



Toxic Sites Identification Program (TSIP) in Ghana

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Prepared for: UNIDO

Date: November 2018

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LIST OF ACRONYMS

ADB	Asian Development Bank
AMA	Accra Metropolitan Assembly
EC	European Commission
EEE	Electrical and Electronic Equipment
EPA	Environmental Protection Agency
GAEC	Ghana Atomic Energy Commission
GAHP	Global Alliance on Health and Pollution
GASDA	Greater Accra Scrap Dealers Association
GreenAd	Green Advocacy Ghana
GSA	Ghana Standards Authority
ISS	Initial Site Screening
LMIC	Low and Middle-Income Countries
MESTI	Ministry of Environment, Science, Technology and Innovation
MMDAs	Metropolitan, Municipal and Districts Assemblies
NDPC	National Development Planning Commission
NGO	Non-Governmental Organization
NYA	National Youth Authority
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PE	Pure Earth
PPB	Parts per Billion
PPM	Parts per Million
TSIP	Toxic Sites Identification Program
ULAB	Used Lead Acid Batteries
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
VOCs	Volatile Organic Compounds
WB	World Bank
XRF	X-Ray Fluorescence

LIST OF ANNEXES

- Annex 1 TSIP Sites
- Annex 2 Research Articles
- Annex 3 Agbogbloshie Sampling

ACKNOWLEDGEMENTS

This activities described in this report were supported by the European Commission and the United Nations Industrial Development Organization project "Mitigating Toxic Health Exposures in Low-and Middle-Income Countries: Global Alliance on Health and Pollution" (DCI-ENV/2015/371157).

INTRODUCTION

Pure Earth's engagement in Ghana began with the signing of a partnership Memorandum of Understanding in 2010 with Green Advocacy Ghana (GreenAd), an environmental advocacy organization. Per the agreement, GreenAd Ghana would act as the secretariat for PE's work on pollution and health issues in Ghana. The main activities focused on the Toxic Sites Identification Program (TSIP) across all regions in Ghana.

Several key stakeholders were identified and consulted. These included:

- MMDAs of all regions assessed
- Environmental Health Departments
- Ministry of Environment, Science, Technology and Innovation (MESTI)
- Environmental Protection Agency (EPA) of Ghana
- Ghana Health Service
- Ghana Atomic Energy Commission
- Ghana Standards Authority (GSA)

TOXIC SITES IDENTIFICATION PROGRAM (TSIP)

TSIP work began in Ghana in 2012 with the selection and training of 12 Site Investigators. TSIP training, conducted over two days, consists of both theoretical and practical components. The theoretical training on day one introduced participants to the work of Pure Earth, the health impacts of pollution, and the model of Pollution-Migration-Pathway-People. Participants were also taught how to use a hand-held Alpha Xray Fluorescence (XRF) spectrometer, a precise instrument that permits collection of real-time field data and is key to building in-country capacity to monitor and assess heavy metal contamination. During day two participants visited a site for hands-on experience in using the ISS protocol.

IMPLEMENTATION STRATEGY/COORDINATION WITH GOVERNMENT

In order to properly implement the project, coordination with government agencies at all stages of the project was essential. Pure Earth's investigators met regularly with government officials to share data and findings. As such, government officials and their respective community constituents gained a better understanding of the scope of toxic pollution and its impact on public health, economic growth, and sustainable development.

In some cases, government officials accompanied investigators during site assessments to learn about the process. This served to engage the government at a more nuanced level, which helped ensure the sustainability and effectiveness of the project.

Program Implementation Strategies:

- Introduction of the project to national and local government officials
- Recruitment and hiring of researchers with Master's and/or PhD degrees in the environmental field
- Training in conducting of rapid site assessments using the ISS protocol
- Coordination with national and local authorities on sites selection and priorities
- Assessment of sites
 - Including site history, estimation of population at risk, creation of site map, and taking of photos
- Collection of samples (water, soil or air)
- Analysis by reputable laboratory when necessary
- Entry of assessment information into existing TSIP database
- Review of data collected for quality and consistency (performed by PE team in New York)

SUMMARY OF KEY RESULTS

From 2012 to 2015, 204 sites were identified, assessed, and uploaded into the TSIP Database. An additional 17 sites were added in 2017 under UNIDO Contract SAP Ref: 150416 for a total of 221 sites (Annex 1). Each site entry includes a description of the contaminated area (coordinates, estimated population at risk, pollutant pathway, pollutant concentration, etc.); pollutant release risks; site stakeholders; relevant linked reports and images.

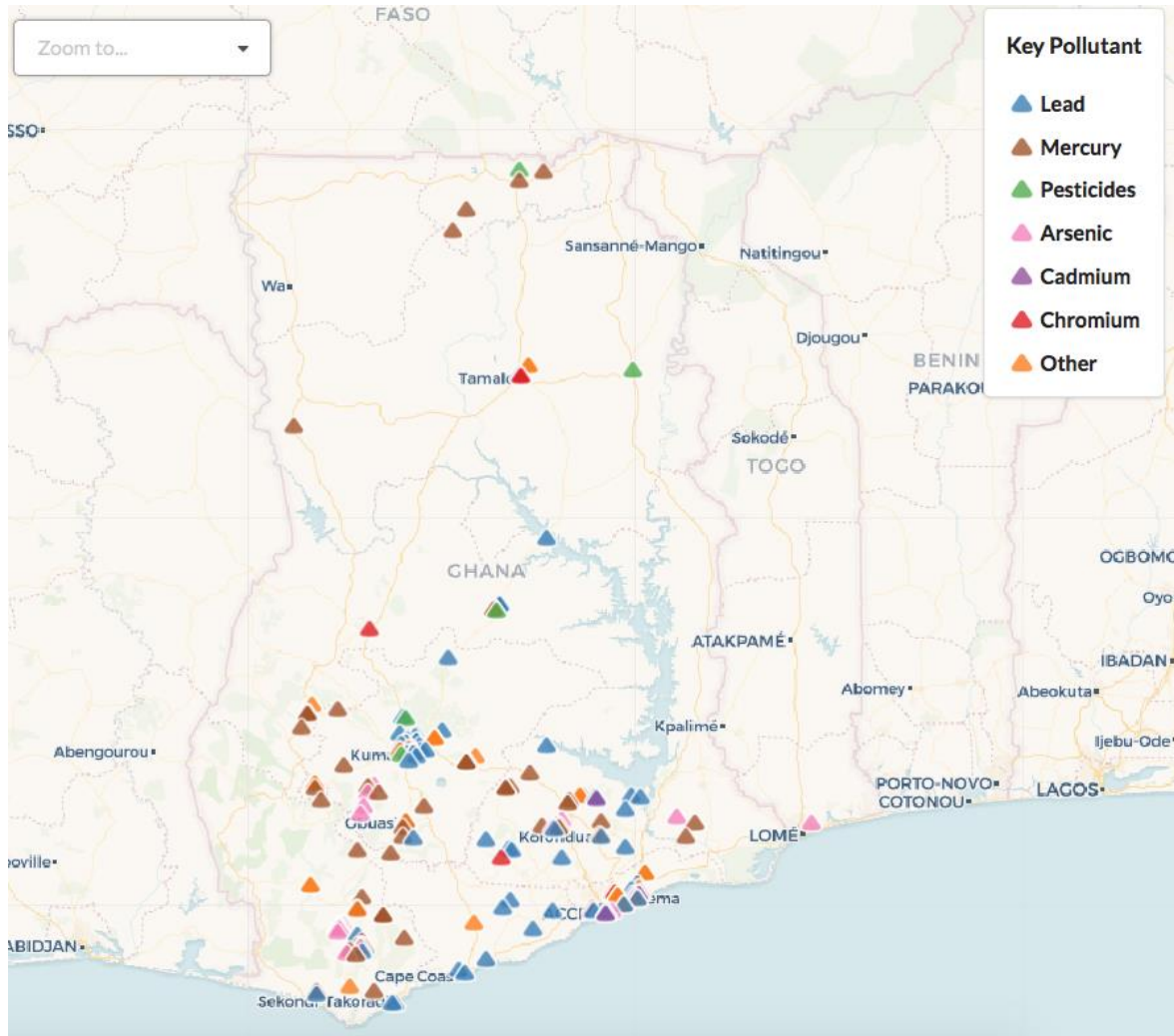


Table 1: The number of sites as categorized by pollution source assessed by Pure Earth's TSIP investigators

Industry	Number of Sites Identified
Artisanal Mining (hand mining)	86
Mining and Ore Processing	29
Industrial/Municipal Dump Site	18
E-waste recycling	12
Multiple Diverse Industries	11
Lead - Battery Recycling	10
Recycling / Recyclers (including salvage yards)	8
Transportation (bus stations, rail yards)	8
Industrial Estate (mixed industries)	7
Electricity Distribution	5
Agriculture	5
Petrochemical Industries (refineries)	5
Tannery Operations	3
Heavy Industry (casting, rolling, stamping)	3
Chemical Manufacturing (acids, organics, base chemicals)	2
Lead Smelting (with ingot production)	2
Dye Industry	2
Product Manufacturing (electronics, equipment, clothing)	1
Smelting (Everything Except Lead)	1
Food Processing	1
Pesticide Manufacturing	1
Electroplating	1
Total	221

Source Industry, All Ghana Sites

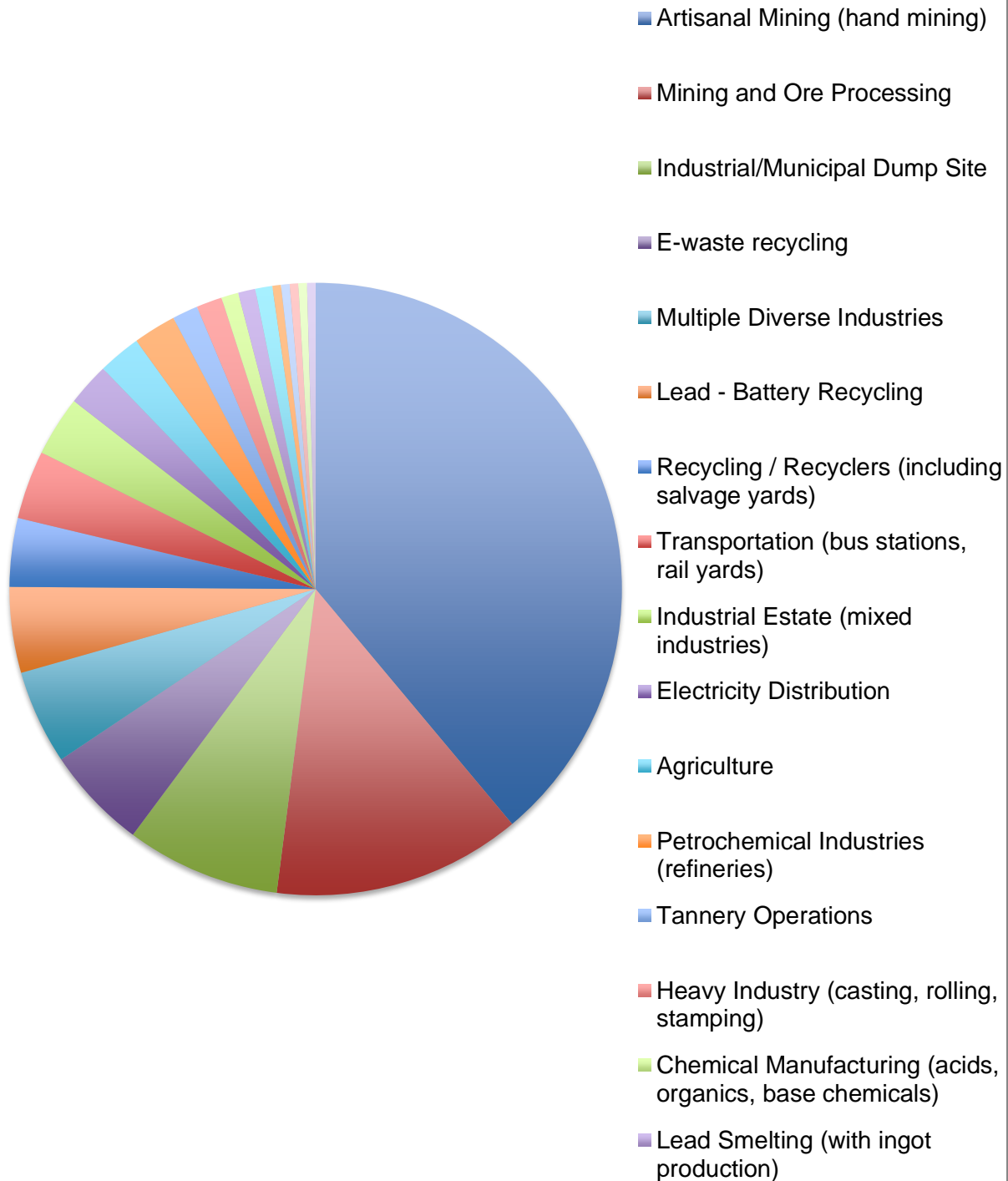


Table 2: Key pollutants identified in Ghana during TSIP site visits

Key Pollutant	Number of Sites Identified
Lead	74
Mercury - elemental	71
Arsenic	22
Cyanide	12
PCBs (PolyChlorinated Biphenyls)	8
Other	7
Chromium (Total)	7
Mercury - organic	6
Cadmium	6
PAH (Total)	2
DDT	2
Fluorides	1
Pesticides	1
Chlordane	1
Endrin	1
Total	221

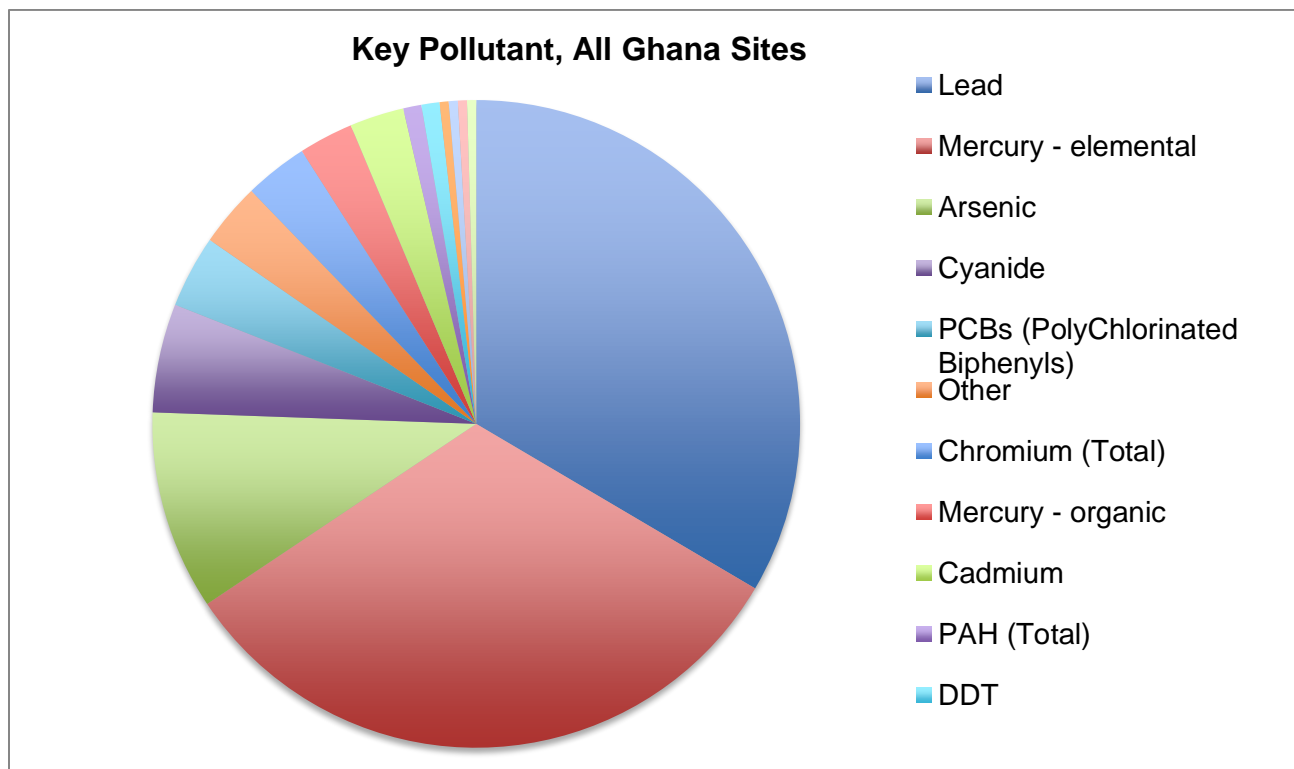


Table 3: Key pollutants identified in Ghana with UNIDO Funding

Key Pollutant	Number of Sites Identified
Arsenic	12
Lead	4
Other	1
Total	17

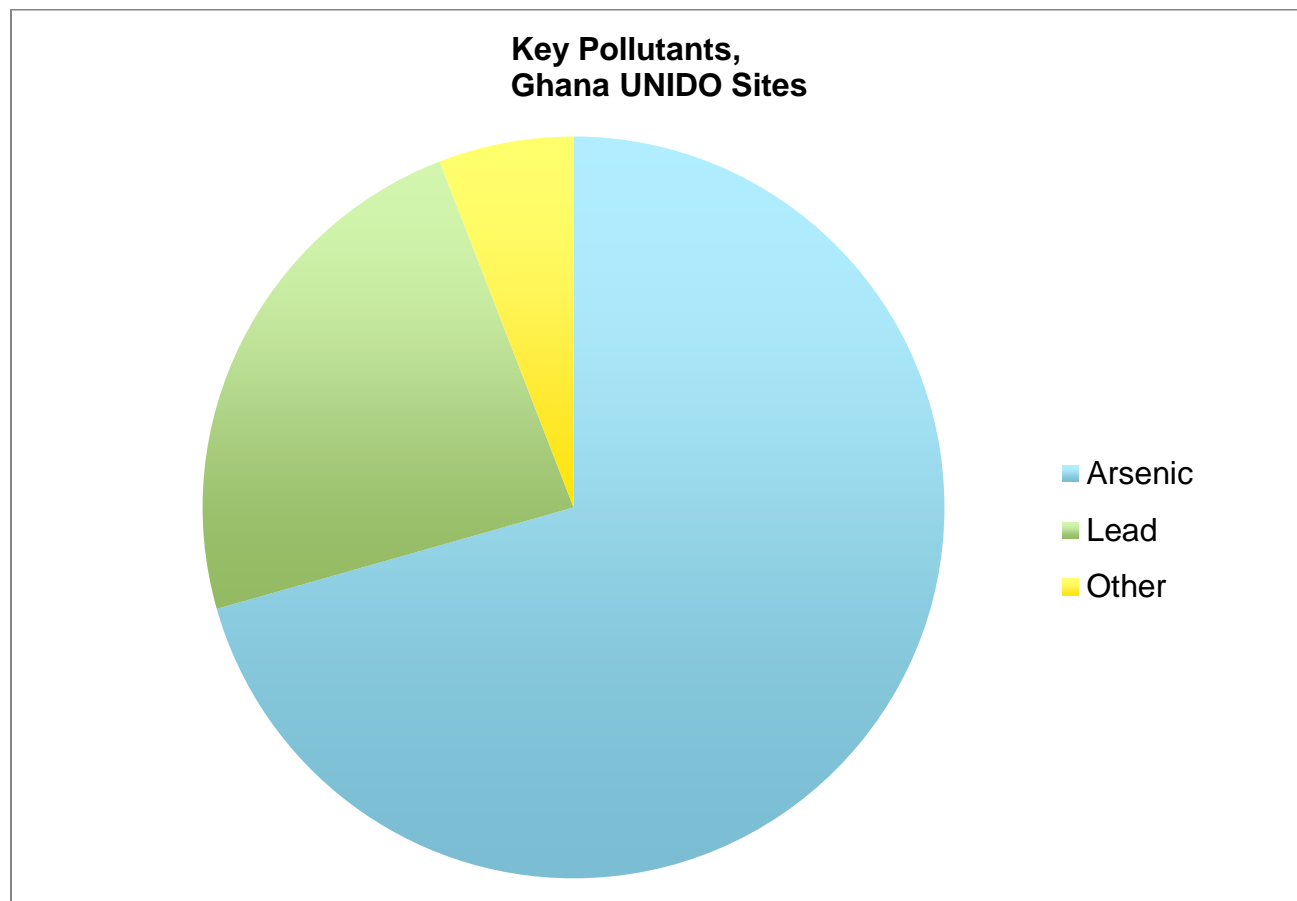
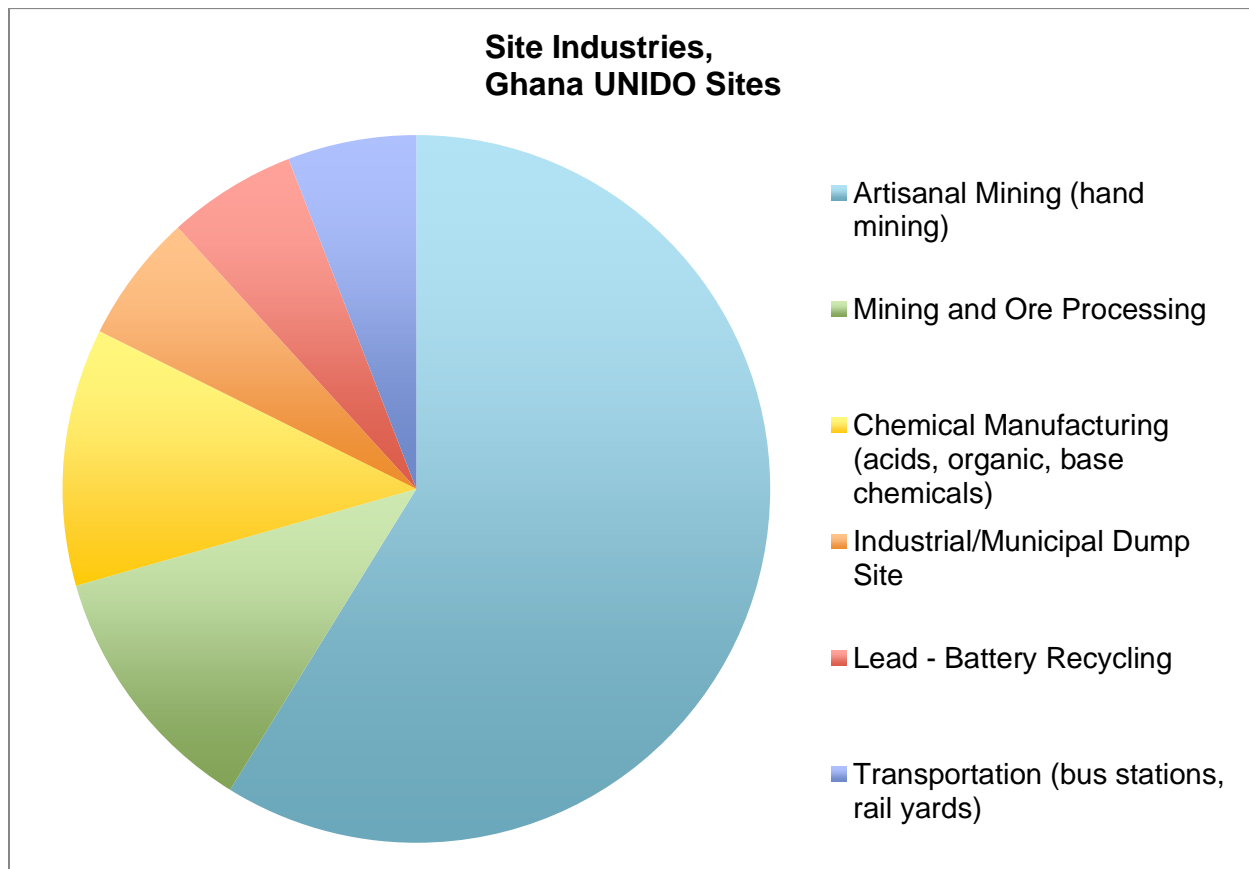


Table 3: The number of sites in Ghana as categorized by pollution source assessed with UNIDO funding

Site Industry	Number of Sites Identified
Artisanal Mining (hand mining)	10
Mining and Ore Processing	2
Chemical Manufacturing (acids, organic, base chemicals)	2
Industrial/Municipal Dump Site	1
Lead - Battery Recycling	1
Transportation (bus stations, rail yards)	1
Total	17



Investigators collected soil samples with the guidance of a sampling protocol provided by Pure Earth. Lead concentrations in soil were measured in the field using an XRF. When an XRF was not available, samples were sent to a certified local laboratory for analysis.

All sites had significant contamination values for toxic substances. Elemental mercury was present in 71 sites, the majority of which were artisanal mining sites, with

concentrations ranging from 1 to 100 parts per billion (ppb). This translates to great risks to human health. Lead was recorded at 74 sites, many of which were E-waste, dumpsites, or ULAB recycling facilities. Concentrations ranged from 14 to 68,000 parts per million (ppm). The test results for arsenic, found at 22 sites, many of which were artisanal mines, ranged from 4 to 27,300 ppm. This is above Blacksmith's recommended standards of 12 ppm.

Health Risks Identified and Other Concerns Identified During Sites Assessments

During site visits, many exposure risks were identified by both the investigators and the workers at the sites. Some of the workers in these industries were aware of the health risks involved, while others were ignorant of the associations between pollution and health. In many cases, workers were experiencing symptoms that could potentially be linked to pollution.

Exposure risks identified included:

- Lack of protective equipment for many workers – inhalation/ingestion of polluted air and dermal contact were the primary routes of exposure
- Lack of environmental controls – leaching of contaminants into ground and surface water
- Incorrect disposal of waste water during lead recycling – especially dangerous in residential areas
- Lack of expertise by medical professionals in recognizing symptoms of pollution exposure (increasing rates of forbearance of protective measures)
- Lack of awareness of health hazards posed by chemical pollution

Health symptoms identified included:

- Memory loss, frequent headaches, miscarriages, lack of appetite and poor body coordination
- Hyperactivity - especially in lead contaminated sites
- Chest pains associated with respiratory challenges in pesticides contaminated sites
- Livestock falling ill and/or dying after drinking contaminated water from mining areas

It is noted that the symptoms identified are only a fraction of potential effects. As research continues to identify and confirm pollution linkages, and as further sites are identified (to more accurately measure the pollution burden in a region) it is likely that the list of pollution-related diseases will expand substantially.

Pollutants, Sources and Health Impacts

Mercury

Mercury occurs naturally in the environment and exists in several forms that can be

broadly categorized into metallic mercury (elemental mercury), organic (bound with carbon), and inorganic mercury (not bound with carbon). Inorganic mercury compounds occur when mercury combines with elements such as chlorine, sulfur, or oxygen. It is a dense, silvery white, shiny metal, which is liquid at room temperature in its elemental form. The most common organic form of mercury, methyl mercury, is of particular concern as it can accumulate in fish and thus get transferred through the food chain. In general, mercury affects the immune system, alters genetic and enzyme systems, and damages the nervous system, including coordination and the senses of touch, taste, and sight. Exposure to very small amounts of methyl mercury can result in devastating neurological damage or death. Mental retardation, blindness, and cerebral palsy have been observed in children born to women having high levels of methyl mercury exposure. Exposure could have a negative impact on their neurological development resulting in psychological abnormalities like deficits in short-term memory, irritability, and social withdrawal.

Lead

Lead pollution emanates from industrial estates that manufacture electrical/electronic equipment, contain lead-acid battery recycling activities, and lead smelters, among other sources. Lead accumulates in soil and can migrate to groundwater. The pathway to humans is mainly through dust inhalation and dermal contact from lead tailings and slag, as adults and children alike can come into contact with these disposed of wastes in the environment. Lead is a known neurotoxin that affects body systems both acutely and chronically. Unborn children and those under the age of 6 years are particularly susceptible to its health effects, which include hindered development of the brain and central nervous system, reproductive problems, kidney damage, stunted growth, learning disabilities and mental retardation, coma, blindness and even death.

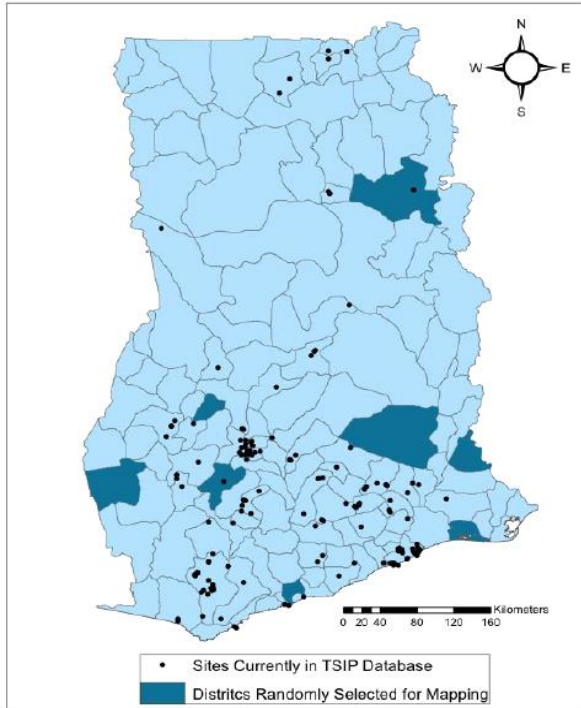
Arsenic

Arsenic is a naturally occurring, brittle, steel gray semi-metallic solid. Arsenic and its compounds are highly toxic. Arsenic in drinking water causes bladder, lung and skin cancer, and may cause kidney and liver cancer. Studies have also found that arsenic harms the central and peripheral nervous systems, as well as heart and blood vessels, and causes serious skin problems. It also may cause birth defects and reproductive problems. Arsenic can be carcinogenic at very low levels and one-tenth of a gram accumulated over a two-month period can be fatal.

ORIGINAL RESEARCH

Following initial rounds of TSIP investigations, researchers refined and executed a protocol for achieving a finer granularity of sites at the district level. The research implemented a grid system that covered eight districts which were randomly selected from eight country regions.

TSIP Sites and District-Level Survey areas



The data generated from the district-based pollution inventory was published in the *Annals of Global Health* under the title “Spatial Associations Between Contaminated Land and Socio Demographics in Ghana” in 2015.

An additional study, “Estimating the Prevalence of Toxic Waste Sites in Low-and Middle-Income Countries” was published in the *International Journal of Environmental Research and Public Health*, in 2016.

Both studies can be found under Annex 2 of this report.

REGIONAL TRAINING IN SENEGAL

In the spring of 2017, a training was conducted in Dakar for PE Ghana and Senegal team as well as officials from DPV on the use of organochlorine pesticide test kits. The training included several site visits to pesticide storage facilities to test for pesticide contamination of surrounding soil.



PILOT PROJECT

Agbogbloshie Scrap Metal Site Phase 1

The Agbogbloshie scrap metal site in Accra is Ghana's largest center for electronic waste (e-waste) recycling and disposal where workers manually disassemble parts and burning off the plastic encasements on computer wires, refrigerator coils, and other electronics in controlled fires to recover profitable metals, mainly copper. It is estimated that on average two tons of materials passed through the site each week at project initiation. This is an informal area where work is often done by young adults using inefficient tools and without protective equipment, leaving them susceptible to exposure to harmful levels of heavy metals (lead and cadmium among others) and other pollutants. Air pollution from the burning can adversely affect the health of workers and others living and working nearby.

Pure Earth began working in Agbogbloshie to investigate the extent of pollution at the site and to work with local agencies and government officials to design and implement a feasible method for mitigating pollution. See Annex 3 for detailed soil sampling results at the site.

The project consisted of two major components; providing training for the local e-waste association, the Greater Accra Scrap Dealers Association (GASDA); and piloting a new portable station that uses mechanized wire stripping technologies.

Objectives

- To eliminate cable burning
- To formalize business operations at Agbogbloshie
- To enhance the value of metal recovery

Launch of E-Waste Facility

Following extensive community planning meetings on site selection, design, and implementation, as well as community education and outreach efforts, and training in worker safety and protection, the recycling facility launched in October of 2014.

During the six months that the facility was officially monitored, it is estimated that nearly 15,000 pounds of material was cleanly recycled in the new facility. This translates to the following reductions in pollution emissions:

- 6,800 pounds of CO₂
- 2,700 pounds hydrochloric acid (pulmonary irritant)
- 14.6 pounds of lead

CONCLUSION - CHALLENGES AND RECOMMENDATIONS

Challenges

1. Security and safety risks in accessing illegal mining and ULAB sites
2. Bureaucratic barriers in obtaining data about sites, e.g. historical data on use and ownership of the site and adjoining land uses
3. Sparse site information on record, e.g. years in operation, ownership, etc.
4. Land use change in spite of contamination, e.g. a contaminated site may not be available for re-assessment due to erection of homes on such a site

Recommendations

1. MESTI (EPA) should consider using the TSIP database as a resource for understanding the scope of pollution and contaminated sites in Ghana
2. The Metropolitan, Municipal and District Assemblies (MMDAs) should consider the health impact of pollution and implement monitoring programs to yield data on areas of concern
3. The recycling facility at Agbogbloshie should be used as a knowledge transfer center on e-waste recycling and as basis for replication in other urban centers
4. E-waste burning should be officially banned to reduce toxic exposures

ANNEX I - TSIP SITES IN GHANA

Total Sites

Site Number	Site Name	Latitude	Longitude	Site Industry	Key Pollutant
GH-781	Agbogbloshie, Accra	5.5537	-0.225474	E-waste recycling	Lead
GH-1952	ULAB Recycling Facility Tema, Ghana	5.634094	0.00824	Lead - Battery Recycling	Lead
GH-1954	Tema Heavy Industrial Area	5.63856	0.01305	Product Manufacturing (electronics, equipment, clothing)	Other
GH-2004	AngloGold Ashanti Mine & Teberebie mine, Iduapriem	5.2333	-2.0333	Mining and Ore Processing	Mercury - elemental
GH-2142	Golden Star Mines, Prestea-Bogoso	5.5667	-2.0167	Mining and Ore Processing	Cyanide
GH-2143	Newmont Ghana Gold, Ahafo Mines	7.0333	-2.35	Mining and Ore Processing	Cyanide
GH-2144	Koforidua E-Waste Recycling	6.0833	-0.25	E-waste recycling	Lead
GH-2145	AngloGold Ashanti Mine, Obuasi	6.2	-1.667	Mining and Ore Processing	Mercury - elemental
GH-2146	Space Rock Noyem mine, Eastern Region	6.55	-0.7667	Artisanal Mining (hand mining)	Mercury - elemental
GH-2180	Closed Mercury site, Nyafoman, Birim North	6.4333	-0.95	Artisanal Mining (hand mining)	Mercury - elemental
GH-2181	Damang Tarkwa	5.5167	-1.8333	Artisanal Mining (hand mining)	Mercury - elemental
GH-2184	Mpohor Wassa East mine	4.9667	-1.9	Artisanal Mining (hand mining)	Mercury - elemental
GH-2186	Akyempem Tarkwa, Western Region	5.2833	-1.9667	Artisanal Mining (hand mining)	Mercury - elemental
GH-2187	Kenyasi mine, Brong Ahafo Region	6.9833	-2.3833	Artisanal Mining (hand mining)	Mercury - elemental
GH-2188	Nkaseim mine, Brong Ahafo Region	6.8667	-2.4333	Artisanal Mining (hand mining)	Mercury - elemental
GH-2189	Abandoned Mercury site, Abompe	6.35	-0.4833	Artisanal Mining (hand mining)	Mercury - organic

Site Number	Site Name	Latitude	Longitude	Site Industry	Key Pollutant
	Ankaase, E/R				
GH-2190	Abandoned mercury site, Kyebi-Asikam, E/R	6.201914	-0.533178	Artisanal Mining (hand mining)	Arsenic
GH-2191	Bogoso Bogomo mine	5.43	-2.16	Artisanal Mining (hand mining)	Mercury - elemental
GH-2192	Dompoase W A E, Western Region	5.9833	-2.0167	Artisanal Mining (hand mining)	Mercury - elemental
GH-2193	Manso- Fawotrikye mine, Ashanti Region	6.4	-1.8667	Artisanal Mining (hand mining)	Mercury - elemental
GH-2194	Asaman kakraba, Tarkwa, Western Region	5.333	-1.9833	Artisanal Mining (hand mining)	Mercury - elemental
GH-2195	Abandoned Mercury site,Asaaman-Juaso	6.3833	-0.3833	Artisanal Mining (hand mining)	Mercury - elemental
GH-2196	Teleku Bokazo mine	4.9722	-2.3203	Artisanal Mining (hand mining)	Mercury - elemental
GH-2199	Dunkwa-On-Offin, Central Region	5.9667	-1.7833	Artisanal Mining (hand mining)	Mercury - elemental
GH-2215	Tebe-Tarkwa mine	5.3	-1.9833	Artisanal Mining (hand mining)	Mercury - elemental
GH-2216	Kumasi E-Waste Recycling	6.6833	-1.6167	E-waste recycling	Lead
GH-2223	Aboabo river	6.446477	-1.9487	Industrial Estate (mixed industries)	Other
GH-2224	Suame garages	6.722575	-1.644473	Recycling / Recyclers (including salvage yards)	Other
GH-2225	United Nations Millennium Villages Project site, (Amansie)	6.446397	-1.9487	Artisanal Mining (hand mining)	Mercury - elemental
GH-2226	Amansie mines	6.716522	-1.622629	Mining and Ore Processing	Cyanide
GH-2229	Bogoso Ayanfuri mine	5.5667	-2.0167	Mining and Ore Processing	Mercury - elemental
GH-2241	Dumasi mine	5.5667	-2.0167	Artisanal Mining (hand mining)	Mercury - elemental
GH-2242	Nakabah mine	5.4333	-2.15	Artisanal Mining (hand mining)	Mercury - elemental
GH-2243	Fumbisi Builsa district mine	10.4333	-1.3333	Artisanal Mining (hand mining)	Mercury - elemental

Site Number	Site Name	Latitude	Longitude	Site Industry	Key Pollutant
GH-2244	Kadema- Builsa district	10.5833	-1.2333	Artisanal Mining (hand mining)	Mercury - elemental
GH-2249	Ataaso Kotokuom 'World Bank' mine, A/R	6.6	-2.1167	Artisanal Mining (hand mining)	Mercury - elemental
GH-2250	Dokyiwa Obuasi mine	6.2	-1.6667	Artisanal Mining (hand mining)	Mercury - elemental
GH-2251	Sansu Obuasi mine	6.2	-1.6667	Artisanal Mining (hand mining)	Mercury - elemental
GH-2252	Anwiam Obuasi, Ashanti Region	6.2	-1.667	Mining and Ore Processing	Mercury - elemental
GH-2279	Former Adenta Mobil Service Station	5.7	-0.1667	Multiple Diverse Industries	PAH (Total)
GH-2280	Former GOIL Filling Station, Banana Inn	5.55	-0.2167	Transportation (bus stations, rail yards)	PAH (Total)
GH-2288	Mantraim mine site	5.3	-2.0167	Artisanal Mining (hand mining)	Mercury - elemental
GH-2289	Breman Gold Dredge mine	6.722575	-1.644473	Artisanal Mining (hand mining)	Mercury - elemental
GH-2291	Daboase Mpohor Wassa East mine	5.35	-1.6833	Artisanal Mining (hand mining)	Mercury - elemental
GH-2292	Prestea-Himan mine	5.4333	-2.15	Artisanal Mining (hand mining)	Mercury - elemental
GH-2293	Dompoase (Adansi North) Kumasi	6.3	-1.5333	Artisanal Mining (hand mining)	Mercury - elemental
GH-2298	Daman Rex Bippo mine	5.5167	-1.8333	Mining and Ore Processing	Mercury - elemental
GH-2299	Daman Cinnamon Bippo mine	5.5167	-1.8333	Artisanal Mining (hand mining)	Mercury - elemental
GH-2308	Brumase Prestea	5.4333	-2.15	Mining and Ore Processing	Mercury - elemental
GH-2309	Konongo, Ashanti Region	6.6167	-1.2167	Artisanal Mining (hand mining)	Mercury - elemental
GH-2310	Odumase Asante-Akyem North mine	6.6167	-1.2333	Artisanal Mining (hand mining)	Mercury - elemental
GH-2311	Nangodi mine, U E R	10.8578	-0.6711	Artisanal Mining (hand mining)	Mercury - elemental
GH-2314	Sakamraso Brong Ahafo mine	6.9667	-2.3833	Artisanal Mining (hand mining)	Mercury - elemental
GH-2315	Bolaekyire Prestea mine	5.4333	-2.15	Artisanal Mining (hand mining)	Mercury - elemental
GH-2316	Prestea Bungalow Number 4	5.4333	-2.15	Artisanal Mining (hand mining)	Mercury - elemental

Site Number	Site Name	Latitude	Longitude	Site Industry	Key Pollutant
GH-2317	Tuapim Prestea mine	5.4333	-2.15	Artisanal Mining (hand mining)	Mercury - elemental
GH-2318	Bole-Kui, Bole-Bamboi district, N/R	9.0333	-2.4833	Artisanal Mining (hand mining)	Mercury - elemental
GH-2341	Kookoase- Heman, Wassa Fiase	5.45	-2.1333	Artisanal Mining (hand mining)	Mercury - elemental
GH-2342	Prestea Dumasi site, Ankobra basin, W/R	5.4333	-2.15	Artisanal Mining (hand mining)	Mercury - elemental
GH-2343	Sekyere-Himan Wassa Fiase mine	5.3	-1.9833	Artisanal Mining (hand mining)	Mercury - elemental
GH-2344	Bontoware-Himan, Wassa Fiase mine	5.45	-2.1333	Mining and Ore Processing	Mercury - elemental
GH-2395	ECG Central Station G (Makola), Accra	5.55	-0.2167	Electricity Distribution	PCBs (PolyChlorinated Biphenyls)
GH-2396	Abandoned Arsenic site, Abuakwa Formulation Plant, Kumasi	6.70397	-1.70965	Chemical Manufacturing (acids, organics, base chemicals)	Lead
GH-2397	Anamon Tannery, Techiman, B/A	7.5833	-1.9333	Tannery Operations	Chromium (Total)
GH-2407	Bolgatanga mine, Upper East Region	10.7856	-0.8514	Artisanal Mining (hand mining)	Mercury - elemental
GH-2408	Bibiani Mawechikrom, Western Region	6.4667	-2.3333	Mining and Ore Processing	Cyanide
GH-2412	Obotan SouthNkranpit mine	6.4333	-2.3333	Artisanal Mining (hand mining)	Mercury - elemental
GH-2413	Prestea Sankofa Tailings	5.4333	-2.15	Mining and Ore Processing	Cyanide
GH-2414	Obuasi Odumase mine	6.2	-1.667	Mining and Ore Processing	Mercury - elemental
GH-2415	Obuasi Fenaso mine	6.2	-1.6667	Artisanal Mining (hand mining)	Mercury - elemental
GH-2416	Kenyasi Ntotoroso, Brong Ahafo Region	6.9667	-2.3833	Artisanal Mining (hand mining)	Mercury - elemental
GH-2417	Ayanfuri mine, Western Region	5.5667	-2.0167	Artisanal Mining (hand mining)	Mercury - elemental
GH-2418	Obenemasi Konongo, Ashanti Region	6.6667	-1.1667	Mining and Ore Processing	Cyanide
GH-2427	Abandoned Mercury site, Noyem Birim	6.448755	-0.93323	Artisanal Mining (hand mining)	Mercury - organic

Site Number	Site Name	Latitude	Longitude	Site Industry	Key Pollutant
	North, E/R				
GH-2428	Badukrom mine, Western Region	6.35	-2.2833	Artisanal Mining (hand mining)	Mercury - elemental
GH-2439	Benso Tarkwa Nsuaem, Western Region	5.3	-1.9833	Artisanal Mining (hand mining)	Mercury - elemental
GH-2441	Apedwa Kyebi Mercury site, Birim, E/R	5.65	-1.9833	Artisanal Mining (hand mining)	Mercury - elemental
GH-2442	Bogoso Junction - Tamso mine, Western Region	5.5667	-2.0167	Artisanal Mining (hand mining)	Mercury - elemental
GH-2462	Wassa Nkwanta-Tarkwa mine	5.3	-1.9833	Artisanal Mining (hand mining)	Cyanide
GH-2463	Essaman-Tarkwa mine	4.9981	-2.0814	Artisanal Mining (hand mining)	Cyanide
GH-2464	Simpa Tarkwa mine	5.3	-1.9833	Artisanal Mining (hand mining)	Cyanide
GH-2465	Bibiani Central African Gold mine	6.4667	-2.3333	Mining and Ore Processing	Cyanide
GH-2466	Legacy Mercury site, Ntronang Abirem, E/R	6.4333	-0.95	Mining and Ore Processing	Mercury - elemental
GH-2467	Subinso-Tepa mine, Ahafo Ano North, A/R	7	-2.1667	Mining and Ore Processing	Mercury - elemental
GH-2490	Obuasi Pompora STP	6.2	-1.667	Multiple Diverse Industries	Arsenic
GH-2491	Abandoned Lead site, Railway Servicing Workshop, Kumasi	6.69071	-1.61835	Transportation (bus stations, rail yards)	Lead
GH-2576	Kyebi GWCL Water Treatment	6.1667	-0.55	Multiple Diverse Industries	Fluorides
GH-2577	Abandoned Pesticide site, Veia Irrigation Project, UE/R	10.8667	-0.85	Artisanal Mining (hand mining)	DDT
GH-2578	Abandoned Pesticides site, Tono Irrigation Project, UE/R	9.4333	-0.0167	Agriculture	DDT
GH-2608	Sansu Obuasi-River	6.2	-1.6667	Mining and Ore	Cyanide

Site Number	Site Name	Latitude	Longitude	Site Industry	Key Pollutant
	Nyam			Processing	
GH-2649	Asuako river, Obuasi, Ashanti Region	6.2	-1.6667	Mining and Ore Processing	Lead
GH-2650	Old Aboabo, Kumasi, Ashanti Region	6.6833	-1.6167	Industrial/Municipal Dump Site	Cadmium
GH-2676	River Subin, Kumasi	6.6833	-1.6167	Multiple Diverse Industries	Lead
GH-2708	Suame Magazine Industrial Development, Kumasi	6.6833	-1.6167	Industrial Estate (mixed industries)	Lead
GH-3132	Kpone Dump Site	5.70896	0.021618	Industrial/Municipal Dump Site	Chromium (Total)
GH-3133	kpone dumpsite, kpone	5.70896	0.021618	Industrial/Municipal Dump Site	Other
GH-3134	Kpone Waste Dump site, Tema	5.75	0.006944	Industrial/Municipal Dump Site	Lead
GH-3136	Lead site, Suame Artisanal Cluster, Kumasi	6.75	-1.7	Industrial Estate (mixed industries)	Lead
GH-3164	Closed Lead site, Butuah Lagoon, NewTakoradi	4.8833	-1.75	Industrial Estate (mixed industries)	Lead
GH-3185	Abandoned Mercury site, PSGL Old Storage, Prestea	5.4333	-2.15	Mining and Ore Processing	Mercury - elemental
GH-3186	Abekoase, Tarkwa-Nsuaem municipality	5.373333	-2.018611	Mining and Ore Processing	Lead
GH-3188	Teberibie mine waste dump, Tarkwa-Nsuaem municipality	5.286944	-1.998611	Mining and Ore Processing	Arsenic
GH-3189	Abandoned Mercury site, Bondaye Old Storage, W/R	5.4166	-2.15	Mining and Ore Processing	Mercury - elemental
GH-3213	Ayigya industrial waste site	6.703	-1.565	Industrial/Municipal Dump Site	Lead
GH-3214	Amakom Auto-mechanic (Odifor Asare Park)near Lobito	6.67	-1.597	Transportation (bus stations, rail yards)	Lead

Site Number	Site Name	Latitude	Longitude	Site Industry	Key Pollutant
GH-3215	Odumase Zongo (Asante Akyem North Municipality)	6.625933	-1.231217	Artisanal Mining (hand mining)	Mercury - organic
GH-3259	Lead Acid Battery Recycling, Ntiribuoho, Afigya Kwabre District	6.7855	-1.6627	Lead - Battery Recycling	Lead
GH-3260	Dump site, Ahenema Kokoben, Bosomtwe District	6.6308	-1.6486	Industrial/Municipal Dump Site	Lead
GH-3262	Scrap Yard and Lead Acid Battery Recycling, Adiembra, Offinso District	6.95	-1.688	Recycling / Recyclers (including salvage yards)	Lead
GH-3263	Dantin cocoa office, Offinso District	6.9362	-1.6751		Pesticides
GH-3269	Konongo Zongo (Asante Akyem North Municipality)	6.621117	-1.216217	Artisanal Mining (hand mining)	Mercury - elemental
GH-3274	Abandoned Ghana Lead Acid Battery Factory, Adukrom	6.011297	-0.080386	Lead - Battery Recycling	Lead
GH-3280	Manhyia reclaimed landfill site	6.715647	-1.635833	Industrial/Municipal Dump Site	Lead
GH-3283	Artisanal gold mining, Kibi Anglican Basic School	6.156667	-0.56125	Artisanal Mining (hand mining)	Mercury - elemental
GH-3284	abandoned Kibi Divisional Police Mercury contaminated site- Kibi 2	6.154067	-0.558292	Artisanal Mining (hand mining)	Mercury - elemental
GH-3293	Asafo Garages	6.072278	-1.612194	Lead - Battery Recycling	Lead
GH-3294	Club 600 suame Garages	6.715639	-1.630583	Lead - Battery Recycling	Lead
GH-3317	New Konkrompe Dam, Atebubu-Amantin District	7.71294	-1.01525	Agriculture	Chlordane
GH-3319	Atebubu Magazine, Atebubu Amantin District	7.76317	-0.98386	Multiple Diverse Industries	Lead

Site Number	Site Name	Latitude	Longitude	Site Industry	Key Pollutant
GH-3320	Atebubu-Prase, Atebubu- Amantin District Assembly Battery Recycling	7.752111	-0.986806	Lead - Battery Recycling	Lead
GH-3321	Yeji Magazine, Pru District	8.229472	-0.650944	Industrial Estate (mixed industries)	Lead
GH-3327	Abandoned Mercury site, Nyafoman, E/R	6.4429	-0.9123	Artisanal Mining (hand mining)	Mercury - organic
GH-3332	Asokwa Cluster of Auto mechanic shops	6.773	-1.588	Lead - Battery Recycling	Lead
GH-3335	Oblogo Municipal Landfill site	5.56912	-0.32236	Industrial/Municipal Dump Site	Other
GH-3336	Tailings dam, Akusu River, Saamang Fanteakwa	6.324525	-0.499389	Mining and Ore Processing	Mercury - elemental
GH-3337	Poloyela Fong Community Blacksmith, Tamale	9.4094	-0.8459		Lead
GH-3338	Aboabo Kesse, reclaimed landfill , Kumasi	6.809	-1.608	Industrial/Municipal Dump Site	Lead
GH-3339	Kaase dump site, Kumasi, Ashanti Region.	6.682	-1.656	Industrial/Municipal Dump Site	Lead
GH-3340	Buokrom/ Sepe, Kumasi, Ashanti Region	6.83	-1.71	Industrial/Municipal Dump Site	Lead
GH-3341	Kenyasi (Truba), Kumasi Ashanti Region Landfill Site	6.815	-1.597	Industrial/Municipal Dump Site	Lead
GH-3342	Buokrom/ Doti, Kumasi, Ashanti Region	6.74316	-1.57254	Industrial/Municipal Dump Site	Lead
GH-3343	Abandoned Lead Site, Aluminum Enterprises Limited	5.68525	0.03598	Lead Smelting (with ingot production)	Lead
GH-3359	Valco Industrial Waste Dumpsite	5.6723	0.02714	Heavy Industry (casting, rolling, stamping)	Other
GH-3360	Cape Coast Siwdu e-waste site,	5.105392	-1.241806	E-waste recycling	Lead
GH-3361	Abandoned Arsenic	5.448541	-2.133436	Artisanal Mining	Arsenic

Site Number	Site Name	Latitude	Longitude	Site Industry	Key Pollutant
	Site, Asesre-Prestea			(hand mining)	
GH-3363	Wyoming Mine, Abomosu	6.18221	0.42402	Artisanal Mining (hand mining)	Mercury - elemental
GH-3364	Ameen Sangari waste water disposal site, Cape Coast	5.119444	-1.283056	Industrial Estate (mixed industries)	Lead
GH-3365	Prestea-Himan Ntokonu gold washing and extraction site, Prestea	5.255833	-1.993056	Artisanal Mining (hand mining)	Lead
GH-3366	Birim river pollution, Akim Oda, Eastern region	5.936389	-0.979167	Artisanal Mining (hand mining)	Chromium (Total)
GH-3368	Abandoned Mining Site, Kibi Apapam	6.08721	0.35891	Artisanal Mining (hand mining)	Mercury - elemental
GH-3370	Bonsa Tyre Manufacturing, Wassa West District, Western province	5.283444	-1.983494	Heavy Industry (casting, rolling, stamping)	Lead
GH-3371	Bremang lead-acid recycle legacy	6.7453	-0.643	Lead - Battery Recycling	Lead
GH-3372	Nkroful Small Scale Mining, Ellembelle District	4.950081	-2.316747	Mining and Ore Processing	Lead
GH-3373	Abandoned Shang Feng Mining Site, Akyem Soabe, Eastern Province	5.997064	-0.918764	Mining and Ore Processing	Lead
GH-3374	Affiduasi small-scale blacksmith industry	6.8486	-1.4013	Industrial Estate (mixed industries)	Lead
GH-3377	Fumesua, Abandoned fuel pump and Cluster of Automobile Artisans	6.712278	-1.524083	Multiple Diverse Industries	Lead
GH-3378	Ejura Cluster of Artisans, Ejura Sekyeredumase District	7.37864	-1.360888	Multiple Diverse Industries	Lead
GH-3379	Meduma Cluster of Artisans, Asore Nkwanta, Ashanti	6.770972	-1.594722	Multiple Diverse Industries	Lead
GH-3381	Amanfrom Landfill	6.76275	-1.667944	Industrial/Municipal	Lead

Site Number	Site Name	Latitude	Longitude	Site Industry	Key Pollutant
	site			Dump Site	
GH-3382	Hwiediem west polar tyre combustion site	6.762889	-1.6695	Recycling / Recyclers (including salvage yards)	Lead
GH-3405	Takoradi Kokompe scrap yard	4.888264	-1.767781	E-waste recycling	Lead
GH-341	Korle Lagoon Ecological Restoration Project, Korle-Bu, Accra	5.536541	-0.219769	Industrial/Municipal Dump Site	Lead
GH-3410	Mixed Industries, Ashiaman Fitter line	5.700085	-0.033319	Multiple Diverse Industries	Lead
GH-3425	Abandoned Aluminium Enterprises Limited Site, Tema	5.68525	0.03598	Lead Smelting (with ingot production)	Cyanide
GH-3427	Mixed Industries, Adadaimkpo artisanal cluster	5.533472	-0.216707	Multiple Diverse Industries	Cadmium
GH-3429	Densu River, Oblogo	5.550245	-0.316716	Agriculture	Cadmium
GH-3432	Akyem Ankaase, Eastern Region	6.22425	0.301	Artisanal Mining (hand mining)	Arsenic
GH-3434	Valco Industrial Waste Dumpsite, Tema	5.6723	0.02714	Heavy Industry (casting, rolling, stamping)	Cadmium
GH-3435	Heavy Industrial Area Municipal Drain, Tema	5.66824	0.00214	Petrochemical Industries (refineries)	Arsenic
GH-3436	Kokompe Auto Spare Parts Shops/ Scrap Yard, Darkuman	5.550245	-0.25005	Multiple Diverse Industries	Lead
GH-3437	Abandoned Mercury Site, Kibi Apapam	6.153638	-0.599772	Artisanal Mining (hand mining)	Arsenic
GH-3438	Oblogo Municipal Landfill site, Oblogo	5.933587	-0.533433	Industrial/Municipal Dump Site	Lead
GH-3442	Wyoming Mine, Abomosu, Eastern Region	5.549867 999	- 0.1805877 69	Artisanal Mining (hand mining)	Arsenic
GH-3505	Ho Dome scrap yard, Ho Municipality	6.36	-0.28495	E-waste recycling	Cadmium

Site Number	Site Name	Latitude	Longitude	Site Industry	Key Pollutant
GH-3513	Anointed Vessel Batik Training Site, Ho Fiave	6.37	-0.28963	Dye Industry	Lead
GH-3514	Tema Community 1 E-waste site, Tema	5.646	-0.00638	E-waste recycling	Arsenic
GH-3551	Ho Zongo E-waste recycling, Ho	6.37971	-0.028849	E-waste recycling	Lead
GH-3552	Akpenamawu E-waste recycling, Ho	6.37393	0.028075	E-waste recycling	Lead
GH-3553	Volta Lake, Kokonte Kpedzi (Akosombo)	6.279	-0.0788	Dye Industry	Lead
GH-3554	Galloway, Accra	5.552	-0.2308	E-waste recycling	Lead
GH-3555	Nungua Scrap Yard, Brigade Junction	5.592756	-0.091119	E-waste recycling	Lead
GH-3564	Auto Mechanic Shop Madina-Nsamanpomu	5.67664	-0.15362	Transportation (bus stations, rail yards)	Lead
GH-3565	Mechanic Shops, Brusi Akraasi, Obuasi, Ashanti	6.211	-1.676	Transportation (bus stations, rail yards)	Lead
GH-3569	Dump site, Obuasi Central, Ashanti Region	6.198	-1.665	Industrial/Municipal Dump Site	Lead
GH-3571	Animal Hide processing site Achimota	5.627778	-0.911111	Food Processing	Lead
GH-3572	Tweapease mining site, Obuasi.	6.165528	-0.678812	Artisanal Mining (hand mining)	Mercury - elemental
GH-3573	Kofikrom landfill site, Obuasi.	6.196528	-0.248194	Industrial/Municipal Dump Site	Mercury - elemental
GH-3577	String of mechanic shops, Madina	5.683056	-0.156944	Transportation (bus stations, rail yards)	Chromium (Total)
GH-3579	Sanso Artisanal Mining Site	6.151233	-1.692533	Artisanal Mining (hand mining)	Mercury - organic
GH-3580	akim wenchi abandoned galamsey site	5.991389	-0.9025	Mining and Ore Processing	Lead
GH-3581	Auto battery refurbishing, Prase, Atebubu	7.752111	-0.986806	Lead - Battery Recycling	Lead
GH-3582	Bidieso Abandoned Artisanal Mining Site, Obuase	6.2028	-1.674167	Artisanal Mining (hand mining)	Mercury - elemental
GH-3583	Adikra Artisanal	6.085616	-1.697336	Artisanal Mining	Mercury - organic

Site Number	Site Name	Latitude	Longitude	Site Industry	Key Pollutant
	Mining Site			(hand mining)	
GH-3584	Artisanal gold mining at Goldfields Int. School, Bondaye - Prestea	5.24812	-2.0934	Artisanal Mining (hand mining)	Arsenic
GH-3585	Informal Mercury Mining - Kporviadzi, Prestea	5.2652	-2.07141	Artisanal Mining (hand mining)	Mercury - elemental
GH-3740	Atwima Boko, Atwima Nwabiagya Disrtict	6.67205	-1.69988	Pesticide Manufacturing	Endrin
GH-3798	Abandoned Mobil Filling Station - Denu	6.06083	-1.08862	Petrochemical Industries (refineries)	Lead
GH-3799	Abandoned Runel Filling Station - Dzodze	6.14092	-0.59591	Petrochemical Industries (refineries)	Lead
GH-3800	Defunct Gadzanku Gas Station - Ho	6.36801	-0.29311	Petrochemical Industries (refineries)	Lead
GH-3801	Mazeema leather tanning	9.39356	-0.83981	Tannery Operations	Chromium (Total)
GH-3812	abandoned tyre burning centre for slaughtering animals, madina	5.682778	-0.157222	Recycling / Recyclers (including salvage yards)	Chromium (Total)
GH-3813	abandoned slaughter house, koforidua zongo magazine	6.101667	-0.260833	Agriculture	PCBs (PolyChlorinated Biphenyls)
GH-3814	Kasoa Tyre Burning Site and abbator	5.571389	-0.96139	Recycling / Recyclers (including salvage yards)	Lead
GH-3815	Abandoned Filling Station at Adenta	5.705833	-0.155	Transportation (bus stations, rail yards)	Cadmium
GH-3819	Sakaman Tyre Burning Site and Abbator	5.548611	-0.601667	Recycling / Recyclers (including salvage yards)	Lead
GH-3820	Waste oil recycling site, Tema heavy Industrial area	5.546944	-0.308889	Recycling / Recyclers (including salvage yards)	Lead
GH-3821	Abandoned fuel service station, Winneba	5.415	-0.745	Petrochemical Industries (refineries)	Lead
GH-3822	ECG Repair and	5.546944	-0.208889	Electricity Distribution	PCBs

Site Number	Site Name	Latitude	Longitude	Site Industry	Key Pollutant
	Maintenance Workshop, Makola				(PolyChlorinated Biphenyls)
GH-3824	Abandoned fuel service station, Kormantse	5.203103	-1.087861	Transportation (bus stations, rail yards)	Lead
GH-3825	Ashaiman tyre burning site, Peterline	5.669403	-0.018558	Recycling / Recyclers (including salvage yards)	Lead
GH-3833	Cluster of Artisanal Tannery	9.3936	-0.83982	Tannery Operations	Chromium (Total)
GH-3835	Asante Kingâ€™s Project battery recycling site	6.701522	-1.624604	Lead - Battery Recycling	Lead
GH-3889	Abandoned abattoir, James Town	5.543472	-0.204117	Agriculture	Lead
GH-4220	Nmai Dzorn Transformer sites 1 and 2, East Legon	5.65987	-0.132232	Electricity Distribution	PCBs (PolyChlorinated Biphenyls)
GH-4221	Madina Zongo Transformer site, Libya Quarters	5.68277	-0.168889	Electricity Distribution	PCBs (PolyChlorinated Biphenyls)
GH-4222	Lakeside Metal Fabricators, Ashaley Botwe	5.685	-0.1411	Electroplating	PCBs (PolyChlorinated Biphenyls)
GH-4224	East Legon ECG Transformer Site, Bondzie Street	5.65987	-0.132232	Electricity Distribution	PCBs (PolyChlorinated Biphenyls)
GH-4225	Nungua E-waste Site, Teshie Nungua	5.596852	-0.0845	E-waste recycling	PCBs (PolyChlorinated Biphenyls)
GH-5210	Abandoned chemical manufacturing plant, Abuakwa	6.70397	-1.70965	Chemical Manufacturing (acids, organics, base chemicals)	Other
GH-5225	Abandoned mine pit, Manso Adubia	6.40029	-1.93925	Artisanal Mining (hand mining)	Arsenic
GH-5226	Abandoned mine pit, Afraso	6.30583	-1.97697	Artisanal Mining (hand mining)	Arsenic
GH-5227	Abandoned mine pit, Tontokrom	6.25451	-2.00261	Artisanal Mining (hand mining)	Arsenic
GH-5228	Abandoned mine pit, Kwahu	6.45248	-1.89953	Artisanal Mining (hand mining)	Arsenic
GH-5237	PSGL Tailing Dump Site, Bondaye	5.39745	-2.1679	Artisanal Mining (hand mining)	Arsenic

Site Number	Site Name	Latitude	Longitude	Site Industry	Key Pollutant
GH-5243	Abrogari Small Scale Artisanal Mining Site	6.184246 161	1.2744140 63	Artisanal Mining (hand mining)	Arsenic
GH-5244	Artisanal gold mining at Goldfields Int. School, Bondaye - Prestea	5.41943	-2.14808	Artisanal Mining (hand mining)	Arsenic
GH-5252	PSGL Old Dump Site II (Abandoned Mercury Site)	5.44525	-2.12921	Mining and Ore Processing	Arsenic
GH-5253	Abandoned Mercury Site at Asesre - Updated	5.44419	-2.15213	Artisanal Mining (hand mining)	Arsenic
GH-5262	Abandoned Mercury site, Adadiantem Habitat, Kibi	6.168329	-0.567685	Artisanal Mining (hand mining)	Arsenic
GH-5263	Prestea Ankobrah Mine Site	5.44907	-2.12418	Artisanal Mining (hand mining)	Arsenic
GH-5266	Abandoned Mercury Site, Bondaye - Updated	5.40261	2.15	Mining and Ore Processing	Arsenic

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Site ID	Site Name	Latitude	Longitude	Key Pollutant	Site Industry
GH-2396	Abandoned Arsenic site, Abuakwa Formulation Plant, Kumasi	6.70397	-1.70965	Lead	Chemical Manufacturing (acids, organics, base chemicals)
GH-2491	Abandoned Lead site, Railway Servicing Workshop, Kumasi	6.69071	-1.61835	Lead	Transportation (bus stations, rail yards)
GH-3274	Abandoned Ghana Lead Acid Battery Factory, Adukrom	6.011297	-0.080386	Lead	Lead - Battery Recycling
GH-3342	Buokrom/ Doti, Kumasi, Ashanti Region	6.74316	-1.57254	Lead	Industrial/Municipal Dump Site
GH-5210	Abandoned chemical manufacturing plant, Abuakwa	6.70397	-1.70965	Other	Chemical Manufacturing (acids, organics, base chemicals)
GH-5225	Abandoned mine pit, Manso Adubia	6.40029	-1.93925	Arsenic	Artisanal Mining (hand mining)
GH-5226	Abandoned mine pit, Afraso	6.30583	-1.97697	Arsenic	Artisanal Mining (hand mining)
GH-5227	Abandoned mine pit, Tontokrom	6.25451	-2.00261	Arsenic	Artisanal Mining (hand mining)
GH-5228	Abandoned mine pit, Kwahu	6.45248	-1.89953	Arsenic	Artisanal Mining (hand mining)
GH-5237	PSGL Tailing Dump Site, Bondaye	5.39745	-2.1679	Arsenic	Artisanal Mining (hand mining)
GH-5243	Abrogari Small Scale Artisanal Mining Site	6.184246161	1.274414063	Arsenic	Artisanal Mining (hand mining)
GH-5244	Artisanal gold mining at Goldfields Int. School, Bondaye - Prestea	5.41943	-2.14808	Arsenic	Artisanal Mining (hand mining)
GH-5252	PSGL Old Dump Site II (Abandoned Mercury Site)	5.44525	-2.12921	Arsenic	Mining and Ore Processing
GH-5253	Abandoned Mercury Site at Asesre - Updated	5.44419	-2.15213	Arsenic	Artisanal Mining (hand mining)
GH-5262	Abandoned Mercury site, Adadiantem	6.168329	-0.567685	Arsenic	Artisanal Mining (hand mining)

	Habitat, Kibi				
GH-5263	Prestea Ankobrah Mine Site	5.44907	-2.12418	Arsenic	Artisanal Mining (hand mining)
GH-5266	Abandoned Mercury Site, Bondaye - Updated	5.40261	2.15	Arsenic	Mining and Ore Processing

