Informal e-waste recycling in Ghana: the big issues

Julius Fobil, Niladri Basu, Stuart Batterman & Thomas Robins

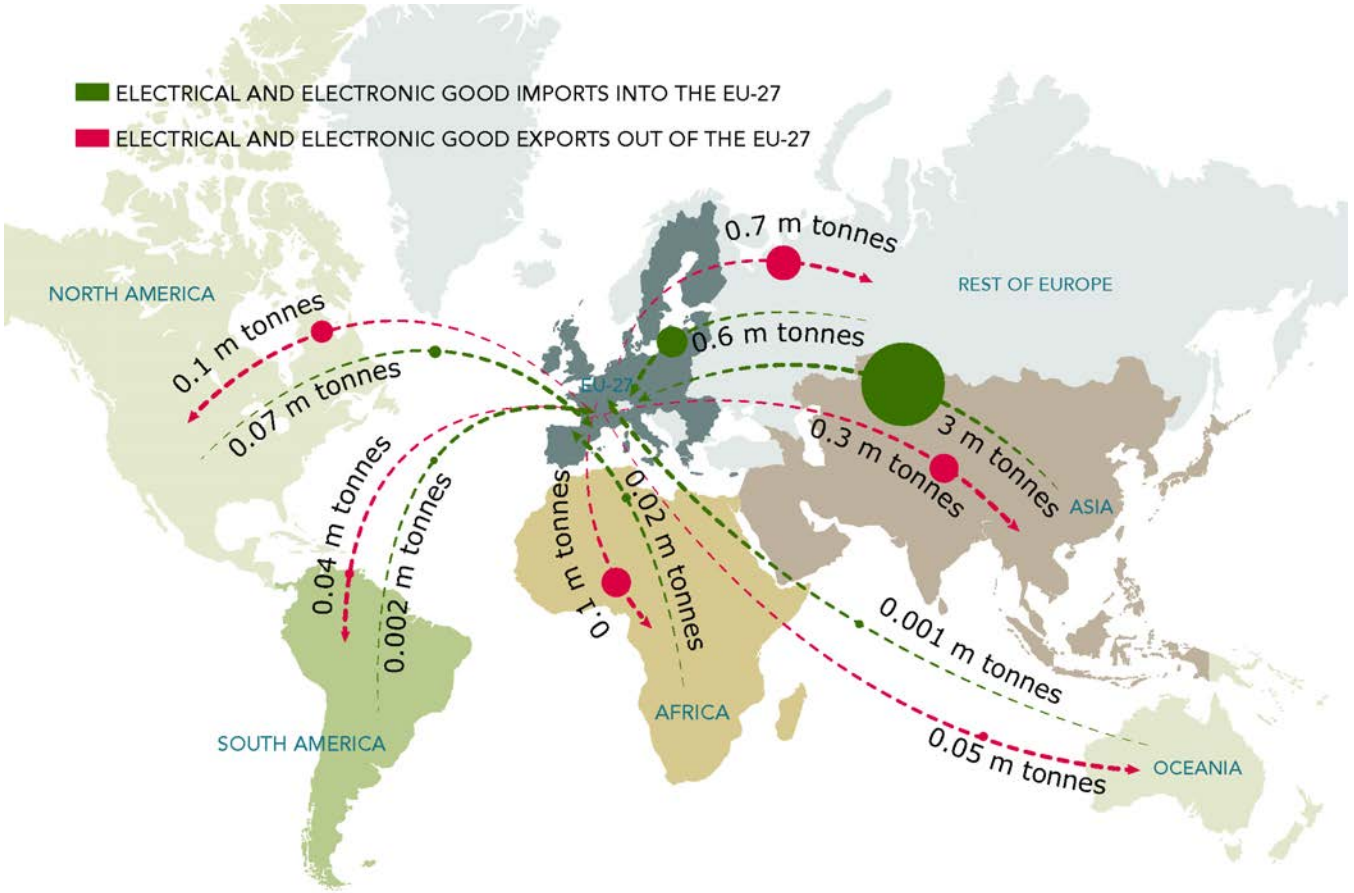
SCHOOL OF PUBLIC HEALTH
UNIVERSITY OF MICHIGAN

McGill

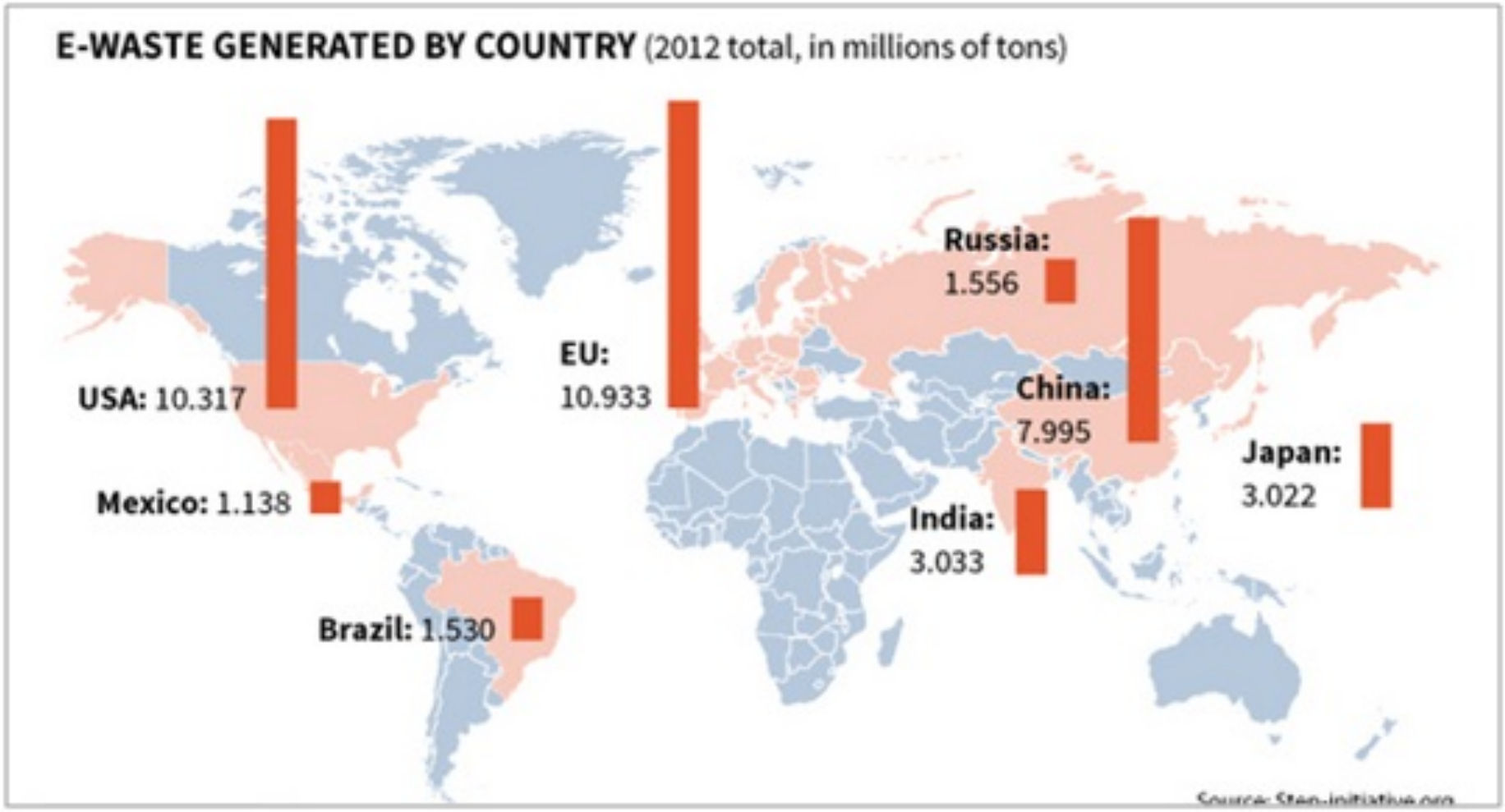
INTEGRI PROCEDAMUS

UNIVERSITY OF GHANA
SCHOOL OF PUBLIC HEALTH

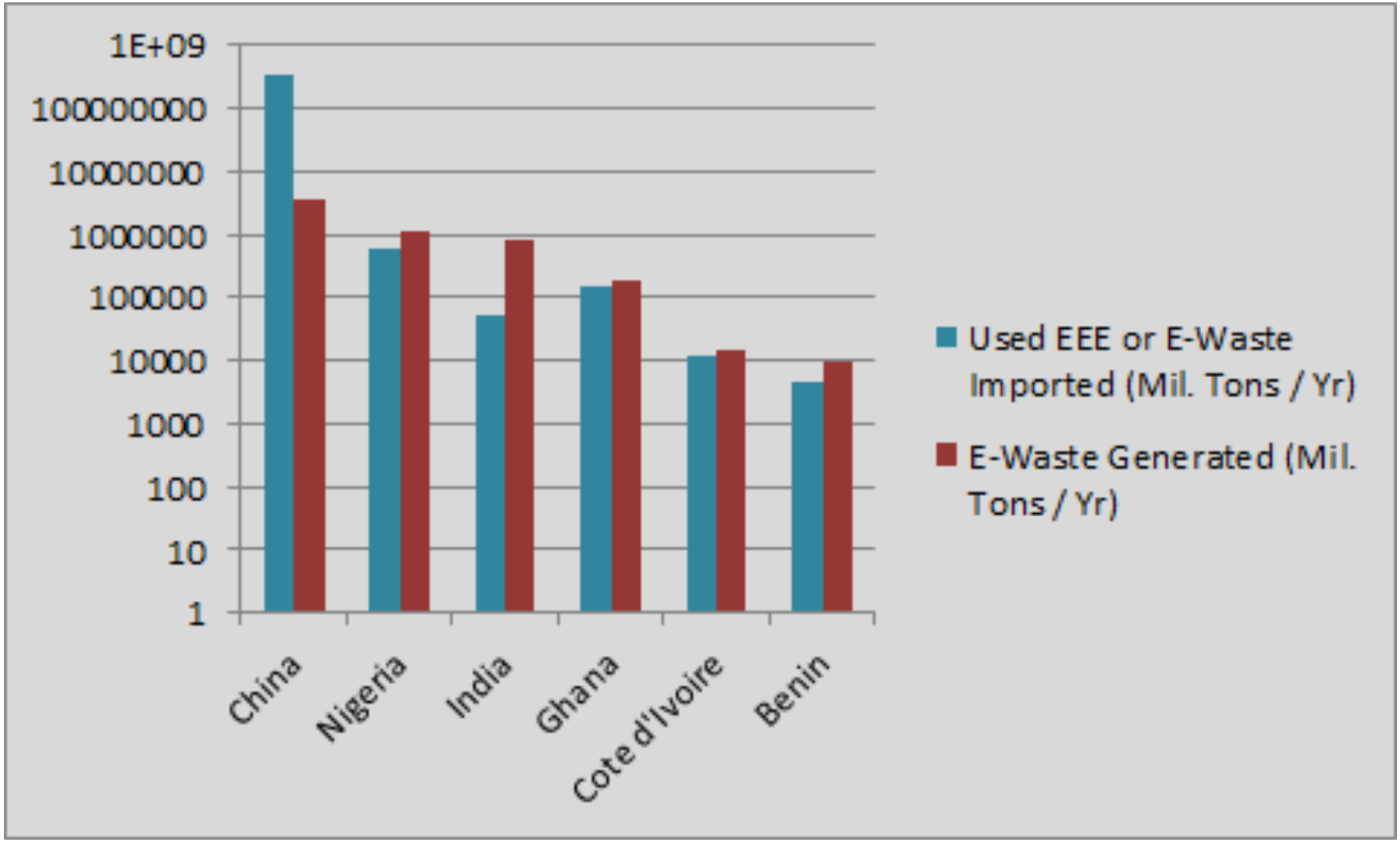
Origin of electronic waste (e-waste)



E-waste: global production



E-waste: Production in Asia & some West African countries



E-waste: global movement

E-waste: global destinations

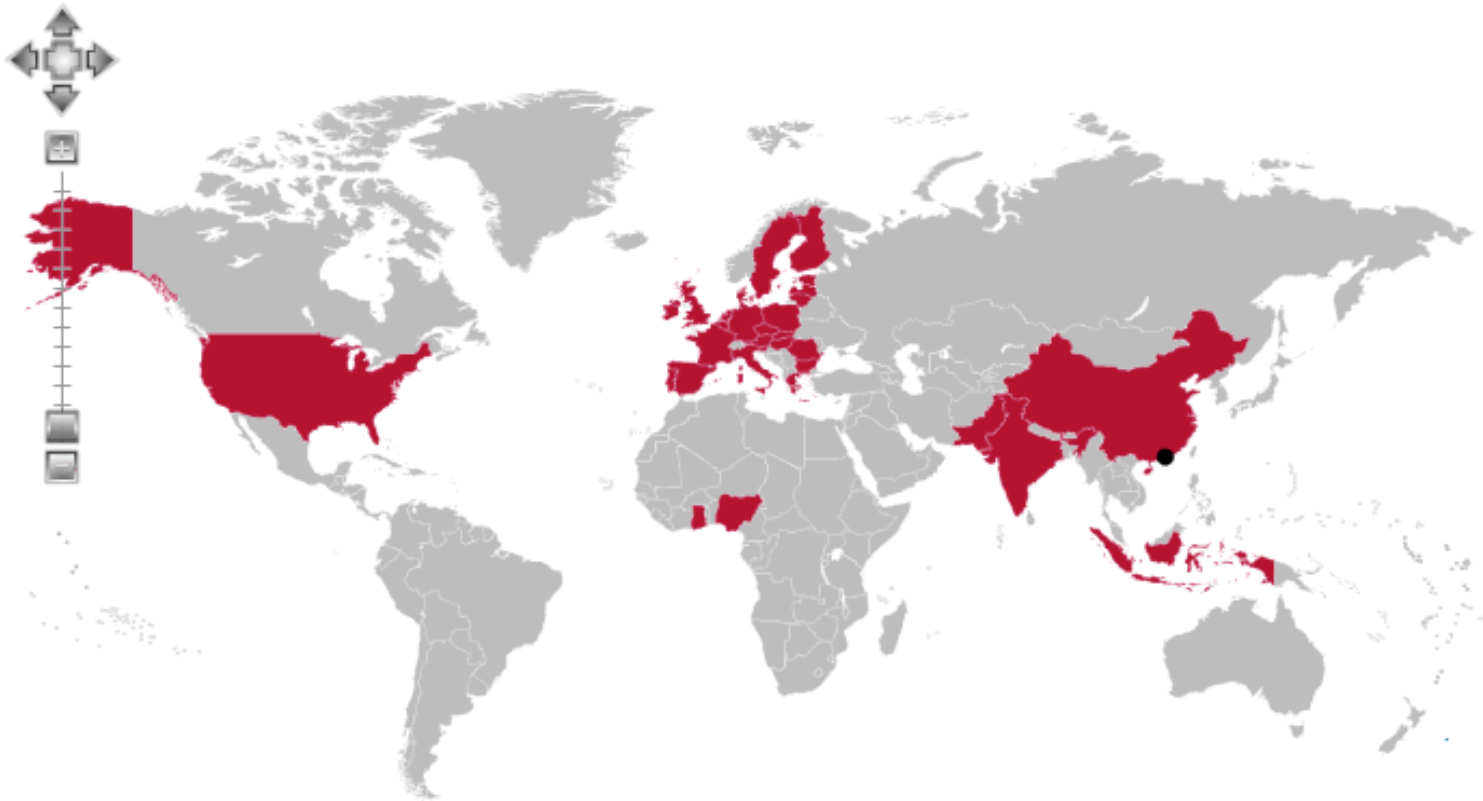
Global trade in e-waste

THE GLOBAL TRADE IN ELECTRONIC WASTE

By Leslie Young

Roll over the red countries to to find out where all our e-waste is going and who is paying the price.

Use the slider on the left to zoom in and out of the map.

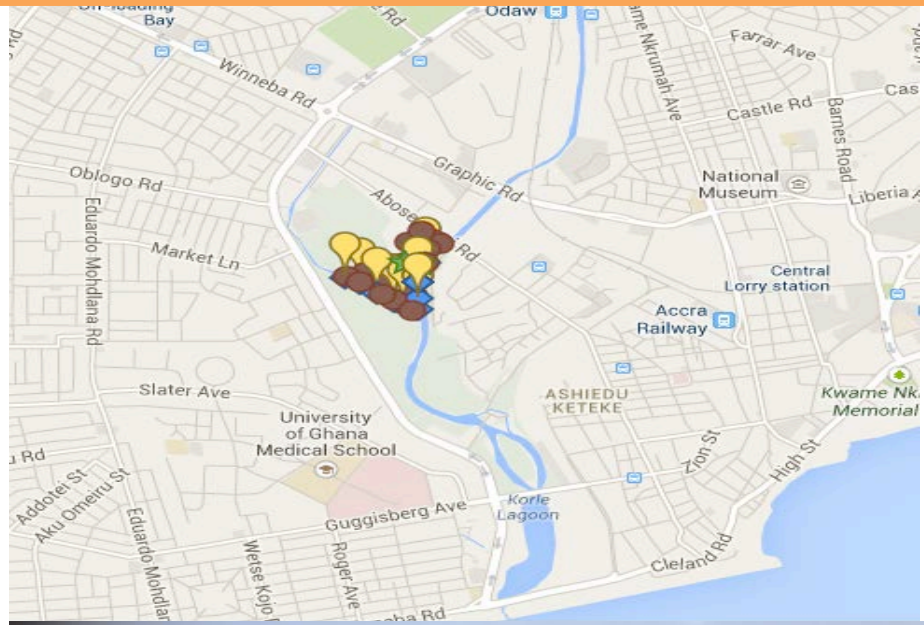


Agbobloshie: geographic location

- Location in relation to:
  - Africa
  - Ghana

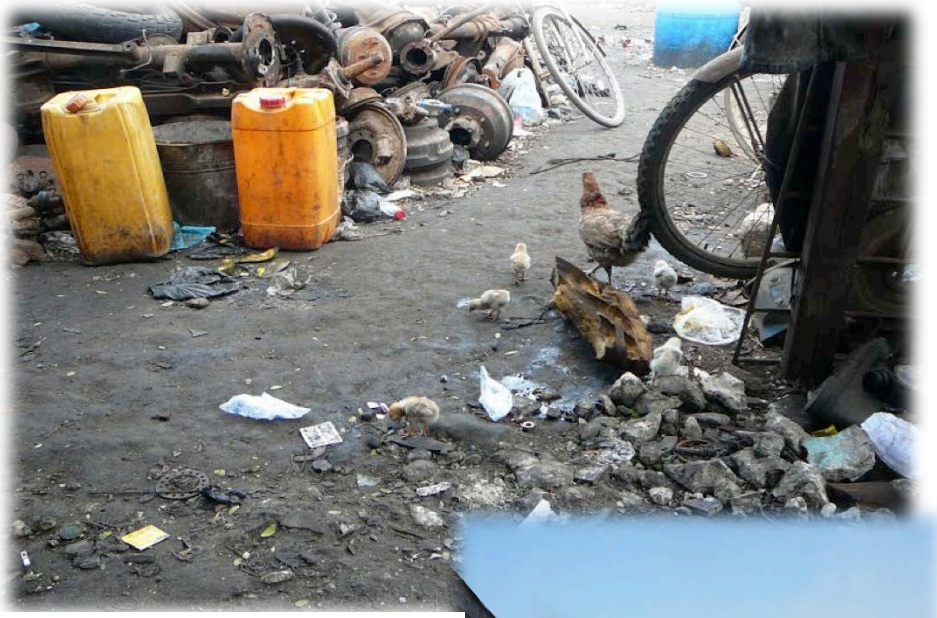
Agbogbloshie

- Within Ghana's capital city Accra
- One of the largest and best-studied e-waste sites
- The site is situated near the CBD
- Two rivers:
  - Korle River to the East
  - Odaw River to the West



Agbobloshie: general economy

- Largest food market
- Banking/Services
- Manufacturing
- Retail
- Scrap metal
- Used electronics
- Car batteries
- Schools/education
- Residential purpose
- Brewery, etc



Recycling Methods

- Recycling activities take place in a highly concentrated area and include:
  - Open burning
  - Manual dismantling
    - Chisels and hammers
- Fabrication/moulding into local cookstoves

Recycling Methods

Multiple Exposures

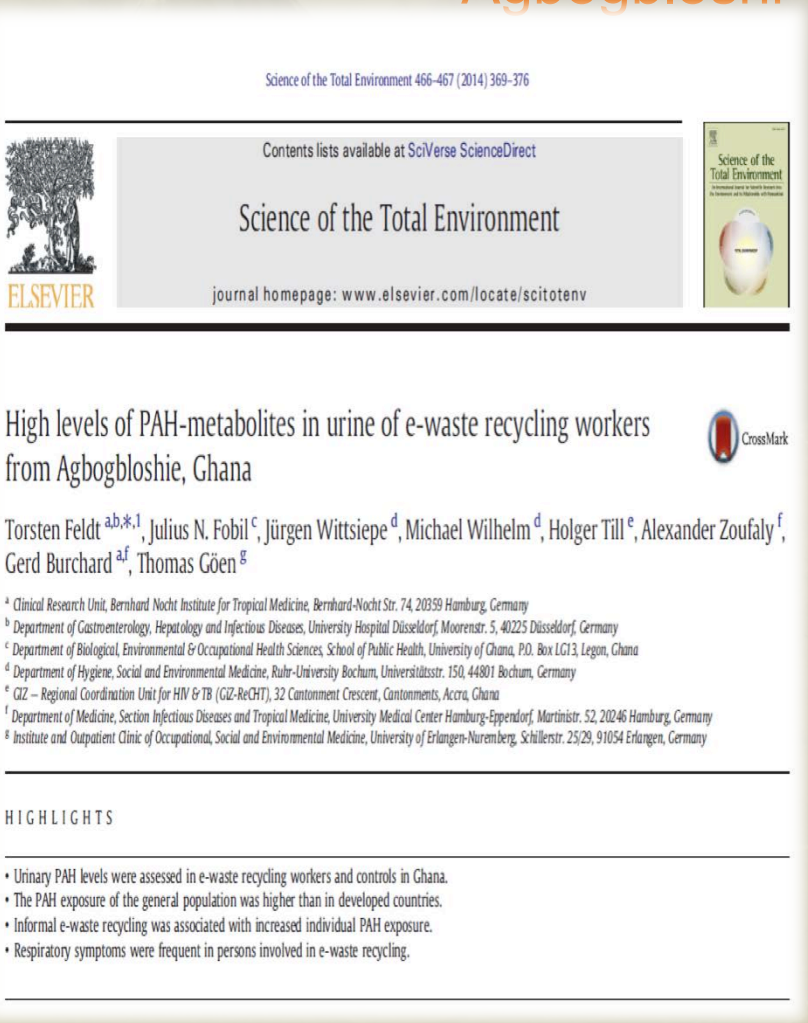
Multiple exposures

Findings of some studies

Polychlorinated aromatic hydrocarbons (PAHs)

Agbogbloshi

- Urinary PAH levels were assessed in e-waste recycling workers and in controls in Ghana.
- The PAH exposure of the general population was higher than in developed countries.
- Informal e-waste recycling was associated with increased individual PAH exposure.



Science of the Total Environment 466–467 (2014) 369–376

Contents lists available at SciVerse ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

High levels of PAH-metabolites in urine of e-waste recycling workers from Agbogbloshie, Ghana

Torsten Feldt [a,b,*,1], Julius N. Fobil [c], Jürgen Wittsiepe [d], Michael Wilhelm [d], Holger Till [e], Alexander Zoufaly [f], Gerd Burchard [a,f], Thomas Göen [g]

[a] Clinical Research Unit, Bernhard Nocht Institute for Tropical Medicine, Bernhard-Nocht Str. 74, 20359 Hamburg, Germany
[b] Department of Gastroenterology, Hepatology and Infectious Diseases, University Hospital Düsseldorf, Moorenstr. 5, 40225 Düsseldorf, Germany
[c] Department of Biological, Environmental & Occupational Health Sciences, School of Public Health, University of Ghana, P.O. Box LG13, Legon, Ghana
[d] Department of Hygiene, Social and Environmental Medicine, Ruhr-University Bochum, Universitätsstr. 150, 44801 Bochum, Germany
[e] GIZ – Regional Coordination Unit for HIV & TB (GIZ-ReCHT), 32 Cantonment Crescent, Cantonments, Accra, Ghana
[f] Department of Medicine, Section Infectious Diseases and Tropical Medicine, University Medical Center Hamburg-Eppendorf, Martinistr. 52, 20246 Hamburg, Germany
[g] Institute and Outpatient Clinic of Occupational, Social and Environmental Medicine, University of Erlangen-Nuremberg, Schillerstr. 25/29, 91054 Erlangen, Germany

HIGHLIGHTS

- Urinary PAH levels were assessed in e-waste recycling workers and controls in Ghana.
- The PAH exposure of the general population was higher than in developed countries.
- Informal e-waste recycling was associated with increased individual PAH exposure.
- Respiratory symptoms were frequent in persons involved in e-waste recycling.

Findings of some studies

Agbogbloshi

Trace metal analysis

- Respiratory symptoms were frequent in persons involved in e-waste recycling.
- High levels of Cu, Zn, Pb, and Al in soil/ash mixtures
- Toxins may not be due e-wastes alone
- Other sources of these environmental toxins are possible

Findings of some studies

Agbogbloshi

We looked for evidence of differences in the toxin concentrations between the two groups

Comparative differences between the exposed and unexposed groups

Environmental Toxin	Mean - exposed	Mean - control	*t-value*	df	Std.Dev - exposed	Std.Dev - control	*F*-ratio	*p - Value*
Mercury, hair [µg/g]	0.48	0.83	-3.59	74.00	0.28	0.54	3.59	0.00
Cadmium, blood [µg/l]	0.57	0.57	0.04	78.00	0.38	0.20	3.51	0.00
Lead, blood [µg/l]	107.10	44.25	6.04	78.00	64.30	14.08	20.87	0.00
Cadmium, urine [µg/l]	0.27	0.20	1.53	77.00	0.25	0.16	2.49	0.01
Nickel, urine [µg/l]	5.62	4.02	1.96	77.00	4.19	2.93	2.06	0.03

Findings of some studies

Agbogbloshi

1. Polychlorinated dibenzo-p-dioxins/dibenzofurans
2. Chlorophenols, polychlorinated biphenyls (PCBs)

- Data on toxic organic compounds i.e. Dioxins – PCDD/F, PCBs, etc
- 17 congeners were assessed
- 10 showed evidence of difference in concentration between exposed and non exposed
- Summing the congeners, only 1 shows evidence of any difference between the two groups
- All higher than WHO value

Findings of some studies

Agbogbloshi

Table 2: Descriptive statistical parameters of blood fat content and PCDD/F blood levels[pg/g lipid base] in exposed individuals and controls

PCDD/F [pg/g lipid base]	Controls (N=21)				Exposed (N=25)				
	AM	GM	P50	P95	AM	GM	P50	P95	p*)
Fat content [mg/g whole blood]	3.54	3.37	3.41	5.13	3.45	3.24	3.59	5.09	0.7325
2,3,7,8-TetraCDD (# D48)	0.66	0.53	0.65	1.3	1.15	0.82	0.85	3	0.6522
1,2,3,7,8-PentaCDD (# D54)	1.40	1.22	1.3	2.7	2.94	1.51	1.5	12	0.7223
1,2,3,4,7,8-HexaCDD (# D66)	0.87	0.64	0.63	1.4	1.59	1.02	0.83	5.6	0.2559
1,2,3,6,7,8-HexaCDD (# D67)	2.72	2.42	2.4	4.4	5.29	3.73	3.5	18	**0.0297**
1,2,3,7,8,9-HexaCDD (# D70)	1.91	1.30	1.4	4.1	3.11	2.05	2	12	0.0955
1,2,3,4,6,7,8-HeptaCDD (# D73)	13.55	10.69	9.1	40	15.81	13.04	13	38	0.1420
OctaCDD (# D75)	104.90	80.72	73	270	85.44	71.53	70	250	0.6431
2,3,7,8-TetraCDF (# F83)	0.65	0.44	0.55	1.7	1.99	1.29	1.4	5.2	**0.0055**
1,2,3,7,8-PentaCDF (# F94)	0.68	0.50	0.48	1.6	1.91	1.42	1.1	4.9	**0.0044**
2,3,4,7,8-PentaCDF (# F114)	3.59	3.10	3.2	7.3	9.12	4.70	4.3	33	0.0980
1,2,3,4,7,8-HexaCDF (# F118)	2.17	1.94	2.1	3.5	7.14	4.46	4.5	27	**0.0014**
1,2,3,6,7,8-HexaCDF (# F121)	1.91	1.68	1.8	3.5	8.32	4.49	4.4	33	**0.0003**
2,3,4,6,7,8-HexaCDF (# F130)	0.79	0.66	0.65	1.6	3.58	2.43	2.4	12	**0.0000**
1,2,3,7,8,9-HexaCDF (# F124)	0.35	0.24	0.215	1	0.56	0.41	0.47	1.4	**0.0417**
1,2,3,4,6,7,8-HeptaCDF (# F131)	3.50	2.47	2.6	8.3	18.41	11.23	11	74	**0.0000**
1,2,3,4,7,8,9-HeptaCDF (# F134)	0.59	0.36	0.28	1.7	2.10	1.09	1.2	8	**0.0004**
OctaCDF (# F135)	3.20	1.08	0.85	6.1	4.42	2.61	2.5	8.6	**0.0047**
Sum P(4-8)CDD	127.09	100.26	89.5	337	116.00	96.35	95.7	343	0.7575
Sum P(4-8)CDF	15.79	11.48	11.5	31.5	58.11	37.56	36.2	210	**0.0001**
Sum P(4-8)CDD/F	142.88	114.41	103	419	174.01	138.67	140	569	0.1894
WHO-2005-TEq (PCDD/F)	4.52	4.02	4.60	7.37	10.44	6.68	5.71	36.34	0.1581

*) p-values were calculated using Mann-Whitney U test

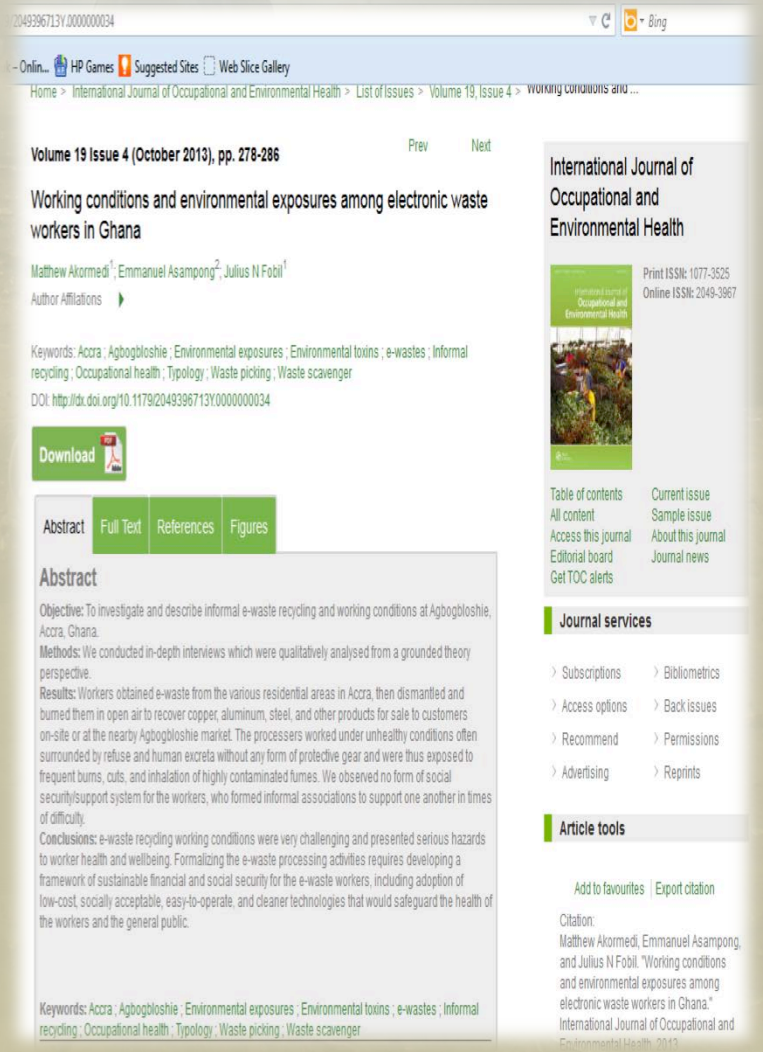
AM = arithmetic mean; GM = geometric mean; P50 = 50th percentile (median), P95 = 95th percentile

Findings of some studies

- Quarrying/biomass fuel use, vehicular emissions, food, etc

- A self-reported survey conducted at Agbobloshie, among the e-wastes workers indicates that the workers themselves acknowledge working under high risk environment

Agbogbloshi



Volume 19 Issue 4 (October 2013), pp. 278-286

Working conditions and environmental exposures among electronic waste workers in Ghana

Matthew Akormedi[1]; Emmanuel Asampong[2]; Julius N Fobil[1]

Author Affiliations

Keywords: Accra ; Agbogbloshie ; Environmental exposures ; Environmental toxins ; e-wastes ; Informal recycling ; Occupational health ; Typology ; Waste picking ; Waste scavenger

DOI: http://dx.doi.org/10.1179/2049396713Y.0000000034

Download

Abstract | Full Text | References | Figures

Abstract

Objective: To investigate and describe informal e-waste recycling and working conditions at Agbogbloshie, Accra, Ghana.

Methods: We conducted in-depth interviews which were qualitatively analysed from a grounded theory perspective.

Results: Workers obtained e-waste from the various residential areas in Accra, then dismantled and burned them in open air to recover copper, aluminum, steel, and other products for sale to customers on-site or at the nearby Agbogbloshie market. The processers worked under unhealthy conditions often surrounded by refuse and human excreta without any form of protective gear and were thus exposed to frequent burns, cuts, and inhalation of highly contaminated fumes. We observed no form of social security/support system for the workers, who formed informal associations to support one another in times of difficulty.

Conclusions: e-waste recycling working conditions were very challenging and presented serious hazards to worker health and wellbeing. Formalizing the e-waste processing activities requires developing a framework of sustainable financial and social security for the e-waste workers, including adoption of low-cost, socially acceptable, easy-to-operate, and cleaner technologies that would safeguard the health of the workers and the general public.

Keywords: Accra ; Agbogbloshie ; Environmental exposures ; Environmental toxins ; e-wastes ; Informal recycling ; Occupational health ; Typology ; Waste picking ; Waste scavenger

International Journal of Occupational and Environmental Health

Print ISSN: 1077-3525
Online ISSN: 2049-3967

Table of contents | Current issue
All content | Sample issue
Access this journal | About this journal
Editorial board | Journal news
Get TOC alerts

Journal services

Subscriptions | Bibliometrics
Access options | Back issues
Recommend | Permissions
Advertising | Reprints

Article tools

Add to favourites | Export citation

Citation:
Matthew Akormedi, Emmanuel Asampong, and Julius N Fobil. "Working conditions and environmental exposures among electronic waste workers in Ghana." International Journal of Occupational and

So what are the big issues?

Global Action – policy failures

Agbogbloshi

- International conventions, treaties and protocols
- Basel convention
  - Prohibits trans-boundary movement of hazardous chemical
  - Classifies e-waste as hazardous
  - Not in my backyard (NIMBY)

Global Action – policy failures

Agbogbloshi

- International conventions, treaties and protocols

- Often not ratified by national governments
  - When ratified; often lack local context/applicability
  - E-wastes continue to move across national boundaries

Global Action – Intervention to reduce exposures

- From everyday observations:
  - Computers
  - Fridges/Refrigerators
  - Printers
  - Photocopiers/scanner
  - Stereos/TV sets
  - Car electronics
- Cables and wires
  - Small wires
  - Large copper wires
- Scrap metals
  - Large vehicle parts
- Need for material flows & characterization study
  - First study under planning

Local Action - Major threats

- Eviction threats from municipal authorities
- Loss of property and livelihoods
- No form of social support mechanisms, e.g. health insurance, savings, access to loans, etc.
- Competition for space from formal sector
- Complex land tenure system
- Income variability
- No laws backing their activities (Unregulated activities)

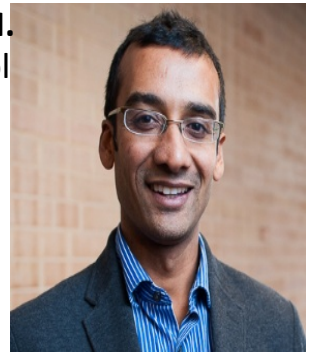
Local Action – Demolition

Research, innovation & development

- Ongoing research exposure assessment and worker health:
  - Exposure reduction initiatives

Mentors and collaborators

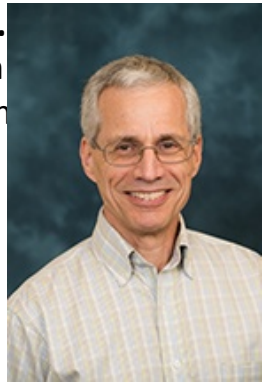
Thomas Robins, M.D., M.P.H.
University of Michigan School of Public Health



Niladri Basu, PhD, MSc, BS
University of McGill University

Michelle Heacock, PhD
NIEHS, Government Collaborator

Marie S. O'Neill, Ph.D.
University of Michigan School of Public Health



Stuart Batterman, PhD
University of Michigan School of Public Health

Benjamin Fayomi, M.D., M.Sc
University of Abomey at Calavi, Benin

West Africa GEOHealth Network UNIVERSITY OF GHANA

Julius Fobil, DrPH, DTM
University of Ghana School of Public Health

NIH Fogarty International Center
Advancing Science for Global Health

Acknowledgement

NIH Fogarty International Center
Advancing Science for Global Health

NIH National Institute of Environmental Health Sciences

IDRC CRDI Canada

Thanks for your attention