



REPUBLIC OF KENYA

**TASK FORCE ON DECOMMISSIONING REMEDIATION STRATEGY FOR THE
METAL REFINERY EPZ LTD (LATER MAX INDUSTRY LIMITED) IN MOMBASA**

DRAFT REPORT OF THE TASK FORCE

JULY 2015

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Preliminaries

The Task Force on Decommissioning Strategy for the Metal Refinery EPZ Ltd (Later Max Industry Limited) in Mombasa

15th July 2015

Director General
National Environment Management Authority
P.O Box 67839 – 00200
Popo Road, Nairobi.

LETTER OF TRANSMITTAL

We, the members of the Task Force on Decommissioning Strategy for the Metal refinery EPZ Ltd (Later Max Industry Limited) in Mombasa were appointed by you, through a letter under ref: NEMA/EA/5/2/6836 of 29th May 2015. The Task Force was launched at NEMA Headquarters on 9th June 2015 and started work on 15th June 2015.

We were mandated, under our Terms of Reference, to recommend to the Director General – NEMA a decommissioning strategy for the Metal refinery EPZ Ltd (Later Max Industry Limited) in Mombasa. The Task Force was also mandated to take the following specific actions: determine the public safety of the site, advice on appropriate remediation procedure(s)/after use area plans, remediation time scales/post remediation care, environment protection and sustainability, involve stakeholders and project affected populations/surrounding community, and any other task as may be determined by the Authority from time to time.

The Task Force started by interpreting the terms of Reference which informed the formation of a multi-sectoral committee on broad thematic areas. The main themes were developed into distinctive chapters in this Draft Report. The Task Force reviewed various legal instruments to guide investigations into Lead exposure at the Metal refinery EPZ Ltd (Later Max Industry Limited) in Mombasa, case studies on deaths and environmental disasters associated with Lead poisoning from a regional (Africa) perspective, documents and correspondences relating to the Metal refinery EPZ Ltd (Later Max Industry Limited) in Mombasa, Lead exposure Laboratory

test results, and sample of medical examination reports of affected population. The Task Force also undertook extensive consultations with various stakeholders across Mombasa County – including Mombasa County Commissioner (National Government), Executive Director – the Center for Justice, Governance & Environmental Action (CJGEA), Chief Officer – Water, Environment & Natural Resources (Mombasa County Government), Owino-Uhuru residents, Medical Superintendent – Port Reitz District hospital, and DCIO – Kilifi. The Task Force accessed additional from libraries and internet before, during and after its reconnaissance survey.

Following the reconnaissance survey and consultative meetings with various stakeholders and affected population, the Task Force prepared a Draft Report on findings and recommendations. The Task Force Draft Report addresses mainly the issues of Lead exposure and Public safety, Decommissioning strategy for the factory site and its immediate environs, Evidence of offences committed and culpable parties, and Restorative Justice.

We have the pleasure to present to you our Draft Report and to sincerely thank you for the trust and confidence you bestowed upon us to serve our country, Kenya.

Yours Sincerely,

1. Mr. Samuel Okuche --- Chairman
2. Mr. Wandera C. Bideru --- Member
3. Mr. Mugambi Mutethia --- Member
4. Mr. Robert Orina --- Member
5. Mr. Kenneth K'oreje --- Member
6. Mr. Justus B. Nyakego --- Member
7. Mr. Ali Samatar --- Ex-officio Member
8. Ms. Oceanic Sakwa --- Joint Secretary
9. Ms. Maureen Njeri --- Joint Secretary

10. Mr. Stephen W. Kitung'a

Acknowledgement

The Task Force appreciates the support and cooperation of Mr. Zephaniah O. Ouma, Ag Director of Compliance, National Environment Management Agency. NEMA provided logistical support and staff to support and facilitate the work of the Task Force.

We are grateful to Ms. Phillis Omido, Executive Director – the Center for Justice, Governance & Environmental Action (CJGEA) for providing the Task Force with invaluable information on the Metal refinery EPZ Ltd (Later Max Industry Limited) in Mombasa.

Lastly, the Task Force acknowledges the contribution of the following for their presentations before the Task Force:

1. Prof. Karanja Njoroge --- Center for Environmental Action
2. Dr. Nancy A. Etyang --- Ministry of Health
3. Dr. Simba Tirima University of Idaho
4. Dr. Philip Mwabe Environmental and Combustion Consultants Limited

Abbreviations and Acronyms

BLL	Blood Lead Levels
EA	Environmental Audit
EIA	Environmental Impact Assessment
EPZ	Export Processing Zones
DCIO	District Criminal Investigation Officer
dl	Deciliter
DOSH	Directorate of occupational safety and health
kg	Kilogram
mg	Milligram
µg	Microgram
mmHg	Millimeter Mercury
mp	Melting point
NEMA	National Environment Management Authority
ppm	Parts per million
SDLL	Soil Dust Lead Levels
ULAB	Used Lead-Acid Batteries
SWLL	Sediment and Water Lead Levels
ToR	Terms of Reference

Executive Summary

Background

A battery recycling factory, Metal Refinery EPZ Ltd, operated from 2007 to 2013 on Plot No. 1707 SECT/V/MN/MIKINDANI/ MOMBASA in Kwa-Shee Sub-Location, Mikindani Location, Mombasa County. The factory used Used Lead-Acid Batteries (ULAB) as primary raw material to produce pure Lead metal for export. The scrap metal from ULAB was smelted and refined to produce the final product. Lead is a highly toxic metal and its effects are deleterious to both fauna and flora.

Metal Refinery EPZ Ltd (Later Max Industry Limited), as a business enterprise, failed to balance its economic interest against public health interest and environmental concerns. Factory workers were occupationally exposed to life threatening materials in their work environment. By releasing toxic fumes containing lead particulates and oxides of sulphur, trade effluent and solid waste into the neighbouring Owino-Uhuru village (an informal settlement with a population of about 4000 people), the proprietors/management of the factory primarily caused the myriad of problems threatening public health and safety of Owino-Uhuru ecosystem and its environs.

Lead Exposure Levels

The Blood Lead levels (BLL) of residents of Owino-Uhuru village ranged from highest 420.04 µg/dl (wife of former factory employee) to 1µg/dl (lowest). Soil-drains Lead Level was 19.82 g/Kg. Soil-Dust Lead levels ranged from 26.84 g/Kg (highest) to 405.1µg/Kg (lowest). Dust lead levels ranged from 0.0196 – 140.51µg/ft² (highest) – 0.0196 µg/ft² (lowest). These numbers show Lead exposure at the factory and in Owino-Uhuru settlement is high and requires intervention.

Public safety and environmental concern

Empirical evidence gathered by the Task Force during reconnaissance survey clearly shows that the situation in Owino-Uhuru settlement and its environs became what it is today because the various legislative frameworks were not strictly adhered to. Little consideration was given to the safety and health of both the factory workers, residents of Owino-Uhuru including other entities/workers who operate near the factory and the environment. There is therefore urgent need to remedy the harm done particularly to affected factory workers and their families, residents of Owino-Uhuru village, and the environment (immediate and extended). There is also an urgent need to bring to book persons/agencies bearing greatest responsibility for choices have consequences.

Recommendations

The Task Force recommends the following:

1. The Metal Refinery EPZ Ltd (Later Max Industry Limited) to remain closed. Future business enterprise in this locality should not be related generally or otherwise to battery recycling.
2. The National Government to positively engage the County Government of Mombasa as stipulated in Sect. 4 (c), (e) and (h) of The Intergovernmental Relations Act, 2012 in order to seamlessly and timeously implement recommendations of this decommissioning strategy.
3. Blood Lead has a half-life of between two and a few months. It is therefore necessary to retest blood lead levels (BLL) of all persons who are primary suspects of Lead poisoning. Further, the heavy rains that flooded Mombasa may have washed some Leaded Soil and Dust away from the factory premises and Owino-Uhuru settlement. Again it is therefore necessary to re-evaluate the present status of Lead contamination/pollution levels.
4. Set up a temporary medical camp at Mikindani health facility to test blood lead levels (BLL) of people who live or operate from the vicinity of the factory. Persons with elevated lead level in their blood will be referred to a clinical diagnostic centre for treatment.
5. Staff and equip Port Reitz District hospital with qualified staff and diagnostic tools and drugs to effectively manage the large numbers of people affected by Lead exposure in the region.
6. Medically move persons with high blood lead levels (BLL), albeit temporarily, to safer area/ground before undergoing treatment. Involve all stakeholders, local leaders and interested parties while carrying out the exercise.
7. Excavate and remove contaminated Soil And Dust from affected areas for safe disposal.
8. Ensure that there is restorative justice for affected population. Pursue Alternative Dispute Resolution (ADR) mechanism and ensure that all culpable individuals and institutions bear the full cost of this decommissioning. In case ADR does not work, all offenders should be charged in a court of law for various offences as shall be determined by the office of the Director of public prosecution.
9. Restore the environment of Owino-Uhuru settlement and its ecosystem.
10. Re-design land use and future developments in Owino-Uhuru settlement and its environs.

CHAPTER ONE

1.1 Context and Mandate of the Task Force

1.2 Introduction

A battery recycling factory known as Metal Refinery EPZ Ltd (Later Max Industries limited) is situated along Mombasa – Nairobi Highway on Plot No. 1707 SECT/V/MN/MIKINDANI/MOMBASA. The Factory is located in Kwa-Shee Sub-Location, Mikindani Location, Mombasa County. The Factory was opened for production in 2007.

The primary raw material used by the Factory is scrap metal vehicle batteries (about 500 Metric Tons per month). A typical Lead acid battery is constituted as follows: Metallic Lead (35 %), Lead Sulphate/Oxide (40 %), Plastic (7 %), Acid (15 %), and Residuals (3 %). The process of producing pure Lead (main product) by smelting and refining involves heating the Lead bearing scrap to high temperatures (900 °C –1000 °C) depending on the material. The wastes produced by the process of Lead smelting and refining include lead dust and fumes containing Sulphur and Carbon based gases, liquid waste (trade effluent), and solid waste/slag which requires great care in handling, disposal and management.

Lead is a highly toxic bluish-white, silvery, grey metal and a very strong poison that easily melts (mp = 327.4 °C) and has a vapour pressure of 1.7 mmHg at 1000 °C. The median diameter of airborne Lead particles is about 0.25 µm, small enough to be absorbed with good efficiency (25 – 50 %) from the respiratory tract. Lead poisoning usually occurs over a period of months or years, and the poisoning can cause severe mental and physical impairment. Information gathered during reconnaissance survey shows that adequate environmental and public health measures were not put in place to safeguard the environment (air, soil/dust, water bodies) from contamination/ pollution, and factory employees including next door neighbours (Owino-Uhuru residents particularly young children who are most vulnerable) from Lead exposure as provided for under Kenya's regulatory frameworks.

From the above, handling used lead acid batteries-smelting-refining-pure lead is a process that

exposes workers on the production line to inhalable Lead. Sulphur gases produced in the furnace (SO_2 and SO_3) and spewed out, together with other gaseous materials through the chimney, to a great extent cause residents of Owino-Uhuru village to experience acrid/burning sensation and coughing, particularly whenever the Factory is releasing SMOKE through its chimney; including the corrosion of roof iron sheets, particularly houses near the factory's chimney in Owino-Uhuru. The waste battery acid (H_2SO_4) is capable of causing burns. A case was made whereof a resident of Owino-Uhuru stepped into the factory's trade effluent which flowed through the village and got scarred. There are indications that some of the factory's trade effluent which comprised waste acid battery was allowed to openly snake its way through Owino-Uhuru residential area.

Lead exposure is deleterious to both fauna and flora. The ill-health effects of Lead poisoning are particularly felt in children and expectant mothers, and this makes Lead exposure a serious threat to our future generations because our children are our future. Lead poisoning has been found to cause the following, depending on exposure levels: deaths; stillbirths and miscarriages; anaemia; central nervous system diseases – seizures, unconsciousness, encephalopathy/mental retardation, poor muscle coordination; osteoarthritis, osteophytes, kidney failure, and erectile dysfunction.

Empirical evidence gathered during reconnaissance survey by the Task Force clearly shows that economic interest overshadowed public safety and health interest. Little consideration was given to the safety and health of both the factory workers, residents of Owino-Uhuru and other neighbours to the factory, and environmental conservation. There is therefore urgent need to remedy the harm done particularly to affected factory workers and their families, residents of Owino-Uhuru village, and the environment (immediate and extended). There is also an urgent need to bring to book persons/agencies bearing greatest responsibility for choices have consequences.

1.3 The Task Force Mandate

The Task Force on Decommissioning Strategy for the Metal refinery EPZ Ltd (Later Max Industry Limited) in Mombasa It was officially launched at NEMA Headquarters by Mr. Zephaniah Ouma on behalf of the Director General – NEMA on 9th June 2015.

1.3 Rationale

Case study: Mass lead intoxication from informal used lead-acid battery recycling in Darkar, Senegal, Nov 2008 – march 2008. Eighteen children died from a rapidly progressing Central Nervous disease of unknown origin in a community involved in the recycling of used lead-acid batteries (ULAB) in the suburbs of Darker, Senegal. Tests on blood lead levels on 32 siblings of deceased children, 23 mothers, 18 children and 8 adults living in the same area were complemented by environmental health investigations. Results showed that all 81 individuals investigated were poisoned with lead, some of them severely. The Blood Lead Level (BLL) of the 50 children tested ranged from 39.8 – 613.9 µg/dl with a mean of 129.5µg/dl. Seventeen children showed severe neurologic features of toxicity. Homes and soil in surrounding areas were heavily contaminated with Lead (indoors, up to 14,000 mg/Kg; outdoors, up to 302,000 mg/Kg) as a result of the informal ULAB recycling. The study concluded that there was mass lead intoxication which occurred through inhalation and ingestion of soil and dust heavily contaminated with Lead as a result of informal and unsafe ULAB recycling; and circumstantial evidence also suggested that most inhabitants of the contaminated area are likely to be poisoned. (Haefliger P. et al. *Environ Health Perspect.*; 2009, Oct. 117(10). Accessed on 27.6.2015)

The rights of citizens to a clean and healthy environment, public safety and health are guaranteed under the various articles of the Constitution of Kenya 2010 and other Acts of Parliament (EMCA, 1999; The Public Health Act, The Food, Drugs and Chemical Substances Act; The OSHA, 2007; The Water Act 2002; EPZ Act; Kenya Subsidiary Legislations and Regulations; etc.). Further, Kenya has elaborate Criminal Procedure Code and Penal Code that ensure fair administration of justice.

1.4 Terms of Reference of the Task Force

The Terms of Reference of the Task Force are to: Determine the contamination and/or pollution levels within the facility and in the adjacent high risk points that the task force will identify by undertaking sampling tests for soil, water, air, waste water and blood; Prepare decommissioning strategy to advise the Director General – NEMA on the best suitable remediation strategy and/or after use plans for the site; and Undertake to provide sufficient evidence to prosecute the offenders.

The specific Terms of Reference of the Task Force were to:

- (a). Determine the public safety of the site by establishing the level of contamination or exposure at the facility and its environs by mapping out areas of high level contamination by undertaking sampling and analysis of applicable parameters;
- (b). Advise on appropriate remediation procedure(s) and/or compatible after use plans of the area/site;
- (c). Time scales to meet the required remediation level depending on the magnitude of the operation, nature of the incident, post remediation care and maintenance required. This will be determined by:
 - the ecological system recovery at the site;
 - the state of recovery in comparison to the surrounding area;
 - the aesthetic value of the site.
- (d). Safety and the stability of the site under a range of seasonal conditions representative of that climate;
- (e). Ensure involvement of stakeholders, project affected populations and surrounding community in the remediation process; and,
- (f). Any other task as may be determined by the Authority from time to time.

1.5 Interpretation of the Terms of Reference

In interpreting the ToR in the context of Lead exposure arising from operations of the battery

recycling factory and its remediation, the Task Force deliberated and agreed on the following key and related questions:

Is there Lead exposure or contamination at the Metal Refinery EPZ Ltd (Later Max Industry Limited) and its environs in Mombasa to warrant intervention or a decommissioning strategy?

- Is there circumstantial evidence of Lead exposure at the battery recycling factory and its immediate environs – reported deaths and other ill-health conditions associated with Lead poisoning, air pollution indicators characteristic of Lead smelting process activity, and is the distribution and magnitude of Lead exposure in the area/site under investigation point to the source of contamination/pollution?
- Is there toxicological evidence of Lead exposure at the battery recycling factory and its immediate environs – reported SDLL and Lead levels in tree bark/vegetation within the factory premises/compound, SWLL in Owino Uhuru stream and hand-dug well, BLL in factory workers, BLL in Owino-Uhuru residents living next to the factory, BLL in other residents (adults and children) of Owino-Uhuru village living beyond a radius of 200 Metres from the Factory?
- Is there clinical evidence of Lead exposure at the battery recycling factory and its immediate environs - medical examination reports of residents of Owino-Uhuru village?
- What is the extent and magnitude of environmental Lead exposure in the area within the Factory and its immediate environs - mapped areas showing SDLL?
- Was due process followed in licensing the Metal Refinery EPZ Ltd in Mombasa – was the licensing to operate take into consideration the nature of the business enterprise?
- Was Environmental Impact Assessment of the Metal Refinery EPZ Ltd professionally done according to the provisions of relevant Law – were key interest parties/neighbors interviewed, did those who participated in interview clearly understand the potential threat the proposed business enterprise posed to them and their immediate environs, and was EIA done prior or after the commissioning of the Factory?
- Was Environmental Audit of the Metal Refinery EPZ Ltd professionally done according to the provisions of the relevant Law(s), in a battery recycling business enterprise, who

is/are supposed to carry out an Environmental Audit, and due diligence exercised while carrying out EA – auditing internal and external environment, adherence to NEMA, OSH regulations, and tracking levels of Lead exposure in workers and immediate environs?

- How proactive was DOSH as custodian of OSHA in ensuring that workers at the Metal Refinery EPZ Ltd are not occupationally exposed to Lead poisoning and other hazards?
- How proactive was WRMA in ensuring that Metal Refinery EPZ Ltd does not pollute/contaminate receiving water bodies (surface and ground waters) with its toxic waste thus endangering aquatic ecosystem that sustains both fauna and flora?
- How proactive and effective was NEMA in enforcing its regulations for the protection and sustainability of safe and healthy environment that is under our National jurisdiction?

1.6 Methodology

The Task Force undertook its work through the following stages:

- Meeting stakeholders, affected project population, and related key institutions in order to become appraised on pertinent issues of concern to the Task Force;
- A walk around in the Metal Refinery EPZ Ltd premises and Owino-Uhuru village in order for the Task Force to become familiarized with the situation on the ground;
- Reviewing relevant documents such as licenses, petitions, reports and correspondences;
- Reviewing and analyzing laboratory test results and medical examination reports;
- Receiving presentations from environmentalists and public health professionals who have done some studies on Lead exposure;
- Finalization of the Draft Report.

1.7 Legislative and Regulatory Frameworks relevant to Metal Refinery EPZ Ltd case.

- EMCA (1999). Provides for the establishment of an appropriate legal and institutional framework for the management of the environment in Kenya, EMCA – Environmental Impact Assessment/Environmental Audit Regulations (2003), Waste Management Regulations (2006), and Water Quality Regulations (2006).

- Physical Planning Act, Cap 286. Sec. 36 states that Local Authority Act may if deem necessary require a submission of Environmental Impact Assessment report together with development application if they feel the project has some injurious effects on the environment. Sect. 33 gives NEMA Director authority to grant the applicant development permission or refuse to grant the applicant such development permission by stating the ground of refusal.
- The Water Act, Cap 372. Prohibits the release of waste water into estuaries, surface, ground water, and marine.
- The Public Health Act, Cap 242. Regulates activities detrimental to human health
- Basel Convention on the Technical Guidelines for the environmentally Sound Management of Lead-Acid Batteries; and, Basel Convention on the Control of Trans-Boundary Movement of Hazardous Waste and their Disposal (1989).

1.8 Organization of the Draft Report

The rest of the Draft Report is organized as follows:

Chapter 2: Lead exposure and Public safety

Chapter 3: Decommissioning strategy for the factory site and its immediate environs

Chapter 4: Evidence of offences committed and culpable parties

Chapter 5: Restorative Justice

Chapter 6: Recommendations

CHAPTER TWO

2.0 Lead exposure and Public safety

2.1 Soil, Dust, Waste Drains Lead (Pb) levels within the Factory yard

Table 2.1: Soil, Dust, Waste Drains Lead (Pb) levels within the Factory yard

No .	Test Sample	Level of Lead (Pb)	Analytical Platform	Remarks
1	Soil-Factory drains next to chimney godown (source: Government Chemist)	(i). 30,787 mg/Kg (ii). 19,810 mg/Kg (19.81 gram per cent)	GFAA ICP	-Sampling date: 7/5/2015 -High lead concentration in storm water drain
2	Soil from open space outside factory godowns (source: SGS)	A – 101 mg/Kg B – 960 mg/Kg C – 914 mg/Kg D – 4930 mg/Kg		-Sampling date: 20/5/2015 -High lead levels within the factory compound
3	Tree Bark (dead) next to chimney godown (source: Government Chemist)	159.76 µg/g	GFAA	Sampling date: 7/5/2015
4	Vegetative matter from factory yard (source: SGS)	0.04 % wt. (4000 µg/g)	-	Sampling date: 25/8/2008

2.2 Sediment and Water Lead levels (SWLL) in Owino Uhuru settlement

Table 2.2 Water and Drainage Water Lead (Pb) levels in Owino Uhuru settlement, Mombasa

No .	Test Sample	Level of Lead (Pb)	Analytical Platform	Remarks
1	Water from Masjid Noor hand-dug shallow well (15 ft deep) (source: Government Chemist)	10 mg/L (ppm)	ICP	The lead level exceeds the permissible levels for drinking water (0.05 mg/l)
2	Water from Owino-Uhuru stream-valley (source: Government Chemist)	16 mg/L (ppm)	ICP	There was lead contamination

3	Effluent water (source: SGS)	0.89 mg/L	-	The lead level exceeds the permissible levels
4	Drainage water (source: SGS)	23.63 mg/L	-	The lead level exceeds the permissible levels

2.3 Air Emission and Temperature measurement– Rotary refining furnace

Table 2.5: Air Emission and Temperature measurement – Rotary refining furnace

No	Parameter	Test Result	Platform
1	Oxygen (O ₂) – Rotary refining furnace	20.97 %	-
2	Carbon Dioxide (CO ₂) – Rotary refining furnace	0.0 %	-
3	Oxides of Nitrogen (NO _x) – Rotary refining furnace	0.0 ppm	-
4	Carbon Monoxide (CO) – Rotary refining furnace	15.0 ppm	-
5	Sulphur Dioxide (SO ₂) – Rotary refining furnace	1.0 ppm	-
6	Flue Gas Temperature – Rotary refining furnace	41.7 °C	-

2.4 Soil Lead (Pb) levels outside and inside factory gate and in Owino-Uhuru

Table 2.2: Soil Lead (Pb) levels outside and inside factory gate and in Owino-Uhuru settlement

No.	Reference	µg/g	mg/g	mg/kg	Remarks
1	Owino Uhuru (1428) ⁰	0.4051	0.0004	0.4	
2	Owino Uhuru (1443) ⁰	354.85	0.3549	354.9	
3	Owino Uhuru (1238) ⁰	63.05	0.0631	63.1	
4	Owino Uhuru (1462) ⁰	21.33	0.0213	21.3	
5	Owino Uhuru (1389) ⁰	160.65	0.1607	160.7	
6	Owino Uhuru (1263) ⁰	42.98	0.043	43	
7	Owino Uhuru (1241) ⁰	294.06	0.2941	294.1	
8	Owino Uhuru (1456) ⁰	287.18	0.2872	287.2	
9	Owino Uhuru (1200)*	680.26	0.6803	680.3	
10	Owino Uhuru (1232)*	661.71	0.6617	661.7	
11	Owino Uhuru (1052)*	677.63	0.6776	677.6	
12	Owino Uhuru (1066) ⁰	308.66	0.3087	308.7	
13	Owino Uhuru (1047)*	640.3	0.6403	640.3	
14	Owino Uhuru (1344) ⁰	297.49	0.2975	297.5	
15	Owino Uhuru (1312) ⁰	320.06	0.3201	320.1	
16	Owino Uhuru (1294)*	632.55	0.6326	632.6	

17	Owino Uhuru (1214) ⁰	221.8	0.2218	221.8	
18	Owino Uhuru (1020) ⁰	336.65	0.3367	336.7	
19	Owino Uhuru (1136)*	521.17	0.5212	521.2	
20	Owino Uhuru (1358) ⁰	64.17	0.0642	64.2	
21	Owino Uhuru (1296) ⁰	229.08	0.2291	229.1	
22	Owino Uhuru (1165) ⁰	109.86	0.1099	109.9	
23	Owino Uhuru (1134) ⁰	101.78	0.1018	101.8	
24	Owino Uhuru (1144) ⁰	114.51	0.1145	114.5	
25	Owino Uhuru (1081) ⁰	113.88	0.1139	113.9	
26	Owino Uhuru (1140) ⁰	127.99	0.128	128	
27	Owino Uhuru (1335)**	2654.55	2.6546	2654.6	
28	Owino Uhuru (0010) ⁰	106.32	0.1063	106.3	
29	Owino Uhuru (003) ⁰	70.55	0.0706	70.6	
30	Owino Uhuru (0050)**	2380.79	2.3804	2380.4	
31	Owino Uhuru (004)***	26836.74	26.837	26837	
32	Owino Uhuru (1293) ^o	6.12	0.0061	6.1	
33	Owino Uhuru (0020)*	504.02	0.504	504	
34	Owino Uhuru (0060) ⁰	84.88	0.0849	84.9	
35	Owino Uhuru (1055) ⁰	247.9	0.2479	247.9	
36	Owino Uhuru (1328) ⁰	262.13	0.2621	262.1	
37	Owino Uhuru (1261) ⁰	291.42	0.4914	491.4	

(source: Government Chemist)

Key:

*** Highly elevated Lead (Pb) exposure (Near the Factory)

** Moderately elevated Lead (Pb) exposure (Near the Factory)

* Slightly elevated Lead (Pb) exposure (Within a radius of 100 Metres From Factory)

^o Low to moderate Lead (Pb) exposure (radius? from the Factory)

2.5: Dust Lead (Pb) levels in Owino-Uhuru settlement, Mombasa

Table 2.3: Dust Lead (Pb) levels in Owino-Uhuru settlement, Mombasa

No.	Reference	µg per ft ²	Remarks
1	Owino Uhuru (1134)	0.4496	
2	Owino Uhuru (1344)	0.3144	

3	Owino Uhuru (1140)	32.186	
4	Owino Uhuru (1200)	0.3601	
5	Owino Uhuru (1317)	0.3892	
6	Owino Uhuru (1214)	140.51	
7	Owino Uhuru (1456)	47.31	
8	Owino Uhuru (1330)	14.814	
8	Owino Uhuru (1263)	1.1416	
9	Owino Uhuru (1462)	1.0376	
10	Owino Uhuru (1402)	46.43	
11	Owino Uhuru (1450)	0.3456	
12	Owino Uhuru (1294)	0.2672	
13	Owino Uhuru (1066)	0.0638	
14	Owino Uhuru (1241)	0.0638	
15	Owino Uhuru (1165)	32.074	
16	Owino Uhuru (1386)	0.0638	
17	Owino Uhuru (1389)	0.0642	
18	Owino Uhuru (1335)	34.018	
19	Owino Uhuru (1319)	0.0689	
20	Owino Uhuru (1232)	0.2152	
21	Owino Uhuru (1428)	0.3152	
22	Owino Uhuru (1081)	33.306	
23	Owino Uhuru (1020)	14.682	
24	Owino Uhuru (1296)	2.7216	
25	Owino Uhuru (1052)	10.846	
26	Owino Uhuru (1144)	6.374	
27	Owino Uhuru (1047)	45.55	
28	Owino Uhuru (1312)	0.034	
29	Owino Uhuru (1435)	0.379	
30	Owino Uhuru (1443)	1.3896	
31	Owino Uhuru (1270)	1.4068	
32	Owino Uhuru (1442)	0.1599	
33	Owino Uhuru (1293)	0.0638	
34	Owino Uhuru (1139)	6.934	
35	Owino Uhuru (1090)	0.1622	
36	Owino Uhuru (1145)	0.1289	
37	Owino Uhuru (1136)	0.16	
38	Owino Uhuru (1293)	0.0196	

NB: Level of Lead (Pb) in Dust samples are within EPA acceptable standard recommendation for bare soil

2.6: Lead levels in household Drinking Water (Municipal Water Supply) in Owino-Uhuru

Table 2.6: A summary of results for Water Lead (Pb) levels in Owino-Uhuru piped water

No.	Sampling points	µg/L	mg/L	Remarks
1	Owino-Uhuru (1165)	42.465	0.0425	
2	Owino-Uhuru (1389)	2.643	0.0026	
3	Owino-Uhuru (1450)	1.813	0.0018	
4	Owino-Uhuru (1241)	3.75	0.0033	
5	Owino-Uhuru (1330)	0.507	0.0005	
6	Owino-Uhuru (1462)	5.454	0.0055	
7	Owino-Uhuru (1214)	3.005	0.003	
8	Owino-Uhuru (1402)	1.684	0.0017	
9	Owino-Uhuru (1445)	1.513	0.0015	
10	Owino-Uhuru (1263)	0.832	0.0008	
11	Owino-Uhuru (1020)	0.427	0.0004	
12	Owino-Uhuru (1344)	2.152	0.0022	
13	Owino-Uhuru (1296)	12.575	0.0126	
14	Owino-Uhuru (1428)	7.594	0.0076	
15	Owino-Uhuru (1294)	2.542	0.0025	
16	Owino-Uhuru (1386)	3.394	0.0034	
17	Owino-Uhuru (1271)	1.226	0.0012	
18	Owino-Uhuru (1456)	0.638	0.0006	
19	Owino-Uhuru (1317)	0.155	0.0002	
20	Owino-Uhuru (1443)	3.748	0.0038	

21	Owino-Uhuru (1047)	0.165	0.0002	
23	Owino-Uhuru (1238)	0.386	0.0004	
23	Owino-Uhuru (1052)	0.091	0.0001	
24	Owino-Uhuru (1232)	1.362	0.0014	
25	Owino-Uhuru (1144)	0.372	0.0004	
26	Owino-Uhuru (1081)	1.417	0.0014	
27	Owino-Uhuru (1200)	1.522	0.0015	
28	Owino-Uhuru (1319)	1.128	0.0011	
29	Owino-Uhuru (1335)	43.445	0.0435	
30	Owino-Uhuru (1134)	1.971	0.002	
31	Owino-Uhuru (1312)	1.047	0.0011	
32	Owino-Uhuru (1140)	0.725	0.0007	
33	Owino-Uhuru (1066)	0.328	0.0003	
34	Owino-Uhuru (1442)	6.686	0.0067	
35	Owino-Uhuru (1098)	0.14	0.0001	
36	Owino-Uhuru (1145)	0.586	0.0006	
37	Owino-Uhuru (1039)	4.757	0.0048	
38	Owino-Uhuru (0010)	0.603	0.0006	

NB: All Water samples drawn from Mombasa water supply water points serving households conformed to Kenya Standard Guidelines for Drinking water. The Action level or maximum allowable level of Lead (Pb^{2+}) is 0.05 mg/L. This means that water from Mombasa water supply has nothing to do with blood Lead condition of the residents of Owino-Uhuru settlement.

2.7 Lead levels in dust deposits within the factory

Name of sampling point	GPS coordinates	Lead level (mg/Kg)	Remarks
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Godown 8a (Machinery area)		21147.5	
Godown 8b (Machinery area)		11098.1	
Godown 8c (Machinery area)		10788.1	
Godown 8d (Machinery area)		14664.3	
Godown 8e (Machinery area)		16286.9	

2.8 Soil lead levels

Name of sampling point	GPS coordinates	Lead level (mg/Kg)		Remarks
		Top soil	Subsoil (30 cm deep)	
Outside the godown 8 in the open space (43 ft from the door)		11942.6	6672.37	Levels above 400 mg/kg which is considered safe level by EPA
Outside the godown 8 in the open space (130 ft from the door)		7730.98	147.63	
Owino-Uhuru village				
1 ft from the factory boundary wall		75.26	237.18	Levels within 400 mg/kg which is considered safe level by EPA
22 ft from the boundary wall		126.96	101.38	
117 m from godown 8 (with GPS)		53.61	57.5	
227 m from godown 8 (with GPS)		74.11	66.69	
484 m from godown 8 (with GPS)		68.87	51.86	

364 m from godown 8 (with GPS) at Bridge International School		99.39	53.88	
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2.7 Mapped Soil and Dust areas with high Lead levels in Owino-Uhuru and its environs

[Figure 2.6: A Map showing areas with Soil and Dust of high Lead levels (elevated Lead exposure) in Owino-Uhuru village and its environs is annexed to the Draft Report]

2.8 Blood Lead Levels (BLL) in factory workers and residents of Owino-Uhuru

SN	CODE	SEX	AGE	Date of Collection	BLL	Remarks
1	PLK 1	F	6	01/03/2015	6 µg/dL	
2	PLK 2	M	72	01/03/2015	5 µg/dL	
3	PLK 3	M	72	01/03/2015	8 µg/dL	
4	PLK 4	M	41	01/03/2015	9 µg/dL	
5	PLK 5	F	49	01/03/2015	3 µg/dL	
6	PLK 6	M	8	01/03/2015	12 µg/dL	
7	PLK 7	M	15	01/03/2015	11 µg/dL	
8	PLK 8	M	42	01/03/2015	5 µg/dL	
9	PLK 9	M	47	01/03/2015	7 µg/dL	
10	PLK 10	F	29	01/03/2015	4 µg/dL	
11	PLK 11	F	8	01/03/2015	14 µg/dL	
12	PLK 12	M	42	01/03/2015	7 µg/dL	
13	PLK 13	F	52	01/03/2015	3 µg/dL	
14	PLK 14	F	48	01/03/2015	1 µg/dL	
15	PLK 15	M	47	01/03/2015	1 µg/dL	
16	PLK 16	M	25	01/03/2015	16 µg/dL	
17	PLK 17	M	33	01/03/2015	5 µg/dL	
18	PLK 18	F	U	01/03/2015	4 µg/dL	
19	PLK 19	M	9	01/03/2015	7 µg/dL	

20	PLK 20	F	32	01/03/2015	33 µg/dL	
21	PLK 21	M	54	01/03/2015	5 µg/dL	
22	PLK 22	M	55	01/03/2015	9 µg/dL	
23	PLK 23	F	67	01/03/2015	2 µg/dL	
24	PLK 24	M	46	01/03/2015	4 µg/dL	
25	PLK 25	M	56	01/03/2015	4 µg/dL	
26	PLK 26	F	48	01/03/2015	6 µg/dL	
27	PLK 27	F	59	01/03/2015	5 µg/dL	
28	PLK 28	M	50	02/03/2015	7 µg/dL	
29	PLK 29	M	60	03/03/2015	4 µg/dL	
30	PLK 30	F	33	01/03/2015	2 µg/dL	
31	PLK 31	M	57	01/03/2015	7 µg/dL	
32	PLK 32	M	36	01/03/2015	8 µg/dL	
33	PLK 33	M	35	01/03/2015	3 µg/dL	
34	PLK 34	M	11	01/03/2015	8 µg/dL	
35	PLK 35	M	47	01/03/2015	2 µg/dL	
36	PLK 36	M	3Y6M	01/03/2015	9 µg/dL	
37	PLK 37	F	32	01/03/2015	12 µg/dL	
38	PLK 38	M	68	01/03/2015	6 µg/dL	
39	PLK 39	M	1Y5M	01/03/2015	8 µg/dL	
40	PLK 40	F	7	01/03/2015	3 µg/dL	
41	PLK 41	F	4	01/03/2015	20 µg/dL	
42	PLK 42	M	8	01/03/2015	7 µg/dL	
43	PLK 43	M	33	01/03/2015	6 µg/dL	
44	PLK 44	M	47	01/03/2015	4 µg/dL	
45	PLK 45	M	2Y6M	01/03/2015	6 µg/dL	
46	PLK 46	M	54	01/03/2015	18 µg/dL	
47	PLK 47	M	41	01/03/2015	3 µg/dL	
48	PLK 48	M	32	01/03/2015	20 µg/dL	
49	PLK 49	F	35	01/03/2015	2 µg/dL	
50	PLK 50	M	25	01/03/2015	24 µg/dL	
51	PLK 51	M	65	01/03/2015	8 µg/dL	
52	PLK 52	F	1Y7M	01/03/2015	7 µg/dL	
53	PLK 53	F	20	01/03/2015	3 µg/dL	
54	PLK 54	F	32	01/03/2015	2 µg/dL	
55	PLK 55	M	29	01/03/2015	20 µg/dL	

Source: Pathology Laboratory Report, Lancet Kenya

SN	Code	Sex	Date of Collection	BLL	Remarks
1	Employee 1	M	10/06/2009	21 µg/dL	
2	Employee 2	M	10/06/2009	24 µg/dL	
3	Employee 3	M	10/06/2009	22 µg/dL	
4	Employee 4*	M	10/06/2009	26 µg/dL	
5	Employee 5	M	10/06/2009	28 µg/dL	
6	Employee 6	M	10/06/2009	28 µg/dL	

Source: Government Chemist Metal EPZ Ltd, Employee Report * deceased

SN	Code	Sex	Date of Collection	BLL	Remarks
1	PKN 1	F	23/11/2009	12 µg/dL	
2	PKN 2	M	23/11/2009	12 µg/dL	
3	PKN 3	M	23/11/2009	12 µg/dL	

Source: Government Chemist, Prof. KaranjaNjoroge Report

SN	CODE	SEX	AGE	Date of Collection	BLL	Remarks
1	PCK 1	M	5	20/11/2012	10 µg/dL	
2	PCK 2	F	6	20/11/2012	28 µg/dL	
3	PCK 3	M	69	20/11/2012	24 µg/dL	
4	PCK 4	M	5	20/11/2012	12 µg/dL	
5	PCK 5	M	67	20/11/2012	24 µg/dL	
6	PCK 6	M	6	20/11/2012	32 µg/dL	
7	PCK 7	M	10	20/11/2012	22 µg/dL	

Source: Pathcare Kenya Limited

SN	Code	Sex	Date of Collection	BLL	Remarks
1	MoH 1	F	13/01/2015	17 µg/dL	
2	MoH 7	F	13/01/2015	7.2 µg/dL	
3	MoH 21	M	13/01/2015	16.9 µg/dL	

4	MoH 22	M	13/01/2015	16.0 µg/dL	
5	MoH 2	F	14/01/2015	21.3 µg/dL	
6	MoH 3	F	14/01/2015	19.4 µg/dL	
7	MoH 5	M	14/01/2015	25.3 µg/dL	
8	MoH 11	F	14/01/2015	4.9 µg/dL	
9	MoH 12	M	14/01/2015	5.6 µg/dL	
10	MoH 13	F	14/01/2015	5.6 µg/dL	
11	MoH 14	M	14/01/2015	6.9 µg/dL	
12	MoH 16	M	14/01/2015	10.8 µg/dL	
13	MoH 18	F	14/01/2015	11.6 µg/dL	
14	MoH 20	F	14/01/2015	15.7 µg/dL	
15	MoH 23	F	14/01/2015	16.1 µg/dL	
16	MoH 4	F	15/01/2015	23.2 µg/dL	
17	MoH 6	M	15/01/2015	7.1 µg/dL	
18	MoH 8	F	15/01/2015	7.3 µg/dL	
19	MoH 9	M	15/01/2015	7.6 µg/dL	
20	MoH 10	M	15/01/2015	4.3 µg/dL	
21	MoH 17	F	15/01/2015	11.3 µg/dL	
22	MoH 19	M	15/01/2015	12.6 µg/dL	
23	MoH 24	M	15/01/2015	8.9 µg/dL	
24	MoH 25	F	15/01/2015	16.9 µg/dL	
25	MoH 15	F	16/01/2015	8.9 µg/dL	

Source: Ministry of Health, Dr. Etiang N. A., Children under 5 years

No.	Code	Age (yrs.)	Residence (yrs.)	Blood Lead (Pb ²⁺) levels		Remarks
1	GC 1	21	10	4.2004 µg/ml	420.0 µg/dl	Wife of employee
2	GC 2	23	5	2.3820 µg/ml	238.2 µg/dl	Wife of employee
3	GC 3	60	30	2.3442 µg/ml	234.4 µg/dl	Next to Factory
4	GC 4	52	52	1.2430 µg/ml	124.3 µg/dl	Next to Factory
5	GC 5	29	7	1.0606 µg/ml	106.1 µg/dl	Former employee
6	GC 6	63	4	0.9956 µg/ml	99.6 µg/dl	Next to Factory

7	GC 7	67	40	0.9932 µg/ml	99.3 µg/dl	Complainant
8	GC 8	57	30	0.9324 µg/ml	93.2 µg/dl	Complainant
9	GC 9	21	10	0.8902 µg/ml	89.2 µg/dl	Former employee
10	GC 10	46	20	0.7680 µg/ml	76.8 µg/dl	Next to Factory
11	GC 11	40	25	0.7256 µg/ml	72.6 µg/dl	Next to Factory
12	GC 12	42	20	0.6482 µg/ml	64.8 µg/dl	Next to Factory
13	GC 13	22	22	0.6340 µg/ml	63.4 µg/dl	Former employee
14	GC 14	23	23	0.5780 µg/ml	57.8 µg/dl	Former employee
15	GC 15	43	25	0.5278 µg/ml	52.8 µg/dl	Next to Factory
16	GC 16	65	40	0.4732 µg/ml	47.3 µg/dl	Next to Factory
17	GC 17	30	20	0.1704 µg/ml	17.04 µg/dl	Next to Factory
18	GC 18	68	10	0.1660 µg/ml	16.60 µg/dl	Next to Factory
19	GC 19	9	9	0.1568 µg/ml	15.68 µg/dl	Complainant
20	GC 20	6	6	0.1553 µg/ml	15.53 µg/dl	Next to Factory
21	GC 21	56	15	0.1394 µg/ml	13.94 µg/dl	Next to Factory
22	GC 22	28	5	0.1202 µg/ml	12.02 µg/dl	Former employee
23	GC 23	43	15	0.1112 µg/ml	11.12 µg/dl	Next to Factory
24	GC 24	8	8	0.0866 µg/ml	8.66 µg/dl	Next to Factory
25	GC 25	74	11	0.0862 µg/ml	8.62 µg/dl	Former employee
26	GC 26	34	14	0.0822 µg/ml	8.22 µg/dl	Next to Factory
27	GC 27	55	35	0.0776 µg/ml	7.76 µg/dl	Next to Factory

28	GC 28	7	7	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Next to Factory
29	GC 29	27	7	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Next to Factory
30	GC 30	34	24	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Next to Factory
31	GC 31	40	30	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Next to Factory
32	GC 32	24	24	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Former employee
33	GC 33	21	10	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Former employee
34	GC 34	46	30	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Next to Factory
35	GC 35	13	13	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Next to Factory
36	GC 36	43	20	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Next to Factory
37	GC 37	30	14	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Food supplier to Factory
38	GC 38	25	25	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Former employee
39	GC 39	42	22	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Next to Factory
40	GC 40	40	14	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Next to Factory
41	GC 41	73	20	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Next to Factory
42	GC 42	8 ½	8 ½	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Complainant
43	GC 43	49	9	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Complainant
44	GC 44	58	51	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Next to Factory
45	GC 45	40	20	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Next to Factory

46	GC 46	50	30	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Next to Factory
47	GC 47	80	46	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Next to Factory
48	GC 48	56	35	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Next to Factory
49	GC 49	27	5	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Former employee
50	GC 50	30	17	Less than 0.047 µg/ml	Less than 4.7 µg/dl	Complainant

2.9 Medical examination reports of residents of Owino-Uhuru village

Table 2.8: A summary of Medical examination reports of residents of Owino-Uhuru village

No.	Patient's Name	Age	Sex	Diagnosis
1	Patient 1	Adult	Female	<p style="text-align: center;">X-Ray – Lumbar Spine</p> <ul style="list-style-type: none"> ✓ There is loss of normal Lordosis ✓ Small anterior and lateral osteophytes are seen from L1 – L5 ✓ The disc spaces are normal <p style="text-align: center;">❖ Conclusion</p> <ul style="list-style-type: none"> ● Lumbar spine degenerative; bone changes are from L1 – L5 <ul style="list-style-type: none"> ● Lumbar spasm ● Dr. Nondi, Radiologist – Island Echo Center, Mombasa
2	Employee 4	Adult	Male	<p style="text-align: center;">Blood Lead Level (BLL)</p> <ul style="list-style-type: none"> ✓ Blood Lead Level (BLL) = 26 µg/dl

CHAPTER THREE

3.0 Evidence of offences committed and culpable parties

The Task Force found sufficient evidence of Lead exposure at the Metal Refinery EPZ Ltd and Owino-Uhuru village. This evidence is summarized under three categories described hereafter.

4.1 Circumstantial evidence

The site whereon the Used Lead-Acid Battery recycling factory was located was not suitable as it borders a large informal settlement with a population estimated at 4000 people. The plant and machinery which were installed by the Metal refinery EPZ Ltd had no provisions for filtering Lead particulates. Further, lack of good waste management practices by both factory management and relevant Government agencies greatly contributed to Lead exposure within the factory premises and its immediate environs.

4.2 Toxicological evidence

The high Lead levels in environmental samples and in blood of both the workers of the Metal refinery EPZ Ltd and residents of Owino-Uhuru confirm Lead exposure within factory premises, Owino-Uhuru village and its environs. Lead poisoning is diagnosed with a blood lead test.

In addition, elevated Lead levels in the bark of the dead tree and in the vegetative matter (all are within the factory's yard confirms that the factory did pollute the air around it during its operation. Both individuals and institutions charged with the responsibility of protecting the environment from harm are culpable in this matter.

4.3 Clinical evidence

Common signs of Lead poisoning are many and include abdominal pain and cramps, aggressive behavior, constipation, sleep problems, headaches, irritability, loss of appetite, fatigue, high blood pressure, numbness or tingling in the extremities, memory loss, anemia, kidney dysfunction and loss of developmental skills in children,. Other signs of mental impairment in children include behavior problems, low IQ, poor grades at school, problems with hearing, learning difficulties (short and long term) and growth delays. A high, toxic dose of lead poisoning may result in emergency symptoms which include severe abdominal pain and cramping, vomiting, muscle weakness, stumbling when walking, seizures, coma, encephalopathy which manifests as confusion, coma, and seizures.

There is a diagnosed case of Lead poisoning from Owino-Uhuru village. This confirms that there is Lead exposure which resulted out of the operation of the Metal refinery EPZ Ltd in Mombasa. It is thus evident that somebody somewhere did not do his or her duty in preventing the highly toxic Lead from exposure to public health.

CHAPTER FOUR

4.0 Decommissioning strategy for the factory site and its immediate environs

4.1 Factory decommissioning

An Environmental Impact Assessment should be undertaken for decommissioning of the factory and the following activities have been proposed;

- Cleaning up of the go-downs with water spray to settle the dust which is then collected for safe disposal
- Scrubbing of any lead from the cemented walls and cemented floors of the godowns
- Removal of the roofing material for disposal;
- Machinery to be sorted out – recyclable materials to be transferred to licensed recycling facilities e.g. plastics to be transferred to licensed plastic recyclers, scrap metal to steel makers.

Offsite disposal

- Landfilling; Option 1: either at the current Owino Uhuru site
 - Option 2: at a designated site away from Owino Uhuru
- Soil washing, testing and return of clean soil to the site
- Soil washing and safeguarding any material that is not clean at a licensed site

Perimeter walls

- Scrubbing of the perimeter wall
- Characterisation of the factory site to determine the level of clean-up/decommissioning required especially within the factory premises
- Excavation of the outside surface within the factory since there are areas which are covered with cabro

4.2 Remediation strategy for Owino-Uhuru settlement

Before this is undertaken a few protocols need to be put in place. These include:

- 1.
- 2.
- 3.
- 4.

4.2.1 Strategies

The Task force option

1. Undertake mapping and colour coding of the OwinoUhuru on the basis of the levels of lead contamination
2. Based on the results, the red coded area (highly contaminated area), to be declared as a hazardous/contaminated site and to be immediately gazetted as such until the area is treated and declared safe. All the facilities within this declared area shall be declared contaminated including the water wells

3. A comprehensive census (population, households, properties) to be undertaken in this area declared contaminated
4. The households within the gazetted area to be relocated to the green coded area to allow for the decontamination process
5. A sanitary landfill to be constructed within the red coded area or on the area of way leaves. National youth service to provide labour and machinery for the excavation and construction of the landfill
6. The contaminated area to be declared as a hazardous/contaminated site and to be gazetted until the area is treated and declared safe. All the facilities within the declared area shall be demolished including the water wells
7. All the contaminated soils to be excavated and buried in the landfill. The local community to be hired to provide labour for excavating the contaminated soil
8. The relocated people to be allowed back once the treatment of the contaminated site is done, [but not on the land fill area.](#)
9. The nearest health facility to be equipped with the necessary personnel, drugs and equipment to manage the already identified patients and to undertake tests for the other villagers.
10. The community should be continuously sensitized on lead poisoning and management
11. The site should be monitored throughout to ensure the landfill is not interfered with. The landfill should be fitted with a leachate monitoring tool.
12. No drilling of boreholes or wells within a distance of 100 meters from the landfill
13. All food materials in the godowns within the compound to be seized and tested by public health and Kephis for lead contamination. In case the foods are contaminated they should be destroyed
14. This remediation process should be subjected to EIA.

OPTION OF PROF. KARANJA

Recommendations by Prof. Karanja were not so different from those of Dr Simba except his take was that the sanitary landfill should be within Owino Uhuru village while Dr Simba's options were open.

-

OPTION OF DR. SIMBA

Recommended the following:

- Comprehensive mapping of the site to identify the extent of the contamination.
- Relocation of the population in the affected mapped areas.
- Excavation of the top soil for safe disposal in an engineered sanitary landfill.
- Bring in clean soil (capping) to replace the excavated soil.

Resettlement of the displaced population.

OPTION OF DR. MWABE

Dr. Mwabe recommended the following:

- Mapping the entire village to identify the extent of the contamination.
- Excavation of the entire area contaminated.
- Washing all the soils contaminated using water and chemicals as required
- These cleaned soils are then taken back to the site.

CHAPTER FIVE

5.0 Restorative Justice

5.1 Alternative Dispute Resolution mechanism

5.2 Prosecution of offenders: Severe lead poisoning is treated with chelation therapy and EDTA. However, damage from lead poisoning cannot be reversed.

CHAPTER SIX

6.0 Recommendations

Recommendations

The Task Force recommends the following:

1. The Metal Refinery EPZ Ltd (Later Max Industry Limited) to remain closed. Future business enterprise in this locality should not be related generally or otherwise to battery recycling.
2. The National Government to positively engage the County Government of Mombasa as stipulated in Sect. 4 (c), (e) and (h) of The Intergovernmental Relations Act, 2012 in order to seamlessly and timeously implement recommendations of this decommissioning strategy.
3. Blood Lead has a half-life of between two and a few months. It is therefore necessary to retest blood lead levels (BLL) of all persons who are primary suspects of Lead poisoning. Further, the heavy rains that flooded Mombasa may have washed some Leaded Soil and Dust away from the factory premises and Owino-Uhuru settlement. Again it is therefore necessary to re-evaluate the present status of Lead contamination/pollution levels.
4. Set up a temporary medical camp at Mikindani health facility to test blood lead levels (BLL) of people who live or operate from the vicinity of the factory. Persons with elevated lead level in their blood will be referred to a clinical diagnostic centre for treatment.
5. Staff and equip Port Reitz District hospital with qualified staff and diagnostic tools and drugs to effectively manage the large numbers of people affected by Lead exposure in the region.
6. Medically move persons with high blood lead levels (BLL), albeit temporarily, to safer area/ ground before undergoing treatment. Involve all stakeholders, local leaders and interested parties while carrying out the exercise.
7. Excavate and remove contaminated Soil and Dust from affected areas for safe disposal.
8. Ensure that there is restorative justice for affected population. Pursue Alternative Dispute Resolution (ADR) mechanism and ensure that all culpable individuals and institutions bear the full cost of this decommissioning. In case ADR does not work, all offenders should be charged in a court of law for various offences as shall be determined by the office of the Director of public prosecution.

9. Restore the environment of Owino-Uhuru settlement and its ecosystem.
10. Re-design land use and future developments in Owino-Uhuru settlement and its environs.