BLACKSMITH INSTITUTE

2010 ANNUAL REPORT

Richard Fuller

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Letter from Blacksmith Institute **President** and **Founder**

Dear Reader:
In 2010, Blacksmith Institute demonstrated its commitment to identify and clean up sites contaminated by toxic pollution and reduce the devastating health impacts it causes. This year, Blacksmith's field investigators have identified and evaluated over 1,000 new polluted sites in low- and middle-income countries. While these new data are a great resource, we are sobered by the reality that the scope of this problem is greater than any of us previously thought.

Fortunately, 2010 has been a year of significant progress, and the international community is starting to recognize the importance of this global issue. In September, Blacksmith Institute hosted an international conference in Bellagio, Italy, where leaders from multilateral organizations and environmental ministries convened to share knowledge and outline future steps to address pollution problems.

At the conference, ministers and representatives from developing countries presented the scope of toxic pollution in their own countries, and acknowledged that the problem is a priority for their respective Ministries of Environment. The participants concluded that an international response is needed. Interim solutions must be implemented while a longer-term strategy, such as a fund to specifically address remediation of legacy pollution, is developed. Seeing so many influential leaders and policymakers gathered to tackle this important issue provided great hope for the future.

Blacksmith completed several important cleanup projects in 2010. Among these was a project that remediated the site of a lead smelter in the community of Haina, in the Dominican Republic. After the final round of blood testing, levels of lead in the blood of local children had fallen by roughly 80%.

Our successes in cleaning up these sites are concrete and measurable, and if scaled up, could be used as models to remediate sites on a global scale. There is still much work to do, but we believe this is an issue that can be solved in our lifetime, and one that can improve the lives of more than one hundred million people.

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Pollution:
The Global Impact of Toxic Pollution

The global health impacts from toxic pollutants such as heavy metals, pesticides, and radionuclides are greater than previously thought. Today, more than 100 million people are estimated to be at risk from toxic pollution at levels above international health standards. This is a public health issue as salient as tuberculosis, malaria, and HIV/AIDS, and should receive considerable attention and resources.

Toxic pollution causes immense harm to humans, especially in children. Health impacts include physical and mental disabilities, reduced IQ, organ dysfunction, neurological disorders, cancers, reduced life expectancy, and in some cases, death.

These pollutants exacerbate other health concerns by weakening the body's immune system, rendering it more susceptible to disease. An initial exposure to toxic pollution can be the undocumented cause of later illnesses, including respiratory infections, tuberculosis, gastrointestinal disorders, and maternal health problems. In addition, while most toxic pollution is localized, some pollutants, such as mercury and persistent organic pollutants (POPs), are transboundary and end up in food chains in oceans and distant countries.

The risk that toxic pollution poses to humans was tragically demonstrated by the lead poisoning disaster that unfolded in Nigeria earlier this year. In the spring of 2010, doctors from Médecins Sans Frontières (also known as Doctors Without Borders) discovered an outbreak of lead poisoning in several villages in northern Nigeria. Men from the villages had brought rock containing gold ore into the villages from small-scale mining operations. The villagers did not know that the ore also contained extremely high levels of lead. The ore was crushed inside village compounds, spreading lead dust throughout the communities.

The scope of the contamination was unprecedented. Hundreds of children died as a result of lead exposure. The United Nations estimates that at least 18,000 people have been affected. Children under the age of five were the most severely impacted. In 2010, Blacksmith conducted emergency remediation in seven villages, in collaboration with Zamfara State Government, the Nigerian Federal Government, Médecins Sans Frontières, TerraGraphics Environmental Engineering, UNICEF and other local and international actors. This tragedy should serve as a reminder to us all that toxic pollution is not an abstract problem for future generations, but an acute challenge that impacts millions of lives today.

While the challenges are great, recent successes provide hope for a cleaner future. Blacksmith Institute and its partners have implemented over 40 successful cleanup projects. The case studies in this report highlight some of the strategies available to reduce health impacts from toxic pollution, and demonstrate that this is a problem we can solve.

Blacksmith Institute

Blacksmith Institute is an international not-for-profit organization dedicated to solving life-threatening pollution issues in low- and middle-income countries. A global leader in this field, Blacksmith addresses a critical need to identify and clean up the world's worst polluted places. Blacksmith focuses on sites where human health, especially that of children, is most at risk.

Based in New York, Blacksmith works cooperatively in partnerships that include governments, the international community, NGOs and local agencies to design and implement innovative, low-cost solutions to save lives. Since 1999, Blacksmith has completed over 30 projects; Blacksmith is currently engaged in over 40 projects in 19 countries.

This disparity has made it difficult for the **international community** to engage in targeted remediation efforts to **reduce risks to human health.**

The Global Inventory Project

While polluted sites in high-income countries are generally well researched, less documentation has taken place in low- and middle-income countries. These countries often do not have the regulatory framework or resources to adequately monitor and clean up toxic pollution. This disparity has made it difficult for the international community to engage in targeted remediation efforts to reduce risks to human health.

To address this problem, Blacksmith Institute and the United Nations Industrial Development Organization, with funding from the European Union, Asian Development Bank and other multilateral organizations, are conducting a survey of polluted sites in countries that could benefit most from increased monitoring and site evaluation. This site assessment process, known as the Global Inventory Project (GIP), began in 2009 and will continue through 2011.

The scope of GIP is limited to sites in low- and middle-income countries and where point source toxic pollution exceeds international standards and impacts human health. This limitation is set in order to focus on Blacksmith's area of expertise and on those problems that are causing immediate harm.

Geographic Scope

To date, GIP investigators have evaluated sites in over 40 low- and middle-income countries, as defined by the World Bank. Additional countries will be added to GIP and assessed as the program continues.

Certain countries have not been included in site assessment due to operational hurdles or a lack of applicable sites. For example, Iraq and Sudan will not be evaluated in-person because of ongoing conflict and potentially unsafe conditions. Additionally, areas such as the Balkans and Turkey, which are already subject to increased attention to environmental problems by international organizations, are also excluded, as are island states or countries with very small populations.

Pollutant Scope

GIP is also limited to point source pollution, i.e., pollution that is emitted from a single fixed location. An example of this form of pollution is smoke emitted from a factory rather than exhaust emitted from cars. As cars do not have fixed locations, it would be impossible to trace pollution back to a single unit. Therefore, GIP focuses only on point source pollution because these can be identified, evaluated by an investigator, and targeted for a tailored site cleanup plan.

In addition, GIP only focuses on pollutants defined as "toxic" by the Blacksmith Institute Technical Advisory Board (TAB). This definition excludes sewage, municipal waste, biological oxygen demand, chemical oxygen demand, and greenhouse gasses. The majority of sites identified in GIP are contaminated by heavy metals, pesticides, persistent organic pollutants, radionuclides, poly-aromatic hydrocarbons, particulate matter, and dioxins.

Health Impact Scope

Lastly, site assessment is limited to pollution concentrations that are above international health guidelines and that pose health risks. The recommended maximum pollution concentration levels used are set by the World Health Organization, the U.S. EPA, and other recognized authorities.

While Blacksmith Institute recognizes that environmental damage at any level can have a negative impact on human health, GIP aims to address those sites that pose the most direct and urgent health threats.

Methodology

GIP relies on the research of over 160 trained field investigators (who identify sites of concern, conduct a site visit, take environmental samples for laboratory analysis, and submit Initial Site Assessment reports), 15 graduate degree–holding regional coordinators, and a team of in-house technical experts and researchers.

Each Initial Site Assessment (ISA), which is a standardized document for field investigators, contains pollutant concentration data from environmental sampling, GPS coordinates, an estimate of the number of people at risk, a site description, a description of the industry type responsible for the pollution, and many other categories of data.

Once an ISA is submitted to Blacksmith's home office in New York, in-house researchers review the assessment for clarity and accuracy. An expert from the TAB conducts a final review and adds comments about potential remediation strategies and estimated cleanup costs.

The Blacksmith Index

After an ISA is submitted and reviewed, each site is given a Blacksmith Index score from 1 to 10. This indicates the severity of the problem at the site, with a "1" representing lower risk and a "10" indicating extreme risk. This model is based on the Hazard Ranking System developed for the Superfund Program.

The Index uses ISA data such as the concentration of the main pollutant relative to international standards, the pathway to humans, and the estimated population at risk. The Index provides a mechanism for prioritizing cleanup efforts and allocating resources to those sites that cause the most harm.

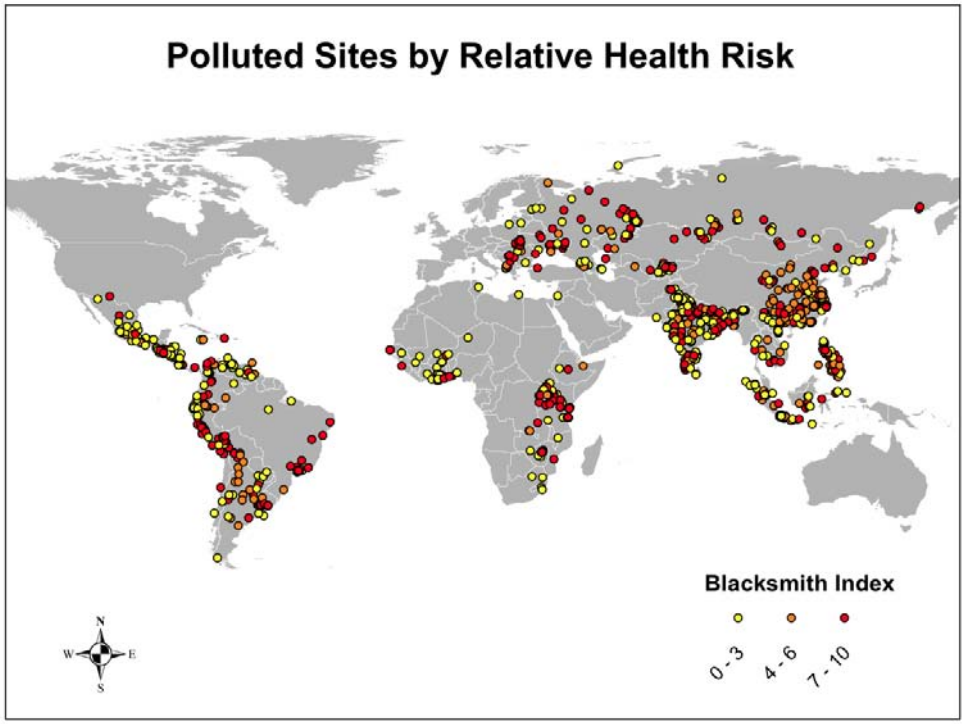
In 2010, the Blacksmith TAB reviewed and adjusted the formulation of the Index model in light of the increasing number of sites assessed and the wide range of information that had become available. The adjusted formulation provides consistent rankings, in terms of risks to human health, across the wide range of sites. It must be emphasized that even with this revision, the Index provides a relative ranking of sites and is intended to help set priorities for a more detailed investigation—it is not, however, a judgment on the health impacts of any one site.

Conclusion

This ongoing global site assessment process is the first attempt to identify and assess sites contaminated with toxic pollution on a global scale. The research from this effort promises to increase our understanding of the scope of toxic pollution and our ability to communicate its global impact.

Going forward, the Blacksmith Index will be a powerful tool to identify and prioritize sites for in-depth analysis and remediation. The site identification and evaluation process will continue throughout the next twelve months, and additional information and data from this process will be available in 2011.

Radionuclides-Radiation warning sign



2010 World's Worst Pollution Problems Report: The Top Six Toxic Threats

In 2010, Blacksmith Institute released its fifth annual report on the scope and impacts of toxic pollution. This year's report, titled "World's Worst Pollution Problems: Top Six Toxic Threats," draws upon the substantial volume of polluted site research the organization has conducted through the Global Inventory Project over the last two years and identifies those pollutants that cause the most harm.

To date, Blacksmith has identified over 2,100 polluted sites in 40 countries, and has conducted in-country assessments at more than 1,000 of these sites. This research has provided Blacksmith with a more sophisticated understanding of the scope of toxic pollution globally, and allows for the level of detail found in the 2010 report.

Summary of the Top Six Toxic Threats

The six pollutants profiled in this report were selected on the basis of the number of people that Blacksmith estimates are at risk from sites impacted by these contaminants. The population estimates are based on research conducted by field investigators as part of our ongoing effort to identify and evaluate polluted sites in low- and middle-income countries.

1. Lead

Lead is a naturally occurring heavy metal, and a key component in car batteries. A powerful neurotoxin, lead is often released during metal smelting and mining. Lead can exist in air, water, soil, and food and enters the human body through inhalation, ingestion, or dermal contact. The health effects of lead exposure can include neurological damage, reduced IQ, anemia, and nerve disorders, among other health problems. The effects of lead are most severe in children, and at high concentrations, lead poisoning can cause death.

2. Mercury

Metallic mercury, the elemental or pure form, is a silver-white metal that is liquid at room temperature. Mercury, commonly used in thermometers, is used in the production of chlorine gas, caustic soda, batteries, and electrical switches, as well as to extract gold from ore. A person can be exposed to mercury through air, water, food, or dermal contact. Mercury is a powerful neurotoxin and can cause severe damage to the brain and kidneys. Inhalation of mercury can also cause lung, stomach, and intestinal damage, and even death due to respiratory failure.

3. Chromium

Chromium is a naturally occurring heavy metal that is commonly used in industrial processes. Although it can be released naturally, most environmental releases of

Pesticides - Pesticide stockpile

To date, **Blacksmith has** identified over **2,100 polluted sites in 40** countries, and has conducted in-country **assessments at more than 1,000 of these sites.**

chromium are from industrial sources. The industries that contribute most to chromium levels include leather tanning operations, metal processing, stainless steel welding, chromate production, and chrome pigment production. Chromium can exist in air, water, soil, and food, and common exposure pathways include ingestion, inhalation, and dermal contact. The primary health impacts from chromium are damage to the gastrointestinal, respiratory, and immune systems, as well as reproductive and developmental problems. Chromium is a known human carcinogen.

4. Arsenic

Arsenic is a naturally occurring element that is frequently characterized as a metal, despite having properties of both a metal and a nonmetal. Arsenic is often found in rocks that contain other valuable metals, such as copper and lead. When smelters heat this ore to retrieve the other metals, the arsenic can be released into the air. Arsenic can exist in air, water, soil, or food, and all of these present potential pathways for human exposure. Arsenic has long been recognized as a poison, and large oral doses can cause death. Lower doses of arsenic can cause decreased production of red and white blood cells, and arsenic poisoning is often characterized by visible changes in the skin. Natural arsenic contamination of ground water is a significant problem in South Asia.

5. Pesticides

Pesticides are substances, often chemical in nature, used with the intent to repel or eliminate species that have an adverse effect on agricultural or horticultural production. Pesticides are also used to fight tropical diseases like malaria. A "pesticide" can be classified as an insecticide, herbicide, fungicide, nematocide, and molluscicide. A significant volume of the pesticides used each year is washed away by rainfall into nearby surface and ground water, making water a common exposure pathway. Studies on chronic health effects of pesticide exposure indicate the potential for neurological, reproductive, and dermatological impacts.

6. Radionuclides

Radionuclides occur naturally in soil and rocks as a consequence of radioactive decay. While they can be released through natural cycles, most environmental releases are the consequence of industrial processes. Common sources of radionuclide exposure include uranium mining and mine waste dumps, nuclear weapon production and testing, processes related to nuclear energy production, and the production of radiological products for medical use. Radiation can damage a living organism's cells upon impact. If radiation affects a significant number of cells, the organism may eventually develop cancer, and at high doses, radiation can cause death.

Mercury-Artisanal mining site

2010 Conference on Legacy Pollution in Developing Countries

In September of 2010, Blacksmith Institute, in collaboration with the Asian Development Bank and the World Bank, hosted a conference with 31 senior-level participants from 16 organizations to discuss the health risks of toxic pollution in low- and middle-income countries. In attendance were five Ministries of Environment (Indonesia, Mexico, Philippines, Senegal, and Ukraine), three multilateral development banks (World Bank, Asian Development Bank, and Inter-American Development Bank), three donor agencies (Canadian International Development Aid Agency (CIDA), Japanese International Cooperation Agency (JICA), and European Commission (EC)), and three UN agencies (UNEP, UNIDO, and WHO), along with Blacksmith Institute and TerraGraphics, an environmental consulting firm.

The purposes of the conference were to 1) Present the scope of toxic pollution in low- and middle-income countries, highlighting the challenges and health effects of pollution using new data collected by Blacksmith and collaborators; 2) Focus on success stories, remediation efforts, and current programs addressing toxic pollution and remediation; and 3) Explore steps in the short- and long-term to promote both awareness of the health effects of pollution and a global response.

Blacksmith Institute presented the preliminary results of its Global Inventory Project, which works with local experts in over 40 countries to identify highly contaminated sites with significant health risk. The project has revealed thousands of places where the health of an estimated 56 million people is endangered. Blacksmith extrapolates that the total global population at risk likely exceeds 100 million.

The conference acknowledged that the international community poorly understands the scope of toxic pollution, and that more work must be done to assess hotspots in Africa, the Middle East, Central and Eastern Europe, and Latin America – regions where the assessment effort currently lacks funding. Agencies presented their current efforts and programs as case studies.

Attendees of the Bellagio Conference

Country representatives presented the scope of toxins in their own countries and acknowledged the priority of the problem for their respective Ministries of Environment. Participants indicated varying levels of national governmental capacity to deal with these issues. Conference participants concluded that an international response to these issues is needed, and that interim solutions should be set while a longer-term strategy is developed. One such strategy is to create a fund that addresses remediation of legacy pollution and emergencies, but this would require more research with regard to its scope and implementation. More work is also needed to determine which types of toxic sites could best utilize the fund, which would minimally be available for remediating compelling legacy sites in Least Developed Countries; for emergencies; and for technical assistance and capacity building in target countries.

Consensus was reached that artisanal pollution should receive considerable attention, as it best integrates into the development agenda with its clear ties to poverty and livelihood issues. Emphasis was also placed on the utility of a holistic approach dealing with chemicals throughout their lifecycle, and that remediation efforts should be closely coordinated with ongoing initiatives. The group agreed that Blacksmith Institute, as an established leader in this field, would be appropriate to continue leading these efforts.

The following priorities were defined:

1. The international community and national governments must be made aware of toxics issues, data, and remediation efforts, and introduce these topics in their governing councils, conferences, and meetings of member states or state parties.

2. Finance, health, and environment agencies in recipient countries are responsible for setting their development agendas and need to be educated about the scope of toxins within their countries in order to pursue international resources.

3. Current efforts must be coordinated to maximize resources, and all options for a long-term fund should be researched and presented. This should include working within existing mechanisms, such as the UNEP Chemicals Financing Initiative; GEF; the Basel, Stockholm, and POPS Conventions; SAICM; the Montreal Protocol; and the new mercury treaty under development.

4. Additional research in Africa, Latin America, Middle East, and Central and Eastern Europe is critical to better understand pollution's global scope.

5. National capacity in low- and middle-income countries is crucial to identifying hotspots with human health impacts and addressing them through policy efforts, regulations, and remediation.

6. Financial support to pursue the above activities is necessary. All options should be explored, including working with private industry and foundations.

Additional research in Africa, Latin America, Middle East, and Central and Eastern Europe is critical to better understand **pollution's global scope.**

Cleanup projects

Africa

Zamfara, Nigeria

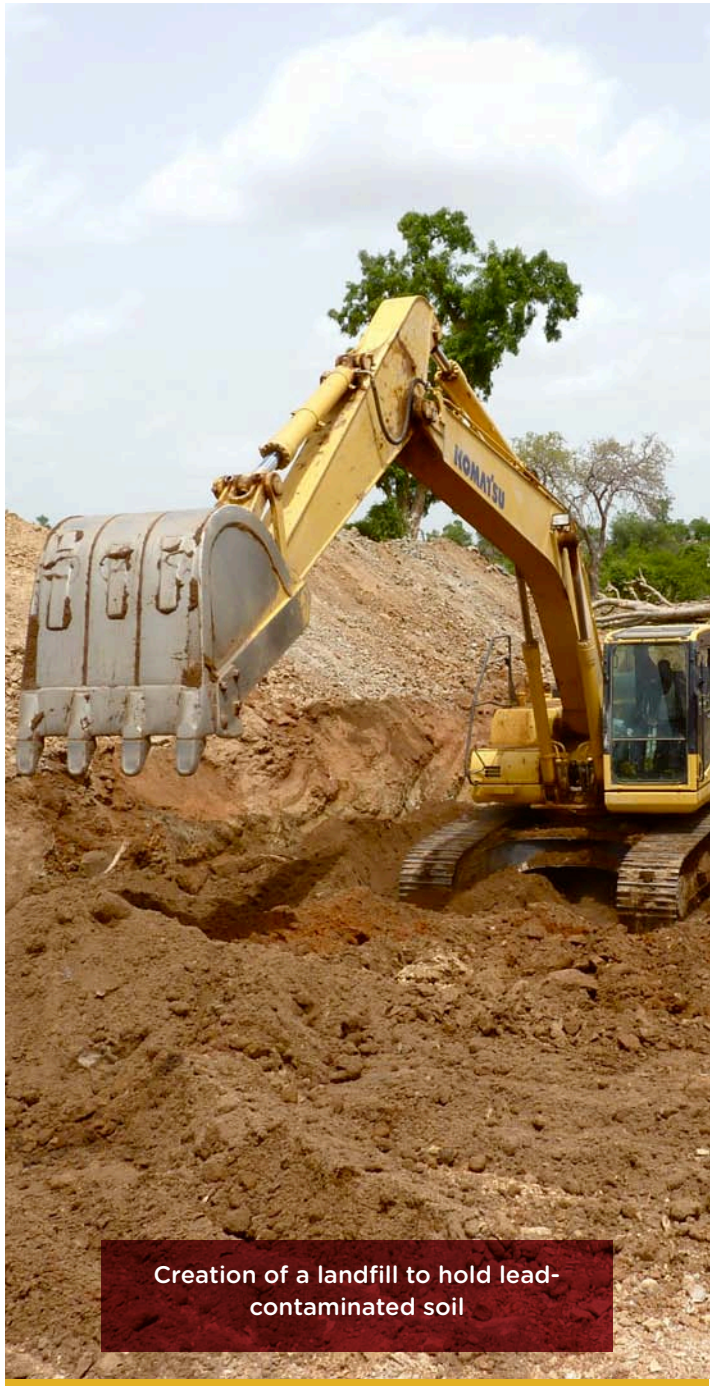
In early 2010, doctors from Médecins Sans Frontières (MSF) noticed an unusual absence of children in several villages in Zamfara State in northwest Nigeria. Inquiries revealed most children had died unexpectedly. This epidemic was reported to the State Health Authorities, who invited international specialists to investigate the cause of death. Investigations led by the U.S. Centers for Disease Control and Prevention (CDC), in collaboration with federal and Zamfara State authorities, MSF, Terragraphics Environmental Engineering, Blacksmith Institute, and the World Health Organization (WHO), revealed that the outbreak was caused by acute lead poisoning.

The source of the lead contamination was the informal processing of lead-rich ore to extract gold. Men from the villages had brought rocks containing gold ore into the villages from small-scale mining operations. The villagers did not know that the ore also contained extremely high levels of lead. The ore was ground into dust inside village compounds, spreading fine particles of lead throughout the community.

Blacksmith Institute joined a CDC field investigation that measured blood-lead concentrations in 113 samples from young children in the villages of Yargalma and Dareta. The results showed that 100% of the children had blood-lead levels (BLLs) exceeding 10 µg/dL (the international standard for the maximum safe levels of lead in blood), 96% exceeded 45 µg/dL, and 84% exceeded 70 µg/dL. The investigation also discovered that there were 78 deaths in Yargalma (30% of the population was less than five years old in the village) and 40 deaths in Dareta (20% of the population was less than five years old), totaling 118 deaths in these two communities since the beginning of the year. 95% of all deaths were in children under the age of five. As of September 2010, it was estimated that a total of 2,500 children had life-threatening levels of lead in their blood. Further investigation identified at least twelve additional villages where similar ore processing activities occurred. Areas in five of those villages were sampled, including family homes and compounds. Some soil-lead concentrations exceeded 100,000 ppm, far above the recommended maximum of 400 ppm considered acceptable for residential areas. Ingestion of contaminated soil has been the primary pathway of lead exposure.

Project Strategies

Throughout 2010, the State and Federal health authorities of Nigeria partnered with WHO, CDC, MSF, UNICEF, Terragraphics, and Blacksmith Institute to address this problem. MSF offered chelation therapy—a treatment for removing lead from the body—to children testing at critical levels.



Creation of a landfill to hold lead-contaminated soil

To ensure the children did not return to homes that were still contaminated with lead, Blacksmith and Terragraphics conducted environmental decontamination and remediation in seven villages in collaboration with local authorities. Local villagers were trained to assist with the cleanup operations. Cleanup crews removed contaminated soil to landfill sites and replaced it with clean soil. In addition to soil removal, a thorough removal of dust from all interior spaces and compounds was completed.

Project Outcomes

The Zamfara project produced three primary results: a marked drop in lead and mercury exposure levels; facilitation of a chelation treatment program; and capacity building of local organizations and individuals.

Over the course of the project, 282 family compounds, 107 exterior areas, and 23 processing ponds were remediated. Contaminated soil was moved to landfills and replaced with clean soil measuring less than 100ppm of lead.

MSF provided chelation therapy to hundreds of families and over 1000 children under five years old. These children were subsequently returned to their remediated family compounds. On average, the BLLs of these children were above 45 µg/dL before chelation therapy. After this medical regimen and the remediation project, BLLs were, in some cases, reduced by roughly 98%.

Education and community outreach were significant components of this project. Villagers now understand the dangers of lead and have measures to safeguard their families. Health and environmental staff in Zamfara State were trained to manage and supervise future remediation programs.

Application of clean soil in domestic compounds

Gold processing pools

Local workers removing contaminated soil

Dakar, Senegal

Street excavation of Thiaroye-Sur-Mer

When 18 children under the age of five died in the neighborhood of Thiaroye Sur Mer in Dakar, Senegal, Blacksmith Institute was called to coordinate a cleanup of the area. These children all died from acute lead poisoning due to consistent exposure to lead dust in the air, soil, and water. The source of lead exposure was quickly determined to be the informal recycling and disposal of used lead-acid batteries (ULAB). This practice was a popular way to supplement domestic income, and was typically undertaken by the women of the community. Because this activity took place in an informal, domestic setting, the unregulated practice exposed some 40,000 people to lead dust.

Upon learning of the death of the 18 children, the Senegalese government shut down these illegal lead battery–smelting operations. Blacksmith Institute tested the blood-lead levels of 41 children. 100% of the children had blood-lead levels over 10 µg/dL, with several over 150 µg/dL. The WHO states that any test indicating a blood-lead level over 70 µg/dL in children is cause for the declaration of a medical emergency. Most of the cleanup work was completed by the end of 2010, and was designed by TerraGraphics Environmental Engineering.

Project Strategies

This project brought together the Blacksmith Institute, the University of Dakar's Toxicology department, as well as the Senegalese Ministry of Environment. The latter two partners developed an educational program in conjunction with local religious and village authorities to convey the dangers and potential persistence of exposure to lead. The WHO committed to treating those who were already exposed, and the local government initiated remediation efforts to treat the soil with funding from Blacksmith Institute and other partners. Policy changes were also implemented to eliminate the market for informal ULAB recycling by better regulating battery collection, transportation, storage, and recycling practices. The Senegalese Department of Women's Affairs was also involved to develop alternate sources of income, and reduce the economic incentive to turn toward informal ULAB recycling.

Project Outcomes

As a result of the remediation work, soil-lead concentrations were drastically reduced from the extreme highs of 400,000 ppm (40% lead). Children between the ages of 1 and 5 that had blood-lead levels in excess of 150 µg/dL in early 2008 now exhibit average blood-lead levels of 53.5 µg/dL with the downward trend continuing. Similar decreases were seen across other age groups, pointing to an overall downward trend in blood-lead levels across the board—a significant achievement in a community that was previously experiencing widespread lead poisoning.

Excavated soils contaminated with lead

Latin America and the Caribbean
Haina, Dominican Republic

According to the United Nations, the population of the community of Haina, Dominican Republic, was considered to have the highest level of lead contamination in the world, with 90% of the population showing indications of lead poisoning. Located near an abandoned used lead-acid battery (ULAB) recycling smelter, the level of contamination in the community prompted the Dominican Secretary of Environment and Natural Resources to identify Haina as a national hotspot of concern in 2000.

The site and surrounding area was the scene of severe lead poisoning in the 1990s. In 1997, 116 children were surveyed in March, and 146 children later in August. Mean blood-lead concentrations were 71 µg/dL in March and 62 µg/dL in August. The study revealed that at least 28% of the children required immediate treatment and 5% had lead levels >79 µg/dL, putting them at risk for severe neurologic damage. In the U.S., the EPA and CDC action level for blood-lead concentration is 10 µg/dL. However, studies have found neurobehavioral impairment in children with blood levels below this guideline.

Over 90% of Haina's residents were found to have elevated blood-lead levels, with an estimated 300,000 people directly affected. Further testing by Blacksmith staff continued to show elevated blood-lead levels, despite the discontinuation of smelting activities at the plant.

Project Strategies

With such high levels of lead, removal of the contaminated material and education about risks of lead was urgently needed. In 2007, Blacksmith formed a stakeholder group that included all of the relevant parties involved—community members, government officials, and local NGOs—to discuss the problem and formulate a plan of action. Blacksmith staff also conducted education workshops for local children to help minimize their exposure to lead dust and materials, and continued monitoring blood-lead levels.

Once the government took control of the land, technical experts from the United States and the Dominican Republic surveyed the site and developed a remediation plan for safely removing the contaminated soils and materials.

Project Outcomes

Between December 2008 and March 2009, Blacksmith and Terragraphics, Inc. coordinated the removal of over 6,000 cubic meters of contaminated soil from the site and transferred it to a specially constructed and lined pit at a nearby industrial estate. The previously contaminated site was then re-graded into a local park. Since the intervention at Haina by Blacksmith and its partners, the health threat from lead has been greatly reduced. Blood-lead concentrations dropped dramatically from 71 µg/dL and 62 µg/dL in 1997 to 31 µg/dL and 28 µg/dL in 2008 and 2009. Soil concentrations also significantly dropped from 11,400 and 463,970 ppm in 2006, to between 10 and 300 ppm in 2009 —well within the U.S. EPA safety standard.


Discarded ULABs in the community


Removal of contaminated soil in Haina


Recycled and discarded ULAB waste dump

Mexico
Transitioning from Lead-Based Glazes

In 2010, Blacksmith made significant advances in its effort to reduce the use of lead-based glazes among Mexican artisanal ceramicists. With its partner organization, Fondo Nacional Para El Fomento De Las Artesanias (FONART), a Mexican government agency, Blacksmith conducted environmental remediation to reduce immediate health risks, and has created a new culture of cooperation among major local health organizations.

An estimated 50,000 ceramics producers in Mexico use lead-based glazes. Toxic lead dust from the process pollutes workspaces, homes, and communities. As a result, blood-lead levels for locals in some cases are five times higher than the international standard, producing irreparable neurological damage in children.

Project Strategies

To deal with the problem, a two-part plan was conceived. First, Blacksmith and partners conducted an education and outreach campaign to persuade Mexican potters to switch to a low-cost, lead-free alternative glaze. This campaign included community outreach, brochures, and blood tests for children to highlight their elevated blood-lead levels.

Once artisans decided to switch glazes, phase two of the project provided workspace remediation to ensure that legacy pollution from years of lead-based glaze use was removed to reduce the risk of ongoing exposure.

Project Outcomes

Of the people who underwent blood testing, those who still used lead glazes had an average blood-lead level of 30.56 ug/dL, over three times the WHO recommended maximum of 10 ug/dL. However, of those who had recently abandoned those techniques for non-lead glazes, the average blood-lead level was 17.73 ug/dL. In May 2010, Blacksmith conducted an additional round of testing that showed that many of those who converted to non-lead-based glazes, and whose workstations had been remediated, showed blood-lead levels below 10ug/dL.

As part of the education campaign, Blacksmith has created a website where customers can identify lead-free producers and learn about lead-free glazes:
www.alfareria.org

Small-scale ceramics production studio

Glazes used in traditional ceramics often contain dangerously high levels of lead

Southeast Asia
Jakarta, Indonesia

Jakarta, located in northwest Java, is the capital and largest city in Indonesia. While Jakarta's 2001 phase out of leaded gasoline has improved the air quality and blood-lead levels in the city and surrounding areas, several regions of Jakarta still suffer from high lead contamination. One major source is used lead-acid battery recycling (ULAB) and smelting, which is often conducted in the open air, in densely populated urban areas.

In 2004, Komite Penghapusan Bensin Bertimbel (KPBB), an Indonesian group working to completely phase-out leaded gasoline in the country, investigated other industrial sources that could be responsible for lead poisoning. Their survey identified 71 ULAB recycling and smelting sites in Jakarta and the surrounding region. In early 2010, KPBB initiated a regional project, funded by Credit Lyonnais Securities Asia, to assess the degree of contamination from ULAB recycling and lead smelters and reduce public health risks from these sources of lead poisoning.

Project Strategies

Blacksmith Institute has been working since May of 2010 with KPBB to synthesize a plan of action, build the technical capacity of KPBB, and design remediations for the removal of contaminated soil in and around Jakarta.

In May, Blacksmith staff supplied KPBB with equipment, technical expertise, and site assessment design in order to help the organization assess the degree of pollution caused by ULAB recycling and lead smelters. KPBB staff were trained to use XRF lead testing devices, follow rapid assessment protocols, and use lead care blood testing kits.

Simultaneously, Blacksmith helped KPBB organize a stakeholder group, produce educational and outreach materials, run community education meetings, and network and build partnerships with local health departments and other governmental bodies. The sharing of data with the related Indonesian authorities has been a large part of this joint program between Blacksmith and KPBB.

Project Outcomes

Of the 71 ULAB recycling and smelting sites identified by KPBB Blacksmith helped select 34 smelter sites for further investigation and site assessment. The majority of these sites have lead concentrations in soil that exceeded the EPA limit of 400 ppm—the highest reading was 252,600 ppm.

Blood sampling in these sites indicates the severity of lead poisoning from legacy smelters in Jakarta. As of August, the average blood-lead level in Cinangka village, the site of 20 smelters, was 36.6 ug/dL, and BLLs ranged from 16.2 to over 60 ug/dL, all above the WHO standard of 10 ug/dL.

From these data, Blacksmith identified the legacy smelters in Cinangka, Curug, and Rawa Buaya as target remediation projects. These decisions were finalized in December, and the pilot remediation will begin in February 2011.

In addition to remediating polluted villages and reducing exposure to lead, these collaborative projects will culminate in the production of a report to highlight policy recommendations to the Indonesian government.

Route of used batteries in Indonesia


Sampling soil for lead concentrations

East Asia
Nandan, China

Nandan, located in China's Guangxi province, is home to both the Diaojiang River and a heavy metals mine. The Diaojiang is the source of the Red River water system, which flows from Nandan County to the City of Hechi, providing water for more than three million people. However, since the opening of the mine in the 1980s, the river has been badly polluted with heavy metals such as arsenic, lead, cadmium, and zinc. This mine has not only discharged wastewater into the river, but also left tailings piled on riverbanks. These tailings wash into the river during storm seasons and as a result, fish and shrimp have died, riverbank farmlands cannot be cultivated, and downstream communities suffer from health problems.

In 1998, the Hechi City government launched the Diaojiang treatment project in order to build wastewater treatment facilities, which improved water quality significantly, but did not address the polluting tailings. Lack of funds and remediation technology further hampered cleanup, until Blacksmith joined with the Chinese Research Academy of Environmental Sciences and Environmental Protection Bureau of Nandan County to address the issue.

Project Strategies

As an initial strategy, Blacksmith organized a stakeholder group that met frequently during the project's duration and rallied the community around remediation. Blacksmith developed a pilot cleanup plan for the polluted area at the origin of the Diaojiang, which was approved by the local Water Conservancy, Land, and Agriculture Bureaus and the Minerals Council.

Project Outcomes

Blacksmith's demonstration project on heavy metal contamination at the Diaojiang—funded by Rockefeller Philanthropy Advisors—has been successful. The resulting project technical report provided a needed reference for the Environmental Protection Bureau of Nandan County to obtain more information and resources to tackle the problem.
In addition, the Chinese government has designated the Nandan project as a central part of a national heavy metal treatment plan and has allocated nearly $16 million to the Environmental Protection Bureau of Nandan County to address the pollution. Together, these steps will advance the Nandan remediation project from a planning stage to that of treatment and field engineering.


Farmhouses and fields near a polluted river


Ore processing facilities


Piles of slag from mining operations

Daobaoshan Mine, China

Located in Guangdong province near the Hengshui River, the Daobaoshan mine is property of the state-owned Guangdong Daobaoshan Mining Co. Ltd. At Daobaoshan, roughly 6,000 tons of copper ore and 850,000 tons of iron ore are mined each year, and the mine was once the largest zinc mine in China.

Wastewater and sludge from the mine's activities have polluted the lower section of the Hengshui, and mounds of tailings are discarded along rice paddy fields. Locally used waters and soils have become contaminated with cadmium, lead, arsenic, as well as other heavy metals, thereby affecting the health of the various villages and towns located nearby.

One of the primary regions impacted by the pollution from Daobaoshan mine is Shangba Village. With a population of roughly 3,300, Shangba is an agricultural village where rice and sugar are the main crops. Environmental testing in the region has demonstrated that both the irrigation water and agricultural soils of Shangba Village contain concentrations of cadmium that exceed the national average, and health surveys show a very high local incidence of cancer. The source of Shangba's high cadmium levels is a nearby dam that stores tailings from the Daobaoshan mine.

Project Strategies

In July of 2009, Blacksmith Institute identified the Guangdong Institute of Eco-Environment and Soil Sciences to be its local partner for the remediation of Shangba Village. Blacksmith provided financial support and technical assistance.

The ultimate aims of the project were to 1) Remediate the contaminated soils with cadmium-accumulating rice plants, 2) Reduce the presence of heavy metals in the food chain through the application of silicate fertilizer, and 3) Develop a method for purifying water sources used by villagers for irrigation.

To assist in this process, from 2009 to 2010, Blacksmith Institute helped the Guangdong Institute formulate a stakeholder group, which consisted of members from the Shaoguan Environmental Protection Bureau, city government, and Center for Disease Control and Prevention. With assistance from Blacksmith's TAB, this group met at least monthly throughout the year to design the remediation, collect baseline data, and plan intervention projects. Local citizens were also recruited to participate in the process.

Project Outcomes

By November of 2010, Guangdong Institute's pilot experiment with cadmium-accumulating rice plants and silicon fertilizer showed a 5 to 8 percent yield increase when compared to contaminated soils without this treatment. Likewise, after water purification methods—including physical precipitation of suspended substance and heavy metals with polymer, chemical adjustment of pH with limestone and slag, and biological treatment with wetlands—the concentration of cadmium was found to be within national standards, and water can now safely be discharged into surface bodies or used in irrigation.

In the last stages of the remediation project, Blacksmith will continue to advise and fund the Guangdong Institute and stakeholder group to refine the design of their water purification technique and to finalize heavy metal analysis of the remediation experiment. Lastly, the group will prepare a booklet with the main results of this project to distribute the knowledge and countermeasures gained to the residents of Shangba Village.

Map of mine and nearby town


A river polluted from mine waste

Financial Highlights
Income

In 2010, Blacksmith Institute was granted $994,290 from the United Nations Central Emergency Response Fund for emergency lead remediation in Zamfara State, Nigeria. Blacksmith also procured a consulting services contract for $890,915 with Asian Development Bank to conduct polluted site identification and assessment activities for the Global Inventory Project. Other significant funding included support from CLSA, Conservation Food and Health, Green Cross Switzerland, Rockefeller Brothers Fund, Rockefeller Philanthropy Advisors, Trust for Mutual Understanding, Vista Hermosa, and Queen Anne Gate Foundation.

Although the weak economy has continued to suppress foundation funding, Blacksmith's ability to procure funds from bilateral and multilateral organizations improved in 2010. Blacksmith's future financial strategy includes increased efforts to secure gifts from private donors, and significant funding from bilateral and multilateral organizations.

Blacksmith has also benefited from the generosity of our Board members, who contributed approximately $280,000. Finally, Blacksmith Institute has benefited from the ongoing commitment and generosity of our Technical Advisory Board, composed of world-renowned leaders in environmental fields, who donate countless hours to help Blacksmith design and implement practical, low-cost solutions to clean up the world's worst polluted places and create healthier communities.

All financials are in the process of audit as of April 2011.

Statement of Activities for the Year Ended December 2010

Revenue

Contributions (Unrestricted)	389,479
In-Kind Donations	930,000
Grants (Restricted)	2,407,906
Total Revenue	3,727,385

Expenses

Program Expenses

CERF Nigeria	1,298,557
Global Inventory Project	732,772
Africa	135,252
Health and Pollution Fund Program	184,286
India	24,821
Latin America & Caribbean	54,945
Russia and Eastern Europe	38,450
Asia, Southeast Asia	197,663
Total Program Expenses	2,666,746
Management and General	264,966
Fundraising	12,361
Total Administrative Expenses	277,327
Total Expenses	2,944,073

Expenses

In 2010, Blacksmith was able to continue its trend of operating with very low overhead, with administrative and fundraising expenses amounting to 9% of total outlay. 2010 saw major expansions in the Global Inventory Project (GIP), adding nearly 1,000 new site assessments to our growing global inventory of polluted places. The growth of GIP is a major achievement and will play a significant role in Blacksmith's programmatic strategy moving forward.

Beginning in 2011, Blacksmith Institute will lead various national governments in the development of Nation Toxics Action Plans (NTAPs) to develop strategies and mechanisms to deal with legacy pollution hotspots once and for all. These NTAPs will rely on the GIP database of polluted sites and the Blacksmith Index to identify sites that require immediate remediation, and prioritize those sites based on their human health impact.

Blacksmith has also begun training officers and staff from national environmental ministries to conduct site assessments according to Blacksmith's GIP Initial Site Assessment Protocol. These Mid-Level Workshops facilitate a two-way sharing of information: first, they allow Blacksmith to share existing GIP inventory data with national governments, and second, they train ministry staff to conduct site assessments that can be entered into Blacksmith's master database and increase the breadth and depth of the inventory. The Global Inventory Project is also a key program in the development of the Health and Pollution Fund, and continues to drive the selection process for Blacksmith's remediation projects.

Expenditures in Africa continued to be high in 2010, primarily due to the emergency lead remediation project in Zamfara, Nigeria—Blacksmith's largest project to date. Starting in June, and continuing throughout the year, Blacksmith Institute and its partners carried out remediation activities in seven villages, resulting in a 98% reduction in lead uptake.

2010 also saw the completion of our lead remediation project in Haina, Dominican Republic, where levels of lead in children's blood have fallen from an average high of over 70 ug/dl—over 7 times the maximum recommended level of 10 ug/dl—to 9.8ug/dl after the project was completed.

Statement of Financial Position for The Year Ended December 31, 2010

Assets

Cash	392,785
Accounts Receivable	839,964
Fixed Assets	150,549
Other Current Assets	20,059
Total Assets	1,403,357
Liabilities	1,265,000
Grant Payable (Projects)	1,265,000
Net Assets	138,357
Total Liabilities and Net Assets	1,403,357

2010 Funders

We would like to thank all those listed below.

Foundations

Barbara Hope Foundation Inc.
Climateworks Foundation
Conservation Food and Health
Green Cross Switzerland
Martin J. and Susan B. Kozak Fund
Rockefeller Brothers Fund
Rockefeller Philanthropy Advisors
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Government

Asian Development Bank
European Commission
United Nations Central Emergency Response Fund

Businesses

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