



**BLACKSMITH**  
INSTITUTE

Solving Pollution Problems.  
Saving Lives.

Annual**Report** 2008

# Blacksmith Institute

Industrial wastes, air emissions, and legacy pollution affect over a billion people around the world, with millions poisoned and killed each year. People affected by pollution problems are much more likely to get sick from other diseases. Other people have reduced neurological development, damaged immune systems, and long-term health problems. Women and children are especially at risk. The World Health Organization estimates that 25 percent of all deaths in the developing world are directly attributable to environmental factors.

A study, published in 2007 by a Cornell research group found even more alarming results. The team surveyed 120 relevant articles, covering population growth, pollution and disease and found that an astonishing 40 percent of deaths worldwide were caused by water, air and soil pollution<sup>1</sup>.

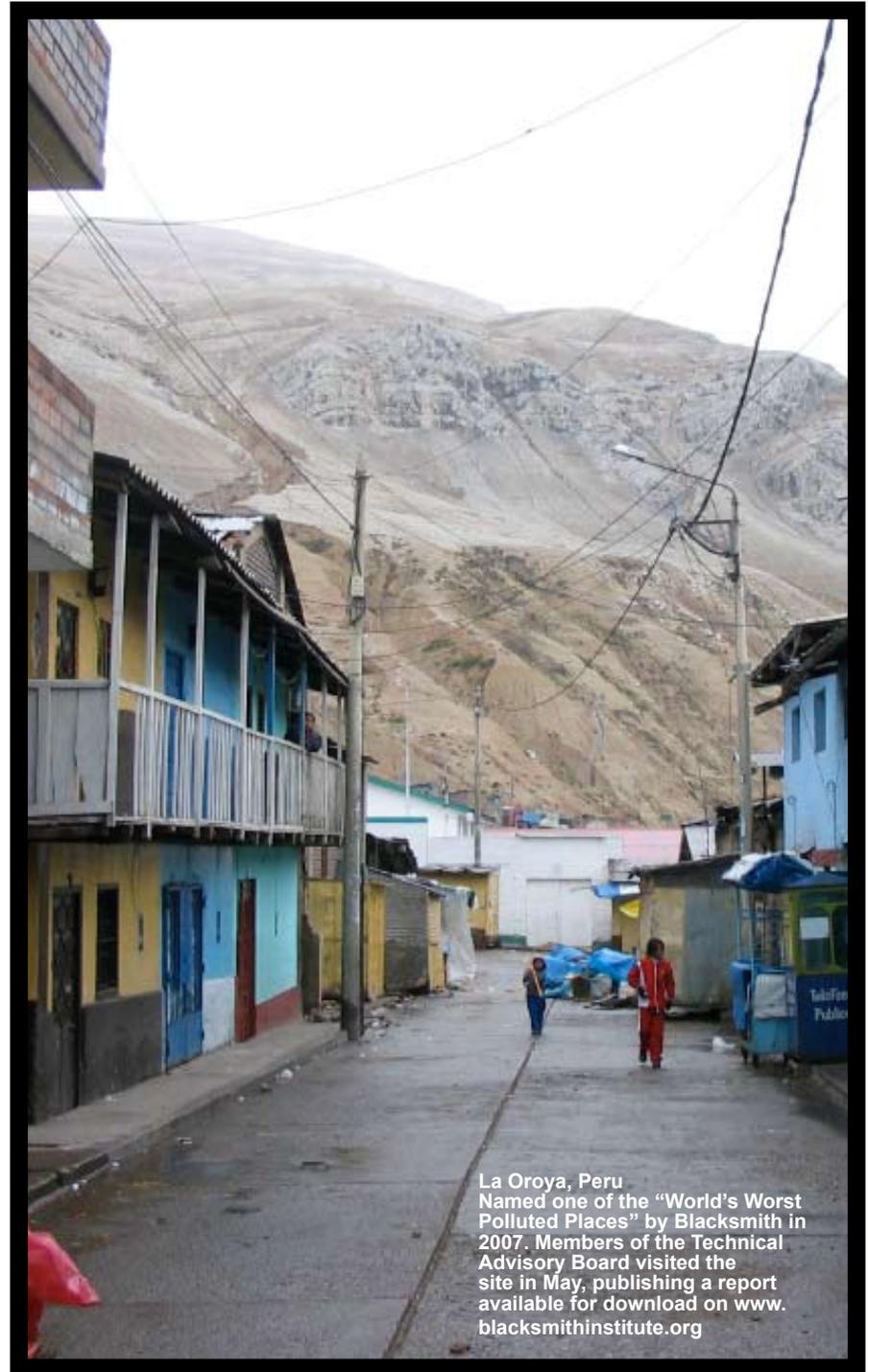
**Blacksmith Institute** designs and implements solutions for pollution related problems in the developing world. Since 1999, Blacksmith has been addressing the critical need to clean up dangerous and largely unknown polluted sites where human health is most affected by pollution. Blacksmith has completed over 50 projects and is currently engaged in over 40 projects in 19 countries.

The handful of sites described in this report represent the geographic reach and unique strategy of Blacksmith Institute. There are simple and affordable solutions to these problems. Together we can clean them up.

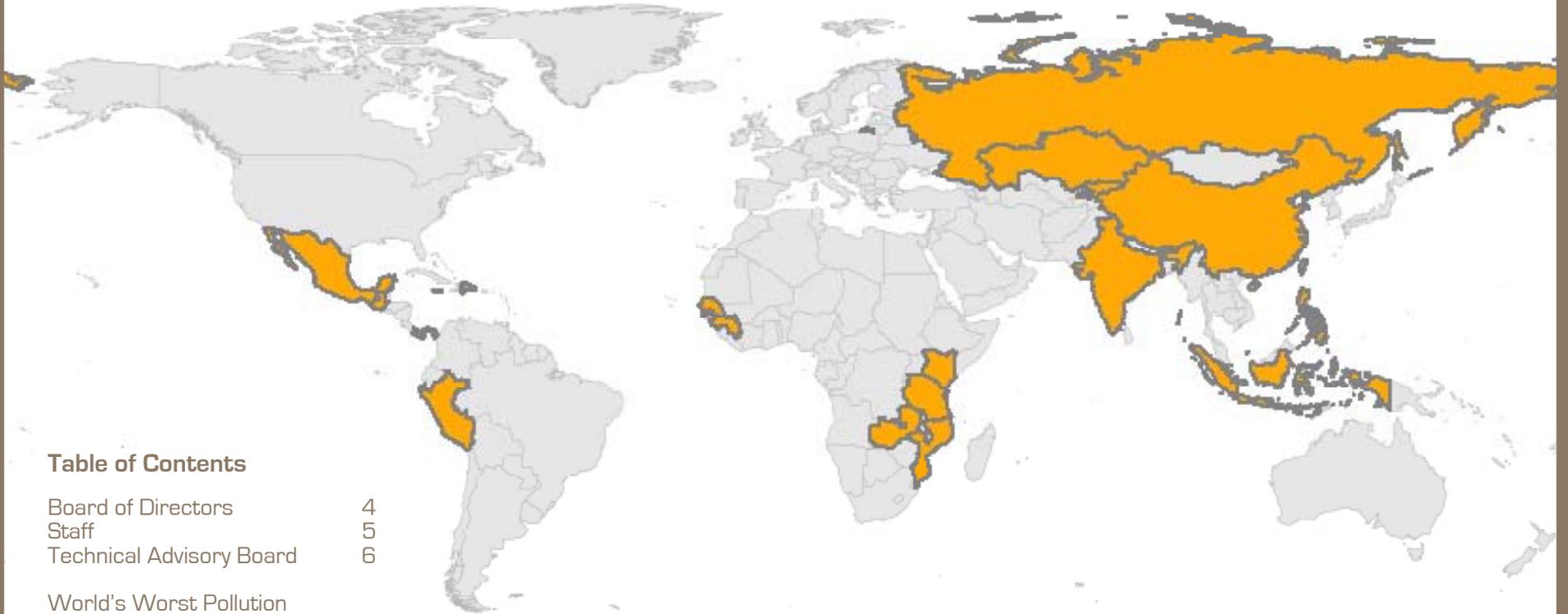


Richard Fuller  
President, Blacksmith Institute

<sup>1</sup> Pimentel, D. et al. "Ecology of Increasing Diseases: Population Growth and Environmental Degradation." Human Ecology, 35.6 (2007): 653-668. <http://www.news.cornell.edu/stories/Aug07/moreDiseases.sl.html>



La Oroya, Peru  
Named one of the "World's Worst Polluted Places" by Blacksmith in 2007. Members of the Technical Advisory Board visited the site in May, publishing a report available for download on [www.blacksmithinstitute.org](http://www.blacksmithinstitute.org)



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Blacksmith Institute is active in nineteen countries:

- |                    |             |
|--------------------|-------------|
| China              | Mexico      |
| Dominican Republic | Mozambique  |
| Guatemala          | Panamá      |
| Guinea             | Peru        |
| India              | Philippines |
| Indonesia          | Russia      |
| Jamaica            | Senegal     |
| Kazakhstan         | Tanzania    |
| Kenya              | Zambia      |
| Kyrgyzstan         |             |

## Board of Directors

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President, Blacksmith Institute

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Vice-President, Conservation Operations, Wildlife Conservation Society

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Director, Center for Children's Health and the Environment

**Joshua Mailman**

President, Sirius Business Corporation

**Ron Reede**

Managing Director, Equity Sales, Lazard Capital Markets

**Sheldon Kasowitz**

Principal, Indus Capital Partners

**Sid Sandilya**

Vermillion Asset Management

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**Francis Beinecke**

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**Paul Dolan**

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**Pradeep Kapadia**

CEO, Kapadia Energy Services

**Karti Sandilya**

Former US Resident Director,  
Asian Development Bank



China's recent economic growth has come at significant environmental cost. Only 1% of China's 560 million urban dwellers breathe air considered safe by the European Union, and nearly 500 million lack access to safe drinking water.



## Blacksmith Institute Staff

Richard Fuller  
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Meredith Block, MPA  
Executive Director

David Hanrahan, MSc  
Director of Global Operations

Mishelle Gomez Cabral  
Latin America Coordinator

Bret Ericson, MSc  
Program Officer

Conor Gateley, MS  
Financial Administrator

Steve Laico  
Web Administrator

Vladimir Kuznetsov  
Russia Coordinator

Marlo Mendoza  
Philippines Coordinator

Peter Odhengo  
East Africa Coordinator

Promila Sharma  
India Coordinator

Magadelene Sim  
Communications Coordinator

Budi Susilorini  
Indonesia Coordinator

Leyan Wang  
China Coordinator

Blacksmith Institute operates with a small staff in its New York office, moving a full 94% of its resources directly into program costs. Nominations are received from NGOs, governments, and international agencies and reviewed by Blacksmith's pro bono Technical Advisory Board (TAB). Interventions are designed and run by our local partners with strong involvement from the TAB. To date, Blacksmith Institute has remediated more than 30 different sites, removing direct health threats to millions of people.



Kabwe, Zambia  
Named one of the "World's Worst Polluted Places" in 2006 and 2007. Blacksmith worked to secure a World Bank loan of \$40 million to remediate this abandoned lead mine.

## Blacksmith Institute Technical Advisory Board

**Margrit von Braun, Ph.D., P.E.**  
Administrative Dean and Founder, Environmental Science Program, University of Idaho.

**Pat Breyse, M.D.**  
Director of the Division of Environmental Health Engineering  
Department of Environmental Health Sciences  
Johns Hopkins Bloomberg School of Public Health

**Tim Brutus, M.Sc.**  
Risk Management Specialist  
New York City Department of Environmental Protection

**Jack Caravanos, Ph.D., CIH, CSP**  
Director, MS/MPH program in Environmental and Occupational Health Sciences  
Hunter College, CUNY

**Denny Dobbin**  
President, Society for Occupational and Environmental Health

**Josh Ginsberg, Ph.D.**  
Vice President, Wildlife Conservation Society

**David J. Green**  
Owner and CEO of Phoenix Soil, LLC; United Retek of CT, LLC; American Lamp Recycling, LLC; Green Globe, LLC; and Jayjet Transportation, LLC.

**David Hanrahan, M.Sc.**  
Director of Global Programs, the Blacksmith Institute

**David Hunter, Sc.D.**  
Professor of Epidemiology and Nutrition, Harvard University School of Public Health

**Eric Johnson**  
Member of the Board of Trustees, Green Cross Switzerland  
Managing Director, Atlantic Consulting

**Donald E. Jones**  
Founder of Quality Environmental Solutions, Inc.

**Mukesh Khare**  
Professor, Department of Civil Engineering, Indian Institute of Technology Delhi, India

Paraiso de Dios, Haina, Dominican Republic  
Named one of the "World's Worst Polluted Places" in 2007,  
this community near an abandoned lead smelter was heavily  
contaminated with lead. Remediation of this site was  
conducted in December of 2008.

**Philip J. Landrigan, M.D., M.Sc.**

Director, Center for Children's Health and the  
Environment; Chair, Department of Community and Preventive  
Medicine; Director, Environmental and Occupational Medicine,  
Mount Sinai School of Medicine

**Ian von Lindern, Ph.D**

CEO and Chariman, Terra Graphics Environmental Engineering,  
Inc.

**Ira May**

Geologist, U.S. Army Environmental Center

**Anne Riederer, Sc.D.**

Co-Director, Global Environmental Health Program  
Rollins School of Public Health, Emory University

**David Richards**

Independent Environmental Advisor

**Stephan Robinson, Ph.D.**

Director of the International Disarmament Program, Green  
Cross Switzerland

**Paul Roux**

Chairman, Roux Associates, Inc.

**Leona D. Samson, Ph.D.**

Ellison American Cancer Society Research Professor; Director,  
Center for Environmental Health Sciences; Professor of  
Biological Engineering, Massachusetts Institute of Technology

**Brian Wilson**

Program Manager, International Lead Management Center  
MRSC - Member of the Royal Society of Chemistry

**Jay Vandeven, MS.**

Principal  
ENVIRON International Corporation



# The Top Ten

In 2006 and 2007, Blacksmith Institute and Green Cross Switzerland produced the first lists of the “World’s Worst Polluted Places.” Widely published and distributed, these lists included an unranked “Top Ten,” as well as a more inclusive “Dirty Thirty” index of polluted places around the world, detailing the sources and effects of pollution at each site.

The sites were compiled based on a variety of criteria. Foremost among these was the impact of pollution on human health.

Although the lists catalyzed widespread interest in the significant threat that environmental pollution poses to human health in the developing world, those sites named were only some of the more egregious examples of widespread problems.

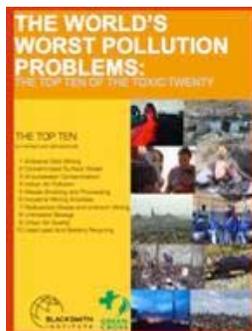
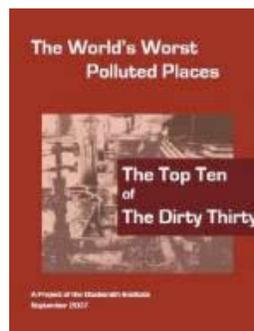
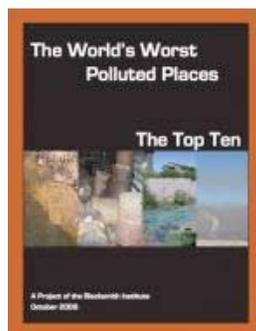
To provide context and scale of these problems, Blacksmith Institute and Green Cross Switzerland updated their work in this year’s report - “World’s Worst Pollution Problems.” Rather than focusing on just a few locations, this report gave an overview of the range of pollution threats humans face throughout the world.

With this report we brought the attention of the international community to the enormous health risk posed by pollution every year in the developing world and to ways in which it might be tackled.

The “**Top Ten World’s Worst Pollution Problems**” is a non-ranked set of global issues, which – in the overall judgment of a panel of expert advisors – represent ongoing activities and conditions that pose the greatest threat to human health. This judgment requires a balance between problems with widespread but moderate contamination levels,

and problems that are smaller but much more toxic. There can always be debate about such judgments, but there is no denying that each of the Top Ten Worst Pollution Problems represents a worldwide threat to human health and development.

The list received significant response from the press, with major stories in Time, Newsweek, Scientific American and Reuters, among others. The full report is available for download at: [www.worstpolluted.org](http://www.worstpolluted.org)



## THE TOP TEN

- Artisanal Gold Mining
- Contaminated Surface Water
- Groundwater Contamination
- Indoor Air Pollution
- Metals Smelting and Processing
- Industrial Mining Activities
- Radioactive Waste and Uranium Mining
- Untreated Sewage
- Urban Air Quality
- Used Lead Acid Battery Recycling

## THE REST OF THE TOXIC TWENTY

- Abandoned Mines
- Agrotoxins and POPs
- Arsenic
- Cadmium
- Chromium
- Coal Power Plants
- Garbage Dumps
- Industrial Estates
- PCBs
- Old and Abandoned Chemical Weapons
- Oil Refineries and Petrochemical Plants

## GLOBAL INVENTORY PROJECT

A major challenge to the international community is to identify exactly where and how pollution affects people. To our knowledge, Blacksmith Institute's internal database of polluted places is the most comprehensive in the world. However, the 600 sites it contains just scratch the surface of what exists.

To address this need, Blacksmith Institute has entered into a partnership with the European Commission and the United Nations Industrial Development Organization to develop a comprehensive inventory of polluted places. The Global Inventory Project will be the first of its kind. During the 18-month project Blacksmith and partners will identify and assess more than 500 additional polluted places. The information collected will be made accessible to organizations and governments working to end the health threat of pollution.

## HEALTH AND POLLUTION FUND

A second major challenge is to leverage the funds necessary to remediate the many polluted places where health is at risk. In order to provide a vehicle to take up this challenge, the Health and Pollution Fund (HPF) was launched in principle in October 2007 by representatives from governmental agencies of the United States, Germany, China, Russia, Mozambique, Kenya, and the Philippines, along with representatives from the World Bank, the United Nations Industrial Development Organization, Green Cross Switzerland, Blacksmith Institute, as well as leading researchers from within the public health and pollution remediation fields. HPF is a planned \$400 million fund which will be dedicated to combating toxic pollution in developing countries that has resulted from industrial, mining, and military operations.

The Fund will be directed toward cleaning up over 400 highly polluted locations worldwide that affect more than 100 million people - people who suffer from reduced life expectancies, increased cancer risks and severe neurological damage. Projects initiated by HPF will channel funds to local stakeholders, with technical support and oversight provided by a central Secretariat. The Fund is in development, in discussions with potential donors.

For more information on the Health and Pollution Fund, please visit [www.HPFund.org](http://www.HPFund.org)



**Conakry, Guinea**  
Polychlorinated biphenyls, also known as PCBs, are a group of man-made chemicals which are very resistant to decay and natural breakdown. Abandoned PCB capacitors from France, England, Germany and the US have contaminated approximately 3 acres in the center of Conakry.

# China

China is home to more than one fifth of the world's population, and is currently going through the most rapid industrialization in human history. While its economic growth has lifted over 100 million people out of poverty in fewer than 30 years, it has come at significant environmental cost. Indeed, only 1% of China's 560 million urban dwellers breathe air considered safe by the European Union, and nearly 500 million lack access to safe drinking water.<sup>1</sup>

## *Some Project Highlights:*

### **Toxic Emissions resulting from the Sichuan Earthquake**

On May 12th 2008, a massive earthquake struck southwestern China. The epicenter was in Wenchuan county, in Sichuan province. Nearly 70 thousand people lost their lives during the quake which measured 8.0 on the Richter scale.

Sichuan is home to a high number of mining complexes and chemical industries, scores of which were damaged during the quake. Anecdotal evidence indicates that there were significant toxic emissions from these sources, contaminating groundwater and soil. Among other contaminants,

<sup>1</sup> "As China Roars, Pollution Reaches Deadly Extremes" The New York Times. August 25, 2007 [http://www.nytimes.com/2007/08/26/world/asia/26china.html?\\_r=1&oref=login](http://www.nytimes.com/2007/08/26/world/asia/26china.html?_r=1&oref=login)

Sichuan, China  
Chemical releases from the devastating May 12th Earthquake potentially pose a significant health threat.

liquid ammonia and various POPs were found to have leaked in high levels. Because many area residents rely on agriculture and groundwater for their livelihoods, there is a large potential threat posed by these toxic releases.

To address this threat, Blacksmith Institute entered into a partnership with the Institute of Geographical Sciences and Natural Resources Research (IGSNRR) of the Chinese Academy of Sciences. During the length of project IGSNRR will develop an inventory of toxic releases in Sichuan, and design remediation plans to remove human exposure pathways. Both the inventory and the plans will be made available to government agencies to assist in the reconstruction.

### **Legacy Arsenic Contamination in WenShan county, YunNan Province**

In the 1960s, a chemical factory was built here, with Arsenic Tri-oxide (white arsenic, As<sub>2</sub>O<sub>3</sub>) being one of the major outputs. The factory operated intermittently since that time, but was finally closed in 2000. Inadequate waste disposal and environmental remediation has been conducted and the legacy of this factory continues to pollute the area. Over 50,000 tons of arsenic residues and 500 tons of rock remain, occupying an area of 53,000 square meters. The approximate concentration of arsenic in the residue

is between 2-5%, and in the rock 12-21% by weight.

Following a 2007 site visit, Blacksmith Institute formed a partnership with the local and provincial environmental protection agencies in 2008.

The toxicity of arsenic for humans is well documented and famous as a method of poisoning used in fiction and in real life. Arsenic poisoned Napoleon, Francesco I de' Medici (the Grand Duke of Tuscany), George the III of Great Britain, and various impressionist painters that inadvertently ingested paints containing arsenic. However, both organic and inorganic forms of arsenic are frequently used for industrial and agricultural purposes.<sup>1</sup>

The arsenic at this site drains into the Longtang River, which flows into the Honghe (Red) River watershed and downstream to Vietnam. The river carried the arsenic, affecting potentially half of a million people.

The partnership will fund a pilot remediation consisting of several measures, including a permanent drainage ditch to be cut along the side of the site. The ditch will mitigate the arsenic risk to the local population.



**WenShan County, China**  
Arsenic contamination from this site affected potentially half of a million people

<sup>1</sup> "ToxFaqs for Arsenic." Department of Health and Human Services: Agency for Toxic Substances and Disease Registry, August 2007. Available at <http://www.atsdr.cdc.gov/tfacts2.html>

# Russia



## Some Project Highlights:

### Lead Poisoning in the Rudnaya River Valley, Russia

In the Russian Far East, on the Sea of Japan, Blacksmith has been working with the Far Eastern Health Fund (FEHF) to end chronic lead poisoning in the communities of Rudnaya Pristan and Dalnegorsk. Situated between a lead smelter and lead mine, the town has been exposed to dust and lead particulates for nearly a century. Although Blacksmith has worked with local partners to successfully close the smelter and upgrade the safety standards for the transport of lead concentrate from the mine, a legacy of contamination still remains in the soil.

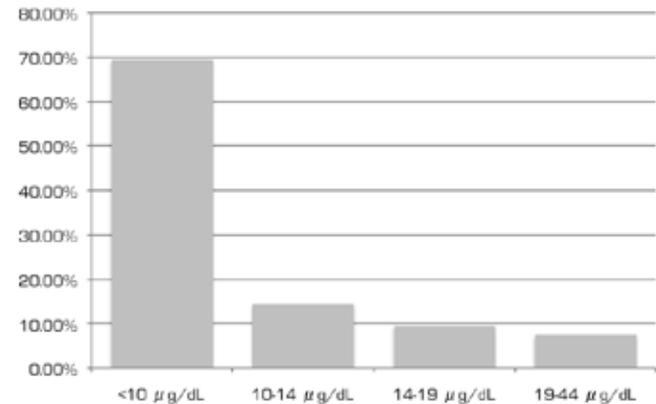
Now that active contamination has stopped, excavation activities have been able to commence to remove legacy hotspots. In

2008 Blacksmith was also able to continue studying and mapping contamination patterns, conducting health intervention activities including awareness and education campaigns to mitigate exposures amongst children.

Contamination Mapping. Soil samples have been analyzed from 140 locations in the Rudnaya River Valley. Since active industrial activity has ceased, the main pathway of exposure is soil contamination, and is therefore the primary focus. Water was also sampled this year revealing the presence of lead, cadmium and other heavy metals.

Because the area is so large, sampling helps determine contamination patterns. The research has indicated that almost all local children play in areas that are contaminated and in need of remediation.

Remediation. Three playgrounds with a total area about 8,000 sq meters have been cleaned up. In each site, soil contamination



This diagram shows the distribution of children according to blood lead level categories. The data comes from the project of the Far Eastern Environmental Health Fund and Blacksmith Institute supported by the Green Cross Switzerland. In 2007-2008 we conducted this survey in which 375 children participated. Most of them are from the city of Dalnegorsk and some from small towns Monomakhovo and Rudnaya Pristan, located nearby. According to our research the main exposure of children to lead in the area comes from the soil that is contaminated by former and present mining and smelting activities. Today smelting of lead is stopped and this remote area does not have many automobiles, so air pollution is low. Our study showed that playgrounds are contaminated with lead. Concentrations range from 150 to 1200 ppm of Pb in sand of children playgrounds. But children also could be exposed to highly contaminated industrial areas with soil Pb concentrations from 5,000 to 15,000 ppm. In the town Rudnaya Pristan where the smelter is located the locally grown foods also contain high amounts of heavy metals. The concentration of lead in the main local food item potato is on average 2.1 ppm.

levels exceeded Russian and international safety standards (400 ppm), at times reaching as high as 900 ppm. Two of these playgrounds are located in Dalnegorsk and the other is in Rudnaya Pristan. FEHF removed the top layer of sand and soil to the depth of 1 ft and replaced it with clean sand from the coast. This will help prevent exposure to children in their kindergartens.

Health Intervention. About 5000 children live in the affected area. Results indicate that more than 30% of the children tested have blood lead levels over the international standard of 10 ug/dl. Through local medical personnel each child with blood lead level over 8 ug/dl was provided with a therapeutic chelation supplement (based on brown algae that helps remove heavy metals from the body).

Awareness and Education. The project has been working with five kindergartens and two schools educating children and their parents about lead and ways to reduce exposure. In the fall of this year, FEHF reached an agreement with the local administration to introduce the lead education program in all public schools and child care institutions in the Rudnaya River Valley. FEHF

currently distributes lessons and materials to local teachers. FEHF is also continuing to work personally with families whose children have elevated blood lead levels. The project also provides personal counseling and printed materials on reducing the risk of lead poisoning. Through local media newspapers, radio, and TV, information is regularly distributed on lead health issues.

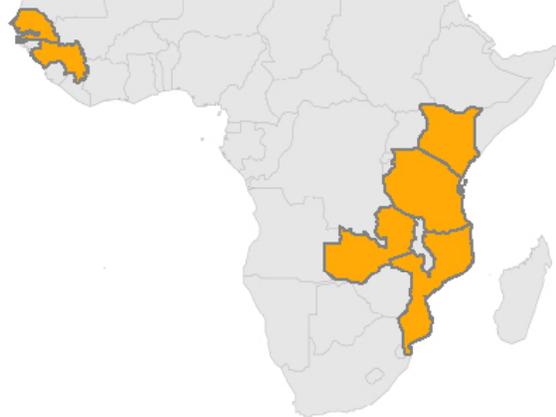
**Other projects in the region include:**

- Uranium tailings in Mailuu Suu Kyrgyzstan
- Industrial Waste in Volgograd, Russia
- Lead smelter in KAZakhstan
- Dioxins in Ufa, Russia



**Rudnaya Pristan, Russia**  
Soil with high lead levels was replaced in several area nursery schools.

# Africa



## *Some Project Highlights:*

### **Used Lead Acid Battery recycling, Senegal**

Recycled lead is a valuable commodity and for many people in the developing world the recovery of car and batteries, also known as Used Lead Acid Batteries (ULABs), can be a viable and profitable business. Therefore, the market for reclaiming secondary lead has been growing, especially in developing countries. Many developing countries have entered the business of buying ULABs in bulk in order to recycle them for lead recovery. These ULABs are often shipped over long distances for recycling, typically from the industrialized countries that produce, use, and then collect the spent batteries for reprocessing.<sup>1</sup>

In the community of Thiaroye Sur Mer, Dakar, Senegal, the main economic activity has involved



Thiaroye Sur Mer, Dakar, Senegal  
Following the deaths of 18 children from acute lead poisoning, Blacksmith Institute and the Ministry of Health implemented a blood lead level monitoring program and education campaign. Area soil measured above 20,000 ppm, or more than fifty times the limit.

<sup>1</sup> "The Basel Ban And Batteries, A Teaching Case: The Basel Ban And Batteries" Available at [http://www.commercialdiplomacy.org/case\\_study/case\\_batteries.htm](http://www.commercialdiplomacy.org/case_study/case_batteries.htm)

haphazard melting of ULAB to reclaim the scrap lead inside. Because this activity has been conducted in the informal sector, out in the open air, and largely by the women of the community, the children of Thiaroye are victims of acute lead poisoning.

In March 2008, 18 children under the age of five died of acute lead exposure as a result of this activity. Although the government has shut down these operations, the legacy wastes combined with wind and highly dusty conditions has potentially contaminated the entire community. The government of Senegal estimates that nearly 100,000 people live in Thiaroye, although the exact number of those contaminated is unknown.

Blacksmith was invited to the site by representatives of the Ministry of Environment and the Basel Secretariat. Following a visit to the site and full assessment in April, Blacksmith began a community education campaign and blood lead level monitoring program with the Ministry of Health. In the intervening months, Blacksmith has developed full remediation plans to be implemented in 2009.

### **PCB Clean-up, Nairobi, Kenya**

This site, located in City Centre, Nairobi is contaminated by used transformer oil that contains a high concentration of



Thiaroye Sur Mer,  
Dakar, Senegal

polychlorinated biphenyls (PCBs). PCBs are a group of man-made chemicals which are very resistant to decay and natural breakdown. They were identified by Blacksmith as one of the World's Worst Pollution Problems released in October of 2008. Once PCBs enter the environment, they do not readily break down and can be carried long distances in the air and waterways.<sup>2</sup> They tend to bioaccumulate and bioconcentrate in the fatty tissues of humans and animals.<sup>3</sup>

At this site, the used oil from broken down-scrap transformers is discharged into the soil and storm water drains. The site is still being used by the Kenya power and lighting company to keep transformers and other

electrical installation materials. Although the exact quantity of contaminated oil discharged annually is unknown, it is estimated to be in hundreds of liters.

In 2008, Blacksmith Institute conducted a full assessment of the site and formed a stakeholder group consisting of the National Environment Management Authority and Kenya Power and Lighting Company. The remediation of the site will begin in 2009.

#### **Other projects in the region include:**

Mercury and gold mining in Senegal  
Mercury and gold mining in Mozambique  
PCB clean-up and Site Assessments in Kenya  
Stakeholder Groups against lead poisoning in Dar es Salaam Tanzania  
Dump clean-up in Tanzania  
Lead poisoning in Zambia

<sup>2</sup> "Polychlorinated Biphenyls (PCBs): Basic Information." U.S. Environmental Protection Agency. Last Updated August 8, 2008. Available at <http://www.epa.gov/epawaste/hazard/tsd/pcbs/pubs/about.htm>

<sup>3</sup> Faroon, Obaid M.; Keith, L. Samuet; Smith-Simon, Cassandra; and De Rosa, Christopher T. "Polychlorinated biphenyls: Human health aspects." Agency for Toxic Substances and Disease Registry. World Health Organization. International Programme on Chemical Safety. 2003

# Americas



## *Some Project Highlights:*

### **Legacy Lead Smelter, Dominican Republic**

According to the U.N., the community of Paraiso de Dios, Haina in the Dominican Republic has one of the highest levels of lead poisoning in the world. Nearly 90% of residents have elevated blood lead levels.

The source of the contamination is a defunct Used Lead Acid Battery processing plant located at the top of a hill. Waste from the site is brought downhill into the community by rainwater.



Haina, Dominican Republic  
Known as the “Dominican Chernobyl,” the community of Paraiso de Dios suffers from one of the highest levels of lead contamination in the world. Remediation began here in December 2008.

Blacksmith has been working in Haina for several years to mitigate the threat through community education campaigns and ongoing blood testing.

In coordination with the Autonomous University of Santo Domingo, the Ministry of Environment and the Inter American Development Bank, Blacksmith developed remediation plans and mobilized the necessary resources.

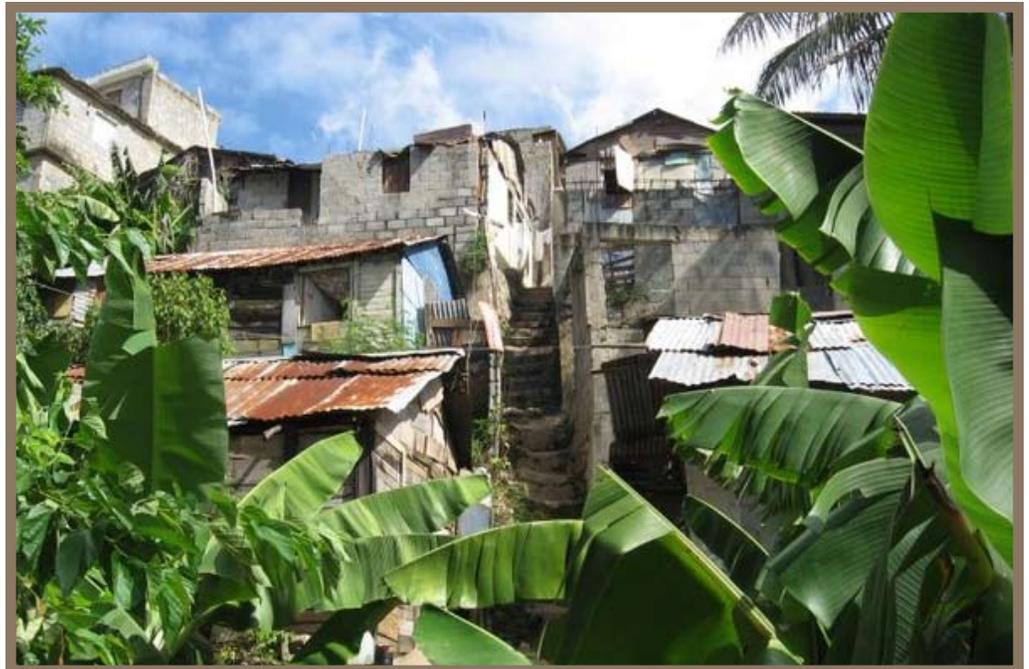
The full remediation of the site began in December of 2008. High level waste has been removed and placed at a site provided by the former plant operator, Metaloxsa.

The remediation was designed and supervised by experts from Terra Graphics Environmental Engineering, Inc and Hunter College. The full report will be available on our web site in 2009.

**Other projects in the region include:**

Air quality monitoring in Panama City, Panama  
Lead poisoning in Kingston, Jamaica  
Site Assessments in Guatemala

The former plant owner, Metaloxsa provided a site where the high level waste will be placed.



The community of Paraiso de Dios is densely populated and located on a steep grade. These factors increase the risk of contamination from the site.

# Southeast Asia

## *Some Project Highlights:*

### **Surfacewater contamination, Philippines**

Located on the northern fringes of Metro Manila, the watershed along the Marilao-Meycauayan-Obando river system in the province of Bulacan are host to a multitude of industries and urban-related activities. The sources of the problem are formal and informal industries utilizing toxic metals which eventually find their way to the thousands of hectares of commercial fishponds downstream and the shellfish beds in the adjoining Manila Bay. These industries include artisanal gold and precious metal refineries, lead acid battery recycling, tanneries and backyard pyrotechnics. Most of these industries lacked any waste treatment facilities before the advent of this project. The basin is one of the top producers of bangus (milkfish) in the Philippines, producing approximately US\$80-100Million a year.

The Blacksmith Institute team has been involved in multiple projects during the past year. Sampling of the river and sediment system for its heavy metal content was conducted. 45 stations were sampled for water and sediments and 50% of the stations showed exceedances of manganese in Philippine national standards as well as exceedances in cadmium, zinc and lead. In addition, a bioaccumulation study was

conducted in the fish species being raised in the fishponds along the river system and the shellfish from Manila Bay where the river system enters the Bay. Copper, manganese, nickel and zinc were often found above health standards in fish while cadmium copper manganese and zinc were found in mussels above health standards.

A wastewater treatment facility in the largest tannery in the basin has been constructed using conventional biological treatment. A chrome recovery facility is presently being piloted by the team. In the future the team will be endeavoring to get all the tannery waste in the basin taken to this facility.

A scrubber for the air exhaust from the gold refining industries has been successfully piloted and the team is working on getting those scrubbers installed in all the refining industry. Next steps will be to develop a simple process to

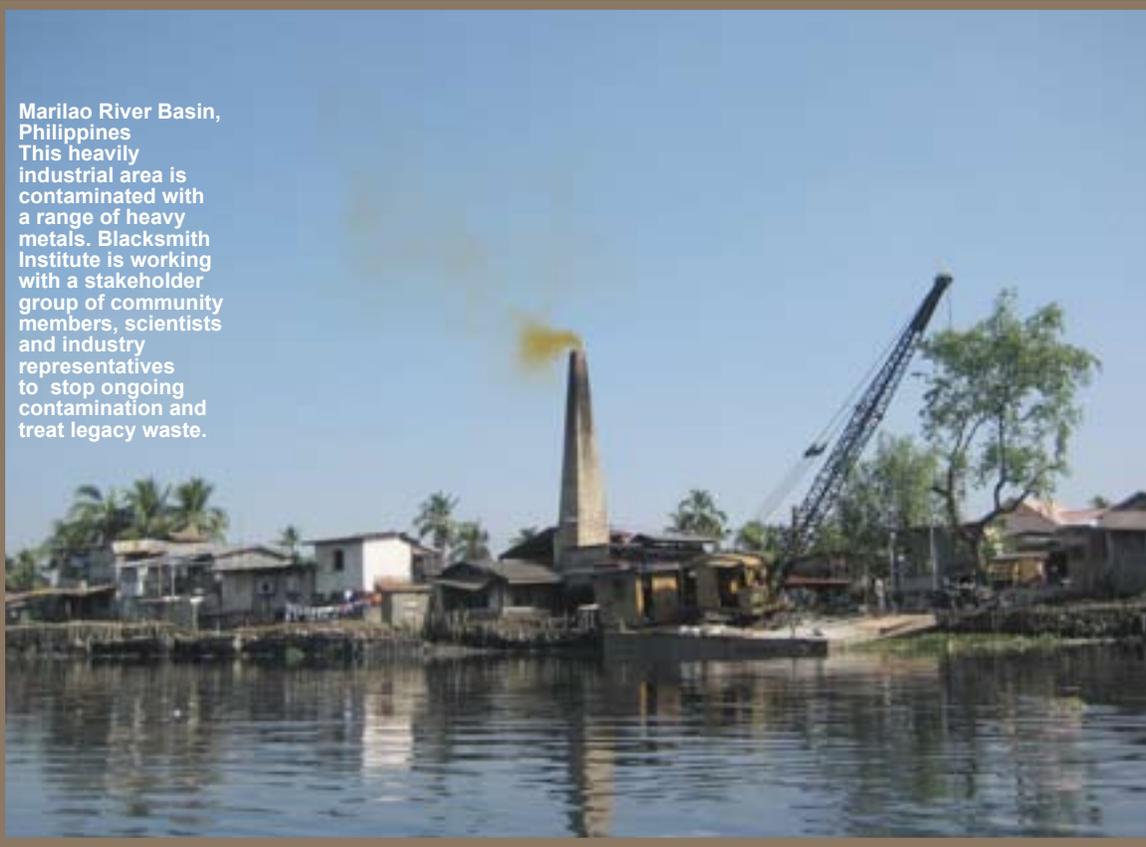
deal with the wastewater from the industry.

Biogas digesters have been installed in several household and medium scale piggeries in the basin and is already reducing the amount of organic pollution entering the river system. In the future the team will help install these digesters in all the piggeries in the basin.

Since 2005, Blacksmith Institute has supported a local Stakeholder Group comprised of community leaders, local government representatives, scientists and industry representatives who have worked to stop ongoing pollution and treat legacy wastes. This group, with watershed-wide representation, has met over 20 times and held technical meetings on the toxicology of the basin and to demonstrate the pilot systems that have been developed.



Marilao River Basin, Philippines  
This heavily industrial area is contaminated with a range of heavy metals. Blacksmith Institute is working with a stakeholder group of community members, scientists and industry representatives to stop ongoing contamination and treat legacy waste.



## Artisanal Gold Mining Central Kalimantan, Indonesia

Artisanal and small-scale mining refers to mining activities that use rudimentary methods to extract and process minerals and metals on a small scale.

Artisanal miners also frequently use toxic materials in their attempts to recover metals and gems. Such miners work in difficult and often

very hazardous conditions and, in the absence of knowledge or any regulations or standards, toxic materials can be released into the environment, posing large health risks to the miners, their families and surrounding communities<sup>1</sup>. In this context, gold mining operations are particularly dangerous, as they often use the mercury amalgamation process to extract gold from ores.

<sup>1</sup> Hilson, Gavin; Hilson, Christopher J.; and Pardie, Sandra. "Improving awareness of mercury pollution in small-scale gold mining communities: Challenges and ways forward in rural Ghana." November 13, 2006.

Artisanal gold mining is one of the most significant sources of mercury release into the environment in the developing world, with at least a quarter of the world's total gold supply coming from such sources<sup>2</sup>. Artisanal gold miners combine mercury with gold-carrying silt to form a hardened amalgam that has picked up most of the gold metal from the silt. The amalgam is later heated with blow torches or over an open flame to evaporate the mercury, leaving small gold pieces. The gaseous mercury is inhaled by the miners and often by their immediate family, including their children. Mercury that is not inhaled during the burning process, settles into the surrounding environment or circulates globally for future deposition far from the site, where it is absorbed and processed by a variety of living organisms. This transforms elemental mercury into methylmercury. Methylmercury is one of the most dangerous neurotoxins, and contaminates the food chain through bioaccumulation.

Central Kalimantan is home to some of Indonesia's largest gold deposits. While there are a handful of formal operators, thousands of artisanal gold miners scrape out a living with rudimentary extraction methods.

Blacksmith began work here this year to introduce affordable mercury capturing technology through community education campaigns. A \$3 "retort" captures mercury emissions for reuse. Blacksmith has conducted similar programs in Mozambique and Tanzania.

<sup>2</sup> Veiga, M.M., et al. (2005). Pilot Project for the Reduction of Mercury Contamination Resulting From Artisanal Gold Mining Fields in the Manica District of Mozambique

# India



## *Some Project Highlights:*

### **Groundwater Contamination, Bichadi, Rajasthan**

Bichadi village is small village (including 10 hamlets) supporting a population of approximately 6000 in Girva Block, Udaipur in southern Rajasthan. Hindustan Agrochemicals Limited - A small industrial estate (320 hectares or 791 acres) manufacturing dyes and dye intermediaries located in Bichadi Village were ordered closed by the government in 1990 (though manufacturing appears to have continued in some plants till 1995). It remains a significantly polluted place due to inadequate remediation post-closure. Indiscriminate surface dumping of sludge along with agriculture with

polluted groundwater since 1989-90, has contributed to serious soil contamination. The wells in a radius of 10 km from the estate have been rendered unfit for consumption.

Although, legal efforts have been underway to compel that the site be cleaned up, for more than a decade community members have been forced to consume untreated water supplied from the bore-wells at Udaisagar. This water supply is however heavily dependent on rain fall and is therefore irregular.

Blacksmith has been looking for a response to the drinking water problem. Rotary Udaipur (Mewar) designed a project with funding support from Rotary Melbourne & Rotary International to install a treatment unit at one of the hamlets at Bichadi to arrange for access to clean drinking water to the villagers.

### **Bioremediation of Heavy Metals, Muthia Village, Gujarat**

Muthia village lies on the eastern periphery of Ahmedabad City and borders a major industrial estate. Approximately 60,000 tons of sludge from effluent treatment plants and other untreated waste has been dumped along the boundary between the industrial estate and the village over the last decade. These hazardous wastes have leached into the groundwater, which has turned yellow/red. Monsoon rains wash and spread the contaminated sludge over wide areas.

Concept Biotech and the Society for Environmental Protection have been studying contamination in this

village since 1996. Blacksmith funded the implementation of a three phase clean-up, the last phase of which is the treatment of the site with vermiculture – using worms – which concentrate heavy metals in their bodies, and reduce contamination in the soil.

This low-cost pilot bio-remediation method has proved highly effective in managing & treating waste dumps. The technical solutions to treat toxic dumps are available and can be applicable in a variety of situations.

The successful demonstration of this project has built confidence among the Gujarat State Pollution Control Board (the state regulatory body) to invite Blacksmith to treat similar sites in Gujarat.

This project was documented by CNN International and aired across the globe in October 2007.

Muthia Village,  
Gujurat, India  
Bioremediation  
using worms that  
accumulate heavy  
metals in their bodies  
was used here to  
remove high levels of  
Chromium



# Financial Highlights

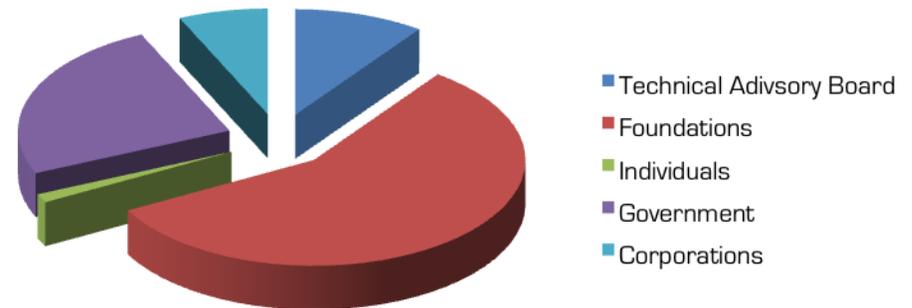
## Income

In 2008, our annual budget more than doubled, with total income above 3 million dollars. This was due in large part to significant increases in funding from government and foundation sources. Notably, Blacksmith Institute received nearly 1 million dollars from the European Commission to carry out the Global Inventory Project. This landmark project aims to identify and assess the bulk of pollution hot-spots around the world.

Our foundation funding grew in two major ways. First, grants from consistent supporters grew substantially. Green Cross Switzerland's annual contribution totaled nearly 1.3 million dollars. Secondly, we reached out to new funding sources. The Annenberg Foundation and Richard and Rhoda Goldman Fund both made generous contributions to support our work in Latin America.

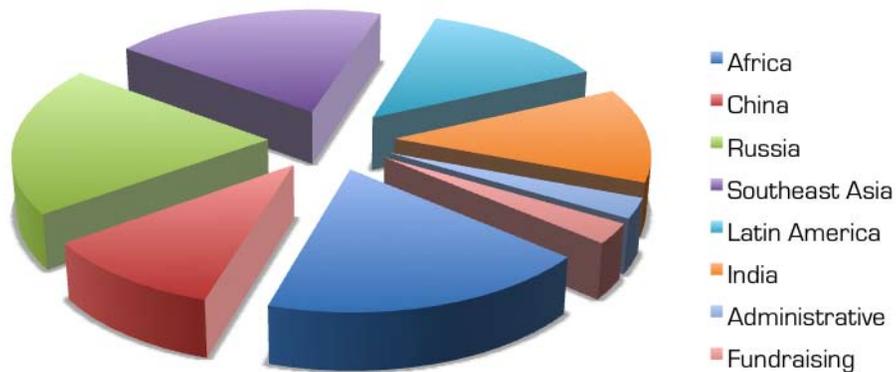
Individual and Corporate contributions also increased during 2008. We developed new fundraising strategies reaching out to small monthly contributors, as well as high net-worth individuals. Contributions from businesses and individuals made up \$170,000 and \$50,000 of our 2008 budget, respectively.

Finally, our Technical Advisory Board, composed of top experts in relevant fields, donate countless hours to Blacksmith. As billable hours donated in-kind the TAB contributes well over \$300,000 annually.



2009 Income by Source

Unaudited as of January 15th 2009. Please contact our office for copies of audited statements



2009 Expenditures by Region

Unaudited as of January 15th 2009. Please contact our office for copies of audited statements

## Expense

Very little of Blacksmith's expenditures go toward administrative costs and fundraising. In 2008, these costs made up less than 6% of total expenditure.

The remaining 94% of our resources are allocated to program expenses in different regions. For the past several years, Southeast Asia has received the largest percentage of program expenses. This is due mostly to the Marilao River Basin project, which receives considerable foundation and government funding, due its scale and severity.

Expenditures in Africa and Latin America increased in 2008. This was due in Latin America to a large regional expansion to four more countries as well as the Haina, Dominican Republic remediation. In Africa, our remediation in Senegal received significant funds, as did our new regional operation in East Africa.

## 2008 Funders

Our resources come from a wide range of sources. We would like to express special thanks to those listed below.

### Foundations

Annenberg Foundation  
Barbara Hope Foundation  
Coca-Cola Foundation  
ERM Group Foundation Inc.  
Green Cross Switzerland  
Kadoorie Charitable Foundation  
Mechner Foundation  
Richard & Rebecca Evans Foundation  
Richard and Rhoda Goldman Fund  
Sohn Foundation  
Vincent Mulford Foundation  
Vista Hermosa Foundation

### Government

European Commission  
Environmental Protection Agency  
Asian Development Bank

### Individuals

Alexander V. &  
Maureen Obrien Moomjy  
Amanda B. Ludlow  
Amy Gomez  
Andrea-Marie J. Smith-Jones and  
Donald E. Jones  
Andrew Biaglow  
Anna Dengler

Barbara Fischer  
C P Osorio  
Carlisle Knowlton Rex-Waller  
Celine Chicote-Navas  
David C and Nichola D Ebel  
David R. Froelke  
Dennis and Eileen Colton  
Donald Jones  
Eugene Choi  
Gabriel A Montano  
Irvine Hunter  
James F. Doran  
Jeffrey Elmer  
JoAnn Hanson  
Kay Binnie  
Kenneth Richards  
Lestrino B. Baquiran  
Margaret Ellen Lyons  
Marisa Raphael  
Mary and Scott Salmirs  
Mary Tyler Knowles  
Miriam and Joseph Bellina  
Murray Palmer  
Nancy Evans Hays  
Newell Washburn  
Patricia Kennedy  
Patrick Hogan  
Paul Roux  
Paula A. Magda  
Peter Ridley  
Rachel Kalman  
Reginald Tartaglione  
Richard and Kelly Lesperance

Richard I. Farr  
Richard Fuller  
Ron Reede  
Ronald Fortune  
Sarah Wolfe  
Sheldon Kasowitz  
Sri P. Wijegoonaratna  
Sylvana Caloni  
Thomas B. Outerbridge  
Tracy Gibbons  
Valerie Lester

### Businesses

ABM Janitorial-Northeast  
AKF Group LLC  
Doyle Trading Consultants LLC  
Eastern Advisors Capital Group LLC  
ESA Biosciences, Inc  
ESRI  
Filco Carting Corporation  
Five Star Carting  
Great Forest Management Services  
IESI Corporation  
Indus Capital Partners, LLC  
Lazard Capital Markets  
Northeast Lamp and Recycling  
Roux Associates  
Royal Waste Services, Inc.  
Searchlight Consulting, Inc.  
SPACESMITH  
Structure Tone, Inc.  
The Angeletti Group, LLC  
Vornado Office Management