMAZON ECOSYSTEMS?

GOLD PRODUCTION	YEAR	SOURCE OF INFORMATION	WHAT AMOUNT OF HG IS USED TO PRODUCE ONE KG. OF GOLD

(UNIT)			(OBSERVATIONS)

5. IS THERE NATURAL OCURRENCE OF MERCURY IN YOUR COUNTRY?

( ) Yes ( ) No

(IF THE ANSWER IS YES, WHAT ARE THOSE MINERALS?, PLEASE NAME THEM):

MINERAL	% MERCURY	INFORMATION SOURCE
1.		
2.....		
If any Other Source, Please Specify		

6. DOES YOUR COUNTRY (OR REGION) RECYCLE MINING RESIDUE CONTAINING HG?

( ) Yes ( ) No

(IF THE ANSWER IS AFFIRMATIVE, WHAT AMOUNT OF MERCURY IS OBTAINED THROUGH RECYCLING AND HOW IS THIS DONE, WHERE DOES THE RECYCLED HG GOES TO?)

7. IS MERCURY IMPORTED IN YOUR COUNTRY?

( ) Yes ( ) No

(IF YOUR ANSWER IS YES, PLEASE, ANSWER THE FOLLOWING QUESTIONS):

7.1 DOES IMPORT OF MERCURY NEED ANY LEGAL AUTHORIZATION?

( ) Yes ( ) No

7.2 WHAT AMOUNT OF MERCURY HAS BEEN IMPORTED PER YEAR OVER THE LAST 10 YEARS?

YEAR	IMPORTED AMOUNT OF MERCURY (UNIT)	WHAT IS THE ORIGIN AND COUNTRY OF IMPORT	INFORMATION SOURCE	REMARKS
2005				
2004				
2003				
2002				

2001				
2000				
1999				
1998				
1997				
1996				
TOTAL				

8. IN YOUR COUNTRY, IS MERCURY EXPORTED?

( ) Yes ( ) No

(IF YOUR ANSWER IS YES, WHAT AMOUNT OF MERCURY HAS BEEN IMPORTED PER YEAR OVER THE LAST 10 YEARS?)

YEAR	EXPORTED AMOUNT OF MERCURY (UNIT)	WHERE TO?	INFORMATION SOURCE	REMARKS
2005				
2004				
2003				
2002				
2001				
2000				
1999				
1998				
1997				
1996				
TOTAL				

9. DO YOU HAVE INFORMATION AVAILABLE ON THE BASIC OR REFERENCE MERCURY LEVELS ("BASELINE") IN YOUR COUNTRY, FOR:

INDICATOR	CONCENTRATION (UNIT)	**PLACE AND YEAR**	INFORMATION SOURCE
FOOD			
Fish			
Vegetables			
Drinking water			
AIR			
WATER			
Ground water			
Surface water			

Estuaries			
SOILS			
SEDIMENTS			
WILD LIFE			
Animals			
Vegetables			
HUMAN BEING			
Blood			
Urine			
Hair			
Mother's milk			
OTHER THAT YOU WANT TO INFORM			

10. DO YOU HAVE ANY INFORMATION AVAILABLE ON HUMAN EXPOSURES TO MERCURY IN YOUR COUNTRY, PARTICULARLY FOR THE PEOPLE LIVING IN THE AMAZON ECOSYSTEMS, FOR THE FOLLOWING POPULATION SEGMENTS? AND IF YOUR ANSWER IS AFFIRMATIVE, WHAT IS THE NUMBER OF PEOPLE EXPOSED TO MERCURY?

INDICATOR	AVERAGE CONCENTRATION OF TOTAL HG AND/OR METHYL-HG					
	EXPOSED TO THE ENVIRONMENT	REFERENCE	EXPOSED TO WORK	REFERENCE	EXPOSED TO THE ENVIRONMENT AND WORK	REFERENCE
BLOOD (UNIT)						
URINE (UNIT)						
HAIR (UNIT)						
MOTHER'S MILK (UNIT)						
OTHER THAT YOU WANT TO INFORM						

(Please, include the information source or bibliographical reference for each citation)

11. WHAT ARE THE MAXIMUM PERMISSIBLE MERCURY LEVELS IN YOUR COUNTRY?

MEAN	MAXIMUM LEVELS	

	UNIT	VALUE	LAW OR REFERENCE
FOOD			
Fish			
Vegetables			
Drinking water			
AIR			
WATER			
irrigation water			
ground water			
recreational water			
surface water			
Estuaries			
SOILS			
SEDIMENTS			
OCCUPATIONAL EXPOSURE			
working place air			
blood			
urine			
hair			
OTHER THAT YOU WANT TO INFORM			

12. ARE THERE LABORATORIES IN YOUR COUNTRY WHICH CARRY OUT ANALYSIS OF MERCURY FROM DIFFERENT ORIGINS?

LABORATORY	ORIGINS								
	AIR	WATER	SEDIMENT	SOIL	VEGETAL TEC.	ANIMAL TEC.	BLOOD	URINE	HAIR
NAME OF INSTITUTION ADDRESS CONTACT									
TECHNIQUE									
DETECTION									

LIMIT									
CERTIFICATION									
LABORATORY INTERCALIBRATION PROGRAM									

B. ABOUT NATIONAL POLICIES:

13. WHICH ARE THE PUBLIC MANAGEMENT POLICIES FOR THE USE AND DISPOSAL OF MERCURY AND WASTE WHICH MAY BE INCLUDED IN IT?

POLICIES	GENERAL LAWS	SPECIFIC LAWS	REMARKS
1.			
2...			

14. IF ANY, WHAT ACTIONS HAVE BEEN ADOPTED OR ARE PLANNED TO BE IMPLEMENTED IN YOUR COUNTRY TO DEAL WITH THE PROBLEM OF MERCURY CONTAMINATION, PARTICULARLY IN THE AMAZON ECOSYSTEMS?

15. WHAT ARE THE STRATEGIES FOR CAPACITY BUILDING AND DIFFUSION OF INFORMATION TO REDUCE THE RISK TO HUMAN HEALTH RELATED TO MERCURY EXPOSURE IN YOUR COUNTRY, PARTICULARLY IN THE AMAZON ECOSYSTEMS?

STAFF TRAINING				
STRATEGIES	RESPONSIBLE	STAKEHOLDERS	CURRENT SITUATION	REMARKS
1.				
2.				
3....				
DISSEMINATION OF KNOWLEDGE				
STRATEGIES	RESPONSIBLE	STAKEHOLDERS	CURRENT SITUATION	REMARKS
1.				
2.				
3...				

16. WHAT ARE THE GOVERNMENTAL ENTITIES INVOLVED WITH THE ISSUE OF MERCURY IN YOUR COUNTRY? IS THERE ANY ONGOING ACTION AMONG THESE ENTITIES IN PROGRAMS OR PROJECTS? PLEASE, DESCRIBE THEM:

ENTITY	PROGRAM	PROJECT /ACTION	ONGOING ACTION WITH...	APPROVED BUDGET	CURRENT SITUATION

17. WHAT REGIONAL COOPERATION ACTIVITIES IN THE AMAZON ARE NEEDED TO REDUCE THE RISKS RELATED TO MERCURY?

COOPERATION	**ACTORS TO BE INVOLVED**	WHY?	EXPECTED RESULT
...			

C. REGARDING THE CURRENT SITUATION IN YOUR COUNTRY:

18. IF ANY, PLEASE, NAME THE SPECIFIC PROBLEMS AND/OR POLITICAL INSTITUTIONAL (GOVERNMENTAL OR PRIVATE) CONFLICTS RELATED TO MERCURY IN YOUR COUNTRY, PARTICULARLY IN THE AMAZON ECOSYSTEMS:

PROBLEM	PLACE	ACTORS INVOLVED	SERIOUSNESS OF THE CASE	SOLUTION PROPOSAL	ACTIONS
...					

19. PLEASE, NAME AT LEAST THREE PRIORITY ACTIONS IMPLEMENTED IN YOUR COUNTRY TO SOLVE THE PROBLEM OF MERCURY POLLUTION IN YOUR COUNTRY, PARTICULARLY FOR THE AMAZON BASIN.

ACTION	RESPONSIBLE	ACTORS INVOLVED	TERM	ESTIMATED COST
1.				
2.				
3...				

20. WHAT ARE THE STRENGTHS AND WEAKNESESS IN SOLVING THE PROBLEMS OF HG USE IN YOUR COUNTRY?

21. WHAT ARE THE PUBLIC (NATIONAL AND INTERNATIONAL) INVESTMENTS ALREADY MADE IN YOUR COUNTRY FOR PROGRAMS, PROJECTS OR ACTIONS REFERRED TO CONTROL THE USE AND THE MERCURY ENVIRONMENTAL POLLUTION, PARTICULARLY FOR THE AMAZON ECOSYSTEMS?

YEAR	**PROGRAM**	PROJECT/ACTION	VALUE (US$)	RESULTS OBTAINED
2005				
2004				
2003				
2002				
2001				
2000				
1999				
1998				
1997				
1996				
...				
		TOTAL		

ANNEX IV

Conclusion and recommendation Lima/Peru Meeting

II MEETING FOR REGIONAL COOPERATION ON MERCURY CONTAMINATION IN THE AMAZON BASIN
(LIMA, PERU, DECEMBER 1-3, 2005)

BACKGROUND:

As agreed by the delegations that attended the I Regional Meeting (Rio de Janeiro, December 2004), the Amazon Cooperation Treaty Organization (ACTO) and the Brazilian Ministry of the Environment, invited representatives from the Ministries of Foreign Affairs, Ministries of the Environment, Ministries of Health, Ministries of Labor, Ministries of Mines and Energy, Ministries of Education from the governments of Brazil, Bolivia, Colombia, Ecuador, Guyana, Peru Suriname, and Venezuela, as well as officials from International Organizations that work with the environment and health issues, to attend Second Meeting for Regional Cooperation on Mercury Contamination in the Amazon Basin. The meeting was held in the Andean Community General Secretariat headquarters in Lima, Peru, from 1 to 3 February 2005. The U.S. Department of State provided technical and financial support during the event.

The complete list of participants is included in Annex I.

The Delegates of the ACTO Member States who attended the event elaborated the following:

RECOMMENDATIONS:

1. Change the name of the regional initiative to REGIONAL COOPERATION ON MERCURY CONTAMINATION IN THE AMAZON ECOSYSTEMS OF THE MEMBER STATES TO ACTO, according to an official request presented by the delegation of Suriname. This request broadened the scope of the initiative by not only considering the Amazon Basin, but the Amazon Ecosystems in which the Basin is included.

2. Create a Working Group, coordinated by the ACTO, composed of high-level officials responsible for the environmentally adequate management and regulation of mercury use, in order to study and evaluate the implementation of the ACTION PLAN FOR THE REGIONAL COOPERATION ON MERCURY CONTAMINATION IN THE AMAZON ECOSYSTEMS (ANNEX II). This document, prepared by consultants, was presented to the delegations.

3. Implement, through what was initially named a MERCURY PORTAL, the a NETWORK FOR THE EXCHANGE OF INFORMATION, EXPERIENCES, AND RESEARCH ON MERCURY IN THE AMAZON ECOSYSTEMS, allowing to share the actions taken by each of the eight countries on good practices, legislation, among others. The proposal of structure and content or the Portal (Annex III) was also presented and distributed to the delegations. The deadline to receive the observations about this document was set for March 3, 2005.

4. Express the recognition of all the Delegations to the Andean Community General Secretariat and to the U.S. Department of State for their support, logistic and financial that made it possible to carry out the II Regional Meeting. It was also agreed that the PS delivers the results of the Lima Meeting to CAN, which can be used as a stepping-stone for the elaboration of an Andean-Amazon Strategy of Water Resource Management.

5. To consult the ACTO Member States on the proposal of a Frame Agreement for the Adoption of Measures towards the Prevention and Control of Water Resources Contaminations and its Effects in order to catch-up on the negotiations about this document, which are pending since the X Meeting of the Amazon Cooperation Council (Caracas, April 2000).

6. In this sense, and if the consultation process is positive, set a deadline for sending the results of the evaluation (for each country) of this Agreement. After this deadline and with all the observations made by all the State Members, the PS will prepare a new version of the Agreement, which will be the basic document for a Regional Meeting to be carried-out for this purpose.

7. Inform to the Member States on the results of the OTCA participation in the 23rd UNEP Session (Nairobi, Kenya, 21 to 25 February, 2005).

8. Inform to the Governments of Guyana and Bolivia, which could not attend the II Regional Meeting, about these Conclusions and Recommendations;

CONCLUSIONS:

1. The delegations agreed upon the following timetable of activities, which will be coordinated by the PS Coordinator on Environmental Affairs:

- 14 FEBRUARY 2005: deadline for the delivery of the Report on the II Regional Meeting to the delegations. The annexes for this document are: List of Participants (Annex I); proposal of Action Plan for Regional Cooperation for Mercury Contamination in the Amazon Ecosystems of the ACTO State Members (Annex II); draft document on Mercury Portal (Annex III); and proposal of Frame Agreement for the Adoption of Measures towards the Prevention and Control of Water Resources Contaminations and its Effects (Annex IV);

- 3 MARCH, 2005: deadline for delivering to the PS the observations on the Mercury Portal;

- 30 MARCH, 2005: deadline for delivering to the Member States, the proposal of Action Plan for Regional Cooperation for Mercury Contamination in the Amazon Ecosystems of the State Members to ACTO;

- 14 APRIL 2005: deadline for delivering to the PS the new questionnaires.

2. Before the timetable is accomplished, the PS will identity a financing source in order to carrying out a III Regional Meeting, which will have the following objectives: i) to have information on the state of the art regarding the implementation of the Action Plan and the Mercury Portal: and, ii) if the consultation process was positive, initiate the process of negotiation on the Frame Agreement for the Adoption of Measures towards the Prevention and Control of Water Resources Contaminations and its Effects.

Lima, Peru, February 4, 2005.

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