The Poisoned Poor: Toxic Chemicals Exposures in Low- and Middle-Income Countries
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Toxic chemicals from industry, mining and agriculture affect the health of hundreds of millions of people world-wide.

Heavy metals, pesticides, solvents, radionuclides and other toxic substances can be found at dangerous levels at thousands of sites around the world, in drinking water, soil, air and food. These chemicals (lead, mercury, chromium, pesticides, etc.) disproportionately impact local populations in the poorest towns and neighborhoods. Children are especially vulnerable to the effects of toxic pollution. Without intervention and cleanup, toxic pollution poses real long-term health and environmental challenges, and can significantly impede economic and social development.

A recent review of more than 3,000 toxic sites worldwide, part of the ongoing Toxic Sites Identification Program, a project funded by the World Bank, European Commission and Asian Development Bank, showed that as many as 200 million people may be directly affected. A detailed analysis of 373 of these contaminated sites in India, Indonesia and the Philippines calculated that the amount of disease caused by toxic exposures was similar to that of malaria or outdoor air pollution in those three countries. The impact of these diseases, in terms of global public health, and the commensurate loss in economic capacity, is enormous.

The review also showed that the majority of acutely toxic sites, especially in terms of health exposures, are caused by local business, many of them artisanal or small-scale. Abandoned or legacy sites are also quite common. Large multinational corporations are rarely implicated.

Interventions to mitigate these toxic exposures while protecting livelihoods have proven to be manageable and affordable. Projects in a number of countries, including India, Senegal, Indonesia and the Philippines, have produced cost-effective solutions for a wide range of toxics issues. Many of them have been conducted in collaboration with local communities, governments, and international agencies such as the World Bank, United Nations Industrial Development Organization (UNIDO) and Blacksmith Institute.

Aside from the obvious health benefits, solving these problems usually promotes, rather than inhibits, economic growth. Solutions can increase access to valuable resources, such as more efficient recovery of lead from battery recycling, or reclamation of land in urban areas. Technical solutions that offer more profit to small-scale players through improved, toxic-free technology transfer can contribute to sustainable development and poverty reduction. No less important, enacting solutions now can avoid longer-term economic constraints, such as mental disability and cognitive impairment of children and rising health care costs from illnesses associated with toxic exposures.

Toxic pollution is a serious concern in the Philippines. Our country urgently needs resources and expertise to be able to control active emissions, prevent future pollution, and clean up legacy pollution to protect human health and the environment.

> Neric Acosta, Presidential Adviser for Environmental Protection, Office of the President, Government of the Philippines
Practical Strategies by Type of Toxic Site

Toxic exposures can be categorized into a series of problems that are seen time and again. Because the categories are similar from country to country, solutions to each type are replicable. Generally, cleaner technologies and better enforcement of environmental regulations are needed in coordination with low-cost clean-up of legacy contamination. Listed below are a few examples of commonly seen problems, and strategies to address them. More detailed examples are presented below under Strategies for Success.

Examples

- **Toxic site type:** Localized lead poisoning from car battery recycling.
  
  **Global exposed population:** More than 20 million people.
  
  **Solution:** Develop incentives to formalize the informal sector and assist polluting smelters to institute cleaner technologies. Clean up legacy sites. Remediation models available from projects in the Dominican Republic, Senegal and Indonesia.

- **Toxic site type:** Mercury contamination from small-scale gold mining.
  
  **Global exposed population:** Up to 17 million people.
  
  **Solution:** Train miners in mercury free technologies that increase gold yields. Mercury-free methodology from the Philippines being tested now in Indonesia, Bolivia, Tanzania and Ethiopia.

- **Toxic site type:** Chromium contamination from industry and anaerobic conversion of trivalent chromium (used in tanneries) to hexavalent chromium.
  
  **Global exposed population:** More than 15 million people.
  
  **Solution:** Clean up contaminated sites, and treat contaminated ground water. Set up treatment plants for tannery effluents. Models for both in India.

- **Toxic site type:** Heavy metal contamination from mine tailings.
  
  **Global exposed population:** More than 25 million people.

**Solution:** Develop appropriate tailings management systems. Monitor active mines and clean heavy metals from land. Successful models in China.

- **Toxic site type:** Electronics waste exposures—dioxins, PAHs and other toxic chemicals from burning plastics and cables, and lead and cadmium from CRT recycling.
  
  **Global exposed population:** More than 3 million people.
  
  **Solution:** Formalize the sector, and relocate away from densely populated urban centers. Introduce better technologies and training for recyclers. Models in China and ongoing efforts in West Africa, including Ghana.

Other types of problems include industrial estates, municipal/industrial dumpsites, chemicals manufacturing, electroplating industries, and smelters.

In general, regulatory responses to these problems alone are insufficient. Enforcement capacity in most countries is sparse, and many regulations exist on paper that are inadequately enforced. Local capacity to manage toxics exposures, especially from orphaned or legacy sites, is generally inadequate. This is often due to lack of resources, technical expertise and trained personnel, rather than lack of political will. **Large gains in public health can potentially be achieved with small investments in site identification, training and technology transfer.**

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3 Global exposed population numbers are an estimate based on analysis of trends in the current Toxic Sites Identification Program database.

4 Strategies presented here are simplified representations of solutions for each type of problem. GAHP is not suggesting a one-size fits all solution to each problem, but rather that successful examples of solutions exist for the various commonly found types of problems, and as models, they can be used and adapted to the particular context found at each individual site.
GAHP is tackling an important issue for an Asia that is rapidly industrializing and urbanizing.

> Rajat Nag, Managing Director General, Asian Development Bank

Government Strategies

Many countries have been responsive to the issue of toxic pollution and its human health impacts. In each country, there is a need to first:

— identify hotspots, and cluster them into type of exposure, toxicant and solution;
— define resources needed to mitigate health impacts;
— coordinate international and national resources for effective management, and health risk mitigation.

Such processes are at various stages of activity in a number of countries to date, including India, China, South Africa, the Philippines, Indonesia, and Mexico, among others. Many countries have taken action with support of agencies such as the Asian Development Bank, European Commission, the World Bank, World Health Organization and US Environmental Protection Agency, and UNIDO, Some countries have built up their own expertise and are engaging in South-South cooperation to share best practices and assist other countries to tackle their toxic pollution problems. For example, the Mexican Secretary of the Environment and Natural Resources (SEMARNAT) is sharing its experience with setting up a national inventory system of contaminated sites and environmental impacts with the Government of Peru, and artisanal gold mining experts from the Philippines are training Indonesian miners to use a Philippine mercury-free technique to extract gold. A large number of low- and middle-income countries need assistance and transfer of other country experience, technical know-how, successful replicable models, and resources to address these problems.

Global Alliance on Health and Pollution (GAHP)

The Global Alliance on Health and Pollution (GAHP) was formed in 2012 to assist low- and middle-income countries to implement solutions to the problems posed by chemicals and wastes. It is led by the Asian Development Bank, Blacksmith Institute, the European Commission, UN Development Program, UN Environment Program, UN Industrial Development Organization, the World Bank and many others.

GAHP offers technical expertise, guidance and resources to help clean up toxic hotspots, prevent re-contamination and guard against future pollution.

This report, presented by GAHP, provides an overview of the scope of toxic pollution in low- and middle-income countries, and its impacts on human health—the poisoned poor—as well as implications for sustainable development, especially poverty and economic growth. It also presents examples of successful strategies to mitigate human health risk. More details on GAHP and the services it provides are included at the end of the report, and can also be found at www.gahp.net.
Toxic Sites—
Current Knowledge

Since 2009, Blacksmith Institute and the United Nations Industrial Development Organization (UNIDO), have been carrying out the Toxic Sites Identification Program (TSIP), an effort funded in part by the Asian Development Bank (ADB), the European Commission, Green Cross Switzerland and the World Bank, to assist low- and middle-income countries to identify and screen contaminated sites where public health is at risk.

More than 3,000 sites have been identified so far in 47 countries, of which more than 2,100 have been visited and screened. These sites alone represent a potential health risk to more than 80 million poor people, a number that is expected to rise as more sites are visited. However, it is important to note that even these 3,000 identified sites likely represent a small fraction of the overall total. By way of example, over the past twenty years, the United States Environmental Protection Agency (U.S. EPA) has identified tens of thousands of sites in the US alone that require remediation, and its National Priorities List for urgent remediation currently contains more than 1,300 sites. Analysis of the data and trends in the TSIP database indicates that as many as 200 million people may be affected in total.

To implement this ongoing work, Blacksmith has contracted roughly 225 professionals. These individuals, often from the environment or health departments at a national university, are trained to identify and assess contaminated sites using the Initial Site Screening (ISS) protocol.

More than 2,100 sites have been visited and screened by investigators as part of the Toxic Sites Identification Program (TSIP). While this is by far the largest global database of its kind, it likely represents a fraction of sites worldwide.

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5 http://www.epa.gov/superfund/sites/index.htm
assess, such detailed assessments are unaffordable for many low- and middle-income countries. Blacksmith’s Initial Site Screening (ISS) protocol provides an alternative first step for governments. The ISS is not an in-depth assessment, but rather a rapid evaluation of key criteria. The ISS identifies major elements of a contaminated site, including estimated population at risk, key pollutant information, human exposure pathway data and sampling data. The ISS can serve as the basis for comparing sites that present a range of different contaminants. Sites can be compared based on their estimated risk to human health and later prioritized for further investigation or intervention.

A typical ISS, including staffing, travel, sampling and overhead, costs about USD 1,000. Certain pollutants appear more commonly in the TSIP than others. For instance, lead is identified as the Key Pollutant in nearly one quarter of all sites in the database. Chromium, mercury and cadmium also occur frequently. These pollutants come from a range of industries. Contrary to popular belief, large or multinational companies are rarely the main source of toxic pollution in low- and middle-income countries. Data from the TSIP database shows abandoned “orphan” or “legacy” sites and active informal industry, especially artisanal and small-scale livelihood activities are responsible for a majority of contaminated sites, especially in terms of number of people at risk. Here, exposures are due in large measure to a lack of environmental controls (including knowledge and resources to implement them) and close proximity of pollution or polluting activities to residential areas.

Many high-income countries have developed extensive inventories of contaminated sites that are used to prioritize interventions, often based on the human health risks present at each site. The first such inventory was carried about by the U.S. EPA under the auspices of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, commonly known as the Superfund Program. Superfund assessments, and similar efforts elsewhere, provide extensive information on a contaminated site. These types of assessments, which often include exhaustive sampling and geospatial information, can provide the basis for remediation efforts. They are, thus, a fundamental step in implementing interventions.

By contrast, few low- and middle-income countries have developed similar inventories. At issue in most cases is cost—a Superfund assessment can cost well over USD 100,000. With such a high number of sites to assess, such detailed assessments are unaffordable for many low- and middle-income countries.

The Initial Screening

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**Toxic Hotspots Identified in TSIP**

as of May 2013

The GAHP provides a unique and needed opportunity for all members of the alliance to each bring to the table, their respective expertise and resources, and play an active role in helping developing countries reduce exposure to toxic chemicals.

> Zoubida Allaoua, Director Urban & Disaster Risk Management Department, The World Bank

### Health Implications

A key output of GAHP’s work is to quantify and publicize in scientific literature the potential health impacts of contaminated sites. It is challenging to quantify the burden of disease resulting from exposure to toxic sites. Limited toxicological datasets and dose-response models for probable contaminants other than lead have restricted research efforts to a small subset of countries and pollutants. Expanding and strengthening the data in the TSIP has been critical to provide data for these types of analyses.

Results from two recent papers are discussed below. The first (Chatham-Stephens et al 2013) examined exposures to multiple contaminants from toxic waste sites in India, Indonesia and the Philippines, and estimated the associated burden of disease in Disability Adjusted Life Years (DALYs). The second paper (Caravanos et al 2013) looked at pediatric exposure to lead from contaminated sites in seven Asian countries. It estimated the potential number of IQ points lost on account of this exposure. Future areas for research include the impact of exposure to lead and other key pollutants in pregnant women and children under five, as well as studies to quantify the cost of inaction.

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Disability Adjusted Life Years (DALYs) Resulting from Toxic Sites in India, Indonesia and the Philippines

Global Burden of Disease (GBD) estimates are regularly expressed in Disability Adjusted Life Years (DALYs). DALYs are actually the sum of two prior calculations, Years of Life Lost (YLL) and Years Lived with Disease (YLD). By combining these two prior calculations, the DALY effectively captures both mortality and morbidity resulting from disease. Prior calculations of the burden of disease from toxic exposures did not include estimates of the burden from toxic waste sites. This was due to lack of information on these sites, including the overall number and the types of contaminants present.

The Chatham-Stephens et al (2013a) analysis focused on three countries where national inventories of contaminated sites were fairly comprehensive: India, Indonesia, and Philippines. In these countries, 8,629,750 individuals were found to be at risk of exposure to industrial pollutants at 373 toxic waste sites. By focusing on one year, 2010, the researchers estimated that 828,722 DALYs resulted, with a range of 814,934 to 1,557,121 DALYs depending on which weighting factors were used. The authors noted that the disease burden from toxic hotspots in those countries is comparable to that from outdoor air pollution (1,448,612 DALYs) and malaria (725,000 DALYs).

Importantly, many contaminants were excluded from this analysis. Mercury contaminated sites, for example, which compose more than one fifth of all sites in the TSIP database, could not be included because of a lack of dose response relationships. Of those contaminants whose health effects could be calculated, lead and hexavalent chromium featured prominently, collectively accounting for 99.2% of the total DALYs.

The paper concluded that toxic waste sites are responsible for a significant burden of disease in low- and middle-income countries. Since not all

<table>
<thead>
<tr>
<th>Key Pollutant</th>
<th>Number of Sites</th>
<th>Estimated Population at Risk</th>
<th>Years Lived with Disability (YLD) b,c</th>
<th>Years of Life Lost (YLL) b,c</th>
<th>Disability Adjusted Life Years (DALYs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aldrin</td>
<td>5</td>
<td>133,000</td>
<td>212</td>
<td>812</td>
<td>1,024</td>
</tr>
<tr>
<td>Asbestos</td>
<td>3</td>
<td>25,000</td>
<td>974</td>
<td>4,218</td>
<td>5,192</td>
</tr>
<tr>
<td>Cadmium</td>
<td>53</td>
<td>976,600</td>
<td>15</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Chromium VI*</td>
<td>128</td>
<td>3,231,750</td>
<td>63,174</td>
<td></td>
<td>298,657</td>
</tr>
<tr>
<td>DDT</td>
<td>4</td>
<td>180,000</td>
<td>4</td>
<td>18</td>
<td>22</td>
</tr>
<tr>
<td>Lead</td>
<td>79</td>
<td>1,829,900</td>
<td>523,630</td>
<td></td>
<td>523,630</td>
</tr>
<tr>
<td>Lindane</td>
<td>9</td>
<td>131,300</td>
<td>20</td>
<td>79</td>
<td>99</td>
</tr>
<tr>
<td>Mercury, Inorganic</td>
<td>92</td>
<td>2,122,200</td>
<td>83</td>
<td></td>
<td>83</td>
</tr>
</tbody>
</table>

373                      | 8,629,750       | 588,112                     | 240,610                               | 828,722                      |

a For sites where only total chromium was reported, the speciation coefficient of 0.6 was used to estimate hexavalent chromium (Avudainayagam et al. 2003; Kumar and Riyazuddin 2010). b S = Soil, W = Water c Soil inhalation is incorporated into the Soil results.
In 2008, 18 children died from lead poisoning associated with unsafe recycling of used lead acid batteries in the neighborhood of Thiaroye Sur Mer in Dakar. It was devastating. We must prevent this and other similar tragedies from happening again.

> Mariline Diara, Director, Directorate of Environment and Classified Establishments of the Ministry of Environment, Senegal

sites in these countries were identified and characterized, the inclusion of additional sites would increase the burden of disease estimate substantially. **Thus, toxic waste sites are a major and heretofore under recognized, global health problem.**

**Pediatric Lead Exposure and IQ Points Lost**

Caravanos *et al* (2013) attempted to quantify the regional burden of disease in Asia from lead exposure resulting in Mild Mental Retardation (MMR). The impact of lead exposure from these sites was calculated in a two-step process. The initial step translated environmental lead levels from the regional database into expected population-level blood lead levels (BLL) using U.S. EPA’s Integrated Exposure Uptake Biokinetic Model (IEUBK) for Lead in Children (U.S. EPA 1994*), an application initially developed to estimate the effect of emissions from lead smelters and used to evaluate remediation activities at sites involved in the Superfund program.

Children are particularly vulnerable to the neurological effects of lead exposure. As their brains develop, even small amounts of environmental lead can result in significant IQ loss.

The second step involved estimating the impact of these BLLs on cognition, specifically intelligence quotient (IQ). The analysis used two meta-analyses, Lanphear *et al* 2005* and Schwartz J 1994, to create a range of IQ decreases associated with different levels of BLLs, and took into account multiple variables, such as birth weight, maternal IQ and education, age distribution data and the quality of stimulation in the home environment as measured by the Home Observa
The authors found that an estimated 189,725 children were exposed to levels of lead in soil and water that correlate with decreases in IQ from 4.94 IQ points lost on average at lower blood lead levels (e.g., < 10 ug/dL) to 14.96 IQ points lost on average at higher blood lead levels.

The above table summarizes the results. Given the restricted scope of the study and the conservative assumptions used in the analyses, the authors concluded that these results almost certainly underestimate the burden of disease from lead exposure at contaminated sites in Asia.

<table>
<thead>
<tr>
<th>Region</th>
<th>Lanphear</th>
<th>Schwartz</th>
<th>Population at Risk (Children)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>-6.7</td>
<td>-3.1</td>
<td>30,900</td>
</tr>
<tr>
<td>India</td>
<td>-4.4</td>
<td>-1.1</td>
<td>50,084</td>
</tr>
<tr>
<td>Indonesia</td>
<td>-4.4</td>
<td>-1.1</td>
<td>10,141</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>-8.5</td>
<td>-5.9</td>
<td>1,906</td>
</tr>
<tr>
<td>Pakistan</td>
<td>-4.4</td>
<td>-1.1</td>
<td>958</td>
</tr>
<tr>
<td>Philippines</td>
<td>-5.8</td>
<td>-2.2</td>
<td>95,217</td>
</tr>
<tr>
<td>Thailand</td>
<td>-11.9</td>
<td>-20.1*</td>
<td>519</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Region Average</th>
<th>Lanphear</th>
<th>Schwartz</th>
<th>Population at Risk (Children)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-6.59</td>
<td>-4.94</td>
<td>-10.32</td>
<td>-14.96 Total = 189,725</td>
</tr>
</tbody>
</table>


Implications for Economic Growth

While the health implications of toxic exposures are direct (though their scale is under recognized), the economic consequences of such exposures are indirect, but no less real. This is an area where more research and analysis is required and can benefit from the data generated by the TSIP. Some economic impacts, such as increased healthcare costs and losses in productivity owing to IQ decrements, can be readily hypothesized. A 2002 study by Landrigan et al., examined increased pediatric healthcare costs associated with environmental exposures for four diseases: lead poisoning, asthma, cancer and developmental disabilities. The study found that environmental exposures in relation to these diseases composed approximately 2.8% of total annual US healthcare costs, or $54.9 billion.\(^1\) True, healthcare costs are lower in low- and middle-income countries but, by the same token, access to and affordability of healthcare are also less.

**Economic costs can also be measured in productivity lost due to decreased IQ, among other factors.** A 2005 study examined the role of decreased brain development due to methyl mercury on lost economic productivity in the U.S.\(^2\) The analysis found that 600,000 children suffered loss of IQ annually as a result of mercury pollution, leading to economic productivity losses of $8.7 billion annually.\(^3\) These types of analyses would have to be conducted on a country-by-country basis to get true estimates of economic cost, but the US studies can be used as an indicator of significant implications for economic growth.

The fallout of IQ decrements associated with pediatric exposures to toxic substances, such as lead and mercury, also have longer lasting, and arguably more damaging consequences for economic growth. Mental impairment in young children can lead to a reduction in average IQ levels in local communities living near toxic sites (see chart below; Weiss B. 1998; Schettler T. et al 2000). Hypothetically, diminution in a community’s intellectual capacity (i.e., the number of children with IQ above 130—“mentally gifted”) can affect its ability to be economically productive and to attract investment (whether in
education or business). It can also mean an increase in the number of children with lower IQs, including those with levels below 70 (“mentally impaired) who require special support and resources (Weiss B. 1998). In addition, there is evidence that individuals with low IQ, including those with high lead exposures in childhood, are associated with higher rates of crime and societal violence.

The longer-term economic constraints imposed by toxic sites—rising healthcare costs, mental disability and cognitive impairment of children—are clearly serious and worth removing and preventing. However, eliminating toxic exposures also contributes positively to economic growth. The most obvious ways are by expanding access to natural resources and land.

Toxic sites are by definition badly degraded areas. In rural areas, soil contamination directly impacts agriculture production, by damaging soil fertility and leading to the introduction of chemicals and heavy metals into crops. In urban areas, sites are often old, abandoned industrial estates that no longer support economic activities, or are unattractive for future investment precisely because of the risk to human health. Direct runoff into rivers and soil contamination can make both ground and surface water sources unsuitable for agricultural and domestic use, affecting the availability of clean water. This can increase family expenditures as a result of the need to purchase water, and disrupting women’s daily routines with the need to fetch or buy water from far away areas.

Cleaning up such sites renders them economically useful again and raises the market value of the land thus regenerated. This increased value can be realized through sale or economic use, such as crop cultivation, livestock grazing or other industrial/commercial use. In addition, rising demands for housing in urban areas due to rapid urbanization has led to informal settlements (shantytowns, favelas) in contaminated areas in many countries.

Many city governments, such as the Cities of Montevideo in Uruguay and Buenos Aires in Argentina, are concerned with this issue and see value in remediation as one part of the solution. Remediation would not only help to mitigate current and avoid future toxic exposures, but would also help alleviate immediate short-term and long-term housing needs. In addition, whether contaminated sites are located in rural or urban areas, growing concerns about food and water security, and rapid urbanization will ensure that the value of remediated land rises.

Solutions to toxic exposures can also increase access to valuable resources. When lead smelters capture more of their fugitive emissions, and automotive batteries are recycled more efficiently, recovery of re-usable lead increases. Similarly, artisanal gold miners can implement more efficient, and nontoxic practices that not only eliminate mercury use, but also extract higher gold yields compared to the traditional mercury use method.

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13 This data helped US Government implement more strict standards regarding coal-fired power plant mercury emissions, and eventually contributed to a US Federal Court decision to overturn a proposed Clean Air Mercury Rule.
16 http://www.epa.gov/airquality/peg_caa/toxics.html
Sustainable Development and Poverty Reduction

Cleaning up toxic hotspots improves the natural environment, reduces environmental health risks, and promotes economic growth. In so doing, it makes economic development more sustainable. In itself, that is valuable but it does more: it also reduces poverty.

The impact on poverty flows from the fact that most toxic sites tend to be in poorer neighborhoods. The WHO estimates that 98% of adults and 99% of children affected by exposure to lead live in low- and middle-income countries.20 In addition, poor people are more likely to be exposed to toxic pollution because they often engage in hazardous subsistence level livelihood activities, such as used lead acid battery recycling, electronic/electric waste recycling, leather tanning, and artisanal gold mining.21 In addition, poverty is often associated with poorer health and nutrition, both of which can magnify the effect of toxic exposures. For example, children with nutritional deficiencies in calcium and iron have higher blood lead levels than peers with sufficient amounts of those nutrients.22 The people living and working in contaminated areas—backyard battery and e-waste recyclers, artisanal gold miners and tanners—do so out of necessity, not choice. They often know they are exposing themselves and their families to deadly chemicals, but short-term survival trumps longer-term consequences. Anything that reduces those exposures means an improvement in the health dimension of poverty.

Healthier environments lead to healthier workers, families and children, who can be more productive members of society. When technical solutions offer more profit to small-scale players through more efficient, toxic-free technology, increased incomes help them escape the poverty cycle. As they rise above the poverty line, they expand the market of consumers and attract more investments. In sum, toxic clean ups can lead to virtuous cycles of growth and development.

22 Same as above.
Strategies for Success

A number of affordable and effective technologies and solutions exist for dealing with contaminated sites. In low- and middle-income countries, the majority of toxic emissions come from two main sources: abandoned “legacy” sites and small-scale informal producers. Each requires different interventions. In the case of legacy sites, decades of remediation experience in high-income countries have yielded a significant knowledge base for dealing with common pollution problems. In the case of informal industry, a more ad hoc approach is required for each industry, in the context of each country.

Interventions at contaminated sites that are focused on mitigating human health risks can take a number of forms. The following examples represent a small selection of replicable approaches.

Abandoned Lead Smelter—Paraiso de Dios, Haina, Dominican Republic

In Haina, a former lead smelter poisoned more than 90% of the local population through airborne lead dust, and contaminated drinking and bathing water. Soil lead levels at the site were more than 50 times above U.S. EPA recommendations. Average children’s Blood Lead Levels (BLLs) were 71 μg/dl, well above the U.S. Centers for Disease Control and Prevention level of concern of 5 μg/dl. Beginning in 2006, a stakeholder group comprised of the Ministry of Environment (MoE) of the Dominican Republic, the Autonomous University of Santo Domingo, the local community, Blacksmith Institute, Terra Graphics Engineering (USA), and the Inter-American Development Bank (BID) was organized. This group coordinated the intervention, which was funded in part by MoE and BID, and implemented by Blacksmith and Terra Graphics. It involved the removal of more than 6,000m3 of highly contaminated soils, covering the lower levels with clean dirt, gravel or concrete and training the MoE in hazardous waste removal operation. The project resulted in a significant decrease in BLLs in the community—within three months of remediation of the site the average BLLs of children fell by more than one third.

Heavy Metal Remediation Using Worms—Muthia Village, Gujarat, India

Over a decade, approximately 60,000 tons of industrial waste containing nitrogen, potassium, phosphorous, cadmium and chromium among other toxicants accumulated from the careless disposal of effluents from wastewater treatment plants in Gujarat. In 2006, the local government, Concept Biotech, Vadodara, and the Naroda Industrial Association removed 3,000 tons of hazardous waste and treated the remaining soil with three low-cost applications of vermiculture (worms) to further reduce heavy metal loads in the soil. After one year, an 80% reduction in all harmful wastes in the soil, water and grasses in the remediated area was observed. By 2008, groundwater samples did not find significant amounts of cadmium or chromium (levels undetected), and the area was deemed safe for agricultural use.

Artisanal Gold Mining—Kalimantan, Indonesia

Artisanal or small-scale gold mining (ASGM) is widely practiced throughout the world. The process usually utilizes mercury to extract gold from ore. The resulting amalgam is then heated to vaporize mercury and leave behind gold deposits. This activity is often carried out in the privacy of the home. Only a small number of miners use technology to recapture these vapors. Most of it is released to the environment or directly inhaled by miners, their children and families. UNIDO estimates that nearly 100% of the mercury used in ASGM is released into the environment (or about 1,400
tons annually).24 These emissions can result in acute exposures in the home and the community, as well as more chronic exposures elsewhere (through drinking water, fish and other medium).

Several technologies have proven effective at recapturing mercury or, even better, providing mercury-free alternatives (for example, enhanced gravimetric processing methods using borax as a flux).25 These range from simple, affordable instruments like “retorts”—specially configured bowls or pipes—to more complex instruments, such as water-box condensers for larger quantities. The success of these technologies or methods depends largely on the cooperation of actors at different levels and the incentives for miners to adopt them. International experts must work closely with local organizations and mining cooperatives, along with local government units to determine feasible solutions. In Indonesia, efforts have helped reduce more than 2,000 kgs of mercury emissions over the past three years. Currently, in collaboration with the Ministry of Environment, efforts by Yayasan Tambuhak Sinta, and the Agency for the Assessment and Application of Technology (BPPT) and the Geological Survey of Denmark and Greenland, among others, are focused on promoting more efficient and higher gold yielding mercury-free practices.

Emergency Intervention for Lead Poisoning—Zamfara, Nigeria

In March 2010, excess death and illness occurring primarily amongst children under five in Zamfara State, Nigeria, was reported by Médecins Sans Frontières (MSF) to the state health authorities. Investigations led by the US Centers for Disease Control and Prevention (US CDC), in collaboration with Federal and Zamfara State authorities, MSF and the WHO revealed that the outbreak was caused by acute lead poisoning. The source was massive environmental lead contamination from the informal processing of lead-rich ore to extract gold. In June, the Zamfara State and Federal health authorities requested assistance from the international community to address the problem. With funding from the UN Central Emergency Relief Fund, UN Children’s Fund (UNICEF), Blacksmith, Terra Graphics and local authorities conducted environmental decontamination and an awareness raising project. Contaminated soil was removed to secure landfills and replaced with clean soil. In total, seven villages were remediated, including 282 residential compounds, 107 exterior areas and 23 processing ponds, allowing for MSF to provide chelation treatment for more than 1000 children. In addition, UNICEF and project partners mobilized the communities and established advocacy programs to raise awareness, facilitate remediation and support prevention of recontamination. The Government recently completed remediation of one of the largest affected villages, Bagega, and currently is working to set up a wider capacity building program on safe mining practices.

In the international chemicals agenda, places where people are being exposed to toxic chemicals should be a key focus. While we’re working on international agreements and capacity building, let’s make sure we’re saving kids from being poisoned.

> Richard Fuller, Blacksmith Institute

23 http://www.cdc.gov/nceh/lead/ACCLPP/Lead_Levels_in_Children_Fact_Sheet.pdf
A Global Response: The Global Alliance on Health and Pollution

The number of people at risk from chemicals, wastes and toxic pollution globally may be as many as 200 million. As such, it is a large-scale public health problem. The bulk of its impact falls on low- and middle-income countries—the countries least equipped with capacity and resources to deal with the problem—and typically in locations of extreme poverty. Without intervention and cleanup, toxic pollution poses real long-term health and environmental challenges. It can significantly impede economic and social development, as well as achievement of the Millennium Development Goals (MDGs).

Formed in 2012, the Global Alliance on Health and Pollution (GAHP) seeks to assist low- and middle-income countries to address the problem of chemicals, waste and toxic pollution, with specific regard to reducing their harmful effects on public health. It looks to build capacity, country by country, to identify, analyze and prioritize the cleanup of toxic hotspots. The vision of GAHP is a world safe from toxic pollution.

Industrial manufacturing and mining companies have a responsibility to ensure local populations and environments are not adversely affected by their activities. As part of UNIDO’s Green Industry Initiative, we are working together with GAHP to coordinate resources in order to effectively build global capacity to help industry produce more cleanly and efficiently.

> Heinz Leuenberger, Director, Environmental Management Branch, UNIDO

The Global Alliance on Health and Pollution is the first of its kind to respond to the threat of toxic pollution in low- and middle-income countries. It functions as a collaborative body that coordinates resources and activities to solve chemicals, waste and toxic hotspot problems. Its members bring decades of technical expertise, successful intervention models and other resources to countries to prevent, clean up and guard against future pollution. GAHP represents an important first step in encouraging global action.
GAHP Activities

With support from the European Commission, and the World Bank, through its Development Grant Facility, GAHP is currently providing capacity building, training and technical assistance to low- and middle-income countries in the following areas:

- Identification and rapid assessment of toxic hotspots and health exposure risk;
- Local, regional and national priority setting related to chemicals, wastes and toxic pollution;
- Mainstreaming remediation of chemicals, wastes and toxic pollution into national, country and donor development/partnership strategies and plans;
- Development and implementation of national toxics action and sound chemical management plans;
- Detailed assessments of polluted sites;
- Pollution intervention and remediation planning;
- Intervention and remediation implementation;
- Regulatory review related to pollution;
- Stakeholder/community engagement and awareness raising/education.

GAHP also provides access to guidance documents and tools, good practices, successful cost-effective remediation models and case studies, and is committed to raising awareness internationally about chemicals, wastes and toxic pollution, and their human health and environmental impacts. GAHP is also supporting research on health impacts from toxic pollution, the benefits of clean up and the costs of inaction. Several pilot projects to test how GAHP functions are also being implemented in countries including Argentina, Armenia, Ghana, Indonesia and Uruguay.

Currently GAHP Members include (in alphabetical order):

The Asian Development Bank (ADB); the Blacksmith Institute; the European Commission (EC), Chilean NGO Fundación Chile, the Cyrus R. Vance Center for International Justice, the German Agency for International Cooperation (Deutsche Gesellschaft fuer Internationale Zusammenarbeit—GIZ), Indonesian NGO Komite Penghapusan Bensin Bertimbel (KPBB); the Inter-American Development Bank (IDB), the Ministries of Environment from the Governments of Indonesia, Madagascar, Mexico, Peru, the Philippines, Senegal, Uruguay, the City of Montevideo and the City of Buenos Aires; the Ministry of Health of the Government of Tajikistan, the UN Development Programme (UNDP), the UN Environment Programme (UNEP); the UN Industrial Development Organization (UNIDO); and the World Bank (WB).

There are many organizations interested in observing the GAHP, such as the Global Environment Facility (GEF), International Council of Chemicals Associations (ICCA), the International Lead Management Center (ILMC), Japanese International Cooperation Agency (JICA), the Norwegian Ministry of Environment, the Strategic Approach to International Chemicals Management (SAICM), the US Agency for International Development (USAID), the US Environmental Protection Agency (U.S. EPA), the US Department of State (US DoS) and the World Health Organization (WHO).

Based on current development priorities and agendas, key stakeholders who have taken concrete action and shown leadership in resolving the issues of toxic pollution and/or are interested to form an international response are invited to participate in the GAHP. In addition, GAHP collaborates with existing parallel initiatives, such as the Strategic Approach to International Chemicals Management (SAICM), the Africa Stockpiles Project, the Stockholm and Basel Conventions, and the Global Mercury Partnership to eliminate duplication of effort, and to minimize overlooking thematic areas which have historically received relatively little attention (e.g. artisanal/livelihood related pollution, emergency or pollution disaster mitigation and prevention, legacy pollution).
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To learn more about GAHP or to join GAHP, please visit www.gahp.net or contact info@gahp.net

For questions, comments and feedback, please contact:
GAHP
c/o Blacksmith Institute
475 Riverside Drive
New York, NY 10115
1 (212) 647-8330
Info@gahp.net