OLKARIA III GEOTHERMAL POWER PLANT

CONSULTANCY SERVICES FOR
ENVIRONMENTAL AUDIT ON EXISTING PLANT OPERATIONS AND CONSTRUCTION WORKS FOR EXPANSION

FINAL AUDIT REPORT FOR THE YEAR 2012
REF NO. NEMA/EA/5/2/02

DECEMBER 2012
OLKARIA III ENVIRONMENTAL AUDIT REPORT FOR THE YEAR 2012
(REF No. NEMA/EA/5/2/02)

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# ACRONYMS AND ABBREVIATIONS

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<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<tr>
<td>EA</td>
<td>Environmental Audit</td>
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<td>ESO</td>
<td>Environmental and Safety Officer</td>
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<tr>
<td>OEC</td>
<td>Ormat Energy Converter</td>
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<td>NEMA</td>
<td>National Environmental Management Authority</td>
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<td>EMCA</td>
<td>Environmental Management and Coordination Act</td>
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<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Act, 2007</td>
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<tr>
<td>NGO</td>
<td>Non-Governmental Organisation</td>
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<tr>
<td>TSC</td>
<td>Teachers Service Commission</td>
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<tr>
<td>DOSHS</td>
<td>Directorate of Occupational Safety and Health Services</td>
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<td>NCG</td>
<td>Non Condensable Gases</td>
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<td>EMMP</td>
<td>Environmental Management and Mitigation Plan</td>
</tr>
<tr>
<td>PPE</td>
<td>Personal Protective Equipment</td>
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<tr>
<td>MSDS</td>
<td>Material Safety Data Sheet</td>
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<tr>
<td>KWS</td>
<td>Kenya Wildlife Service</td>
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<tr>
<td>LNRA</td>
<td>Lake Naivasha Riparian Association</td>
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<tr>
<td>ODC</td>
<td>Oserian Flower Development Company</td>
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<td>KEBS</td>
<td>Kenya Bureau of Standards</td>
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SIGNATURE PAGE

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1 INTRODUCTION

1.1 Background

This document is an Environmental Audit (EA) for OrPower 4 Inc. Power Plant located at South West, Lake Naivasha. OrPower 4 Inc. is undertaking this audit as a follow up to the self Environmental Audit carried in 2011.

The Audit complies with the requirements of the Environmental Management and Co-ordination Act (EMCA), 1999 and is in accordance with the general Environmental (Impact Assessment and Audit) Regulations of 2003, the NEMA public notice on the format and content for self audits.

GIIB Africa Ltd is a firm of experts registered with the National Environmental Management Authority (NEMA) to undertake Environmental Impacts Assessment (EIA) and Audits (EA). GIIB was commissioned by OrPower 4 Inc. to undertake the Environmental Audit of its plant for the year ending December 2012.

The plant is situated within the greater Olkaria geothermal area which covers an approximate area of 11.9 km$^2$.

The plant borders the Maasai Community Land to the south and south east, the Hell's Gate National Park managed by the Kenya Wildlife Service (KWS) to the east and Oserian Flower Development Company (ODC) to the north east.

This report presents the findings of Orpower 4 Inc. Olkaria III Power plant 1 operations and construction of plant 2 (Ref: NEMA/EA/5/2/02) audit carried out on 10th - 19th September, 2012.

1.2 Objectives and scope of the audit

1.2.1 Objective of the audit

The overall objectives of this audit were:

- To fulfil the legal requirements outlined in Section 68 of the Act and Regulation 31 of the Environmental (Impact Assessment and Audit) Regulations;
- To perform an environmental audit of the existing facility operations as agreed in the scope of work;
- To propose recommendations for corrective measures for environmental and safety non-conformities;
- To prepare an Audit Report for submission to NEMA.

1.2.2 Scope of the Audit

The audit covers all the facilities and operations within the plant, which includes the following:

- Current environmental status of the facility, compared to local legislative requirements;
- A comparison of progress against the environmental management plan proposed in the initial environmental audit (IEA) of 2004, as well as closure of the gaps highlighted then;
- Get feedback from neighbours, on any concerns with the facility.
Following the review by OrPower 4 Inc. management, 3 bound hard copies of the report will be printed and submitted to NEMA accompanied with one soft copy (in a compact disc), one copy of both the hard copy and soft copy will to be submitted to OrPower 4 Inc.

1.2.3 Criteria for the report

This report is prepared on the basis of field survey/inspection and literature reviews. The Environmental Audit Reports of 2009, 2010 and 2011 have been reviewed. There have been five (5No.) previous environmental audits from 2004 to 2011. Reference numbers of the reports are as follows:

<table>
<thead>
<tr>
<th>No.</th>
<th>Reference Number</th>
<th>Year</th>
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<tbody>
<tr>
<td>1</td>
<td>NEMA/EA/5/2/2</td>
<td>2005</td>
</tr>
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<td>2</td>
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<td>2006</td>
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<td>3</td>
<td>NEMA/EA/5/2/2285</td>
<td>2007</td>
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<td>4</td>
<td>NEMA/EA/5/2/2</td>
<td>2010 and 2011</td>
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1.3 Terms of Reference of NEMA audit

The Terms of Reference for this audit is based on the NEMA public notice in the format and contents for Self-Audits. According to the published notice a self-audit report should contain the following:

* ……
  * NEMA's file reference number;
  * Company name, address and telephone number;
  * Summary of the environmental performance of the facility/enterprise vis a vis the initial environmental audit including:
    * Mention of any legal framework/regulatory change impacting on your operations;
    * Brief description of internal environmental policy as well as capacity to implement it;
    * A brief but concise description of immediate environment.
  * Report on quantities/values of materials used, by products and wastes generate and describe how they are managed with respect to legal especially environmental and health provisions. Describe changes in relation to previous years.
  * Present test results from NEMA accredited laboratories showing status in the quality of water, wastewater, noise levels, soil and air emissions where applicable;
  * Report on consultation with employees, neighbours and other affected communities on the operations of the facility;
  * Present a matrix indicating compliance and progress in the implementation of your environmental management plan;
  * Any other relevant information;
  * Name and signature of the chief executive.
* ……

1.4 Methodology

The methodology used in undertaking this audit involved the following stages:

* A desk-study to obtain background biophysical information, legal and regulatory issues associated with the project/facilities;
* A visit to the Plant to assess potential impacts of the operations;
* Visual assessment of environmental and occupational health and safety aspects at the
facilities;
- Study of documents and site visit for the proposed construction of Olkaria III Second Plant;
- Use of prepared checklist to collect data;
- Preparation of an EA report and environmental corrective action plan.

The findings described in this report are based on information provided by the staff at the facility, observations at the time of the facility inspection and from consultation with stakeholders and locals of Narasha area within Hells Gate National Park.

1.5 Registration

As required by Regulation 14 of the NEMA Regulations, GIBB Africa Ltd is registered as a firm of Experts for Environmental Impact Assessment and Audit by NEMA (License No. 0001) and is therefore authorised to undertake the environmental audit study and submit a report.

1.6 Acknowledgements

GIBB would like to take this opportunity to thank the following staff amongst others for their assistance during the audit:

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<td>Alvin Charo</td>
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1.7 Limitations

The Audit Report was based on reviews of existing and accessible documents, current legislation governing site facilities site inspections and formal and informal interviews with identified parties within the project zone of influence.
1.8 Structure of the Environmental Audit 2012 Report

This report has been prepared under the following chapters:

Chapter 1: **Introduction**: This chapter presents the following:
- Background of the environmental audit;
- Objective of audit;
- Scope of audit;
- Terms of Reference.

Chapter 2: **Policy, legal and institutional / administrative framework**:

This chapter outlines the different guiding frameworks in the legislation and regulatory setting for the project.

Chapter 3: **Environmental Audit**: This chapter gives a description of the following:
- Olkaria III Plant history, location and operations;
- Environmental Setting;
- Socio-economic environment;
- Technical activities, process and operations;
- Materials, final products, by products and waste generated;

Chapter 4: **Olkaria III Second Plant**: This section presents findings of the following:
- Environmental management of the plant at the different phases;
- Occupational Health and Safety during construction of the plant.

Chapter 5: **Findings and Recommended Corrective Action**: This chapter presents findings during the environmental audit of Olkaria III Plant 1.

Chapter 6: **Consultations**: This section presents findings of the following:
- Employees Consultations;
- Public / Neighbourhood Consultations.

Chapter 7: **Environmental Management Plan**: This chapter presents the following:
- Corrective action plan;
- Environmental mitigation for the construction of Plant (2) two;
- Follow-up activities.

Chapter 8: **Conclusion**
2 POLICY LEGAL AND REGULATORY FRAMEWORK

2.1 Introduction

The operations of the Olkaria III are governed by OrPower 4 Inc. / Ormat International Standards and the local laws and regulations.

The Second Schedule to EMCA specifies the projects for which an EIA and environmental audit must be carried out. According to EMCA, Section 68, "all projects listed in the Second Schedule of the Act (EMCA) must undertake an environmental audit, keep accurate records and make annual reports to NEMA or as NEMA may, in writing, require."

This audit falls within this mandate.

2.2 The Constitution

Kenya passed a new constitution which was promulgated on the 27 August 2010. In the Preamble of the Constitution it recognises the role of environment in sustaining our heritage for the benefit of future generations.

The relevant section of the constitution to this project is Chapter 5 on Land and Environment.

Part 2 of the chapter defines environment and natural resources, obligations in respect of the environment, enforcement of environmental rights, agreements relating to natural resources and legislation relating to the environment.

Section 69 explains each and every citizen's obligations in respect of the environment in subsection (1) it states the following:

The State shall:

(a) Ensure sustainable exploitation, utilisation, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;
(b) Work to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya;
(c) Protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of the communities;
(d) Encourage public participation in the management, protection and conservation of the environment;
(e) Protect genetic resources and biological diversity;
(f) Establish systems of environmental impact assessment, environmental audit and monitoring of the environment;
(g) Eliminate processes and activities that are likely to endanger the environment; and
(h) Utilise the environment and natural resources for the benefit of the people of Kenya.

Part (f) is of relevance to this audit.

Subsection (2) states:

Every person has a duty to cooperate with State organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources.
OrPower 4 Inc. is expected to cooperate with National Environment Management Authority (NEMA) of which it is charged with the responsibility of general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of Government in the implementation of all policies relating to the environment.

Section 70 explains each and every citizen’s enforcement of environmental rights it states in subsection 1 and 2 states: (For the purposes of this Article, an applicant does not have to demonstrate that any person has incurred loss or suffered injury).

The following sections discuss the relevant OrPower 4 Inc. and Kenyan policies legal framework in regards to the Olkaria III plant I operations and plant II construction.

2.3 Policy and Legal Framework

The Government created the Geothermal Development Company (GDC) through the policy paper on energy which was later actualised in the Energy Act (No. 12 of 2006). GDC became fully functional in 2009 to fast track the generation of electricity from geothermal resources in Kenya.

The Government awarded Ormat Company through OrPower 4 Inc. the Olkaria III power plant project in order to foster renewable energy generation and ensure Kenya’s geothermal development.

The Government’s environmental policy aims at integrating environmental aspects into national development plans. The broad objectives of the national environmental policy include:

- Optimal use of natural land and water resources, including subsurface resources in improving the quality of human environment;
- Sustainable use of natural resources to meet the needs of the present generations while preserving their ability to meet the needs of future generations;
- Integration of environmental conservation and economic activities into the process of sustainable development;
- Meeting national goals and international obligations by conserving biodiversity, arresting desertification, mitigating effects of disasters, protecting the ozone layer and maintaining an ecological balance on earth.

2.3.1 OrPower 4 Inc. Policies

OrPower 4 Inc. has an existing “Environmental, Health and Safety Policy”, which is communicated to every employee on joining the company. The company has a “Safety Manual for the Plant Operation and Maintenance”.

There is an Environmental Health and Safety Officer, who is in charge of environmental issues, safety and procedures in the plant, covering staff, contracted workers and visitors to the site.

The plant is audited and inspected periodically in accordance with the Environmental (Impact Assessment and Audit) Regulations of 2003 and the Occupational Safety and Health (OSHA) Act of 2007 respectively.

The Acts of Parliament and regulations applicable to Olkaria III plant operations are discussed in the following sections.

2.3.2 The Environmental Management and Co-ordination Act, 1999

This Act of parliament provided for the establishment of a legal and institutional framework for the management of the environment and for matters connected therewith and incidental thereto.
Section 68 of the Environmental Management and Coordination Act (EMCA) requires all facilities to undertake environmental audits as outlined in the NEMA Regulations for Environmental Impact Assessment and Audit of June, 2003, Regulation 31. OrPower 4 Inc. must therefore undertake an environmental audit of its operations, keep accurate records, and make annual reports to NEMA or as NEMA may require.

Just as in the new constitution, Part II of EMCA confers to every person the right to a clean and healthy environment and to its judicial enforcement. The new Constitution and EMCA therefore obligates OrPower 4 Inc. to operate in a clean environment and not to contravene the right of any person within its zone of influence, to this entitlement.

EMCA has provided for the development of several subsidiary legislations and guidelines which govern environmental management and are relevant to the operations of Olkaria III.

In line with EMCA of 1999 and EIA/EA regulations guidelines, NEMA issued a License to OrPower 4 Inc. so as to generate power in September of 2007. The license was issued with conditions to ensure protection of the environment. Since 2007, another License of variation was issued in May of 2010 on the same regard and also to increase power generation from 46MW to 100MW.

It is noted that the same conditions apply on the variation license of 2010. Refer to in Appendix 2 for a copy EIA Licenses.

(a) The Environmental (Impact Assessment and Audit) Regulations, 2003 Legal Notice No. 101

Part V of the Regulations outlines requirements for undertaking an environmental audit, projects that should undertake an audit (Regulation 31), procedures for environmental auditing (Regulation 35) details of an environmental audit (Regulation 36) and issuance of improvement orders (Regulation 37).

OrPower 4 Inc. is therefore mandated by law to undertake an environmental audit and submit the Reports to NEMA of its operations as stipulated in these Regulations.

(b) The Environmental Management and Coordination (Waste Management) Regulations, 2006 Legal Notice No. 121

These Regulations apply to all categories of waste. These include:

- Industrial wastes;
- Hazardous and toxic wastes;
- Pesticides and toxic substances;
- Biomedical wastes; and
- Radio-active substances.

OrPower 4 Inc. produces industrial waste from its operations and maintenance. Some of the industrial wastes from the plant include:

- Grease and oils used in lubricating machinery such as turbines;
- Scrap metal and plastics from old steam pipes.

Apart from the industrial waste mentioned above, domestic waste is also produced at the plant.

The Regulations also govern the handling, storing, transporting, and treatment / disposal of all waste categories as provided therein. Regulations 7, 8 and 9 outline requirements, responsibilities for licensing of waste transporters, while Regulation 10 provides for licensing of waste disposal facilities.
NEMA has licensed waste transporters and approved several disposal sites and treatment facilities for the handling of the said waste categories. OrPower 4 Inc. is expected to work with NEMA licensed transporters/handlers.

(c) The Environmental Management and Coordination (Water Quality) Regulations, 2006 Legal Notice No. 120

These Regulations provide for the enforcement of protection of sources of water, regulation of effluent discharge and uses of water. It classifies effluent discharge into the following:

- Discharge into the aquatic environment;
- Discharge into the environment;
- Discharge into public sewers.

These Regulations require that every person who discharges effluent into the environment under a license issued under EMCA to carry out daily effluent discharge quality and quantity monitoring and to submit quarterly records to NEMA.

The Regulations provide standards for effluent discharge into the environment (Third Schedule) as well as a monitoring guide for discharge into the environment (Fourth Schedule). Other standards and monitoring guides set out in these Regulations include:

- Quality standards for sources of domestic water (First Schedule of the Regulations).
- Quality monitoring for sources of domestic water.
- Standards for effluent discharge into public sewers.
- Monitoring for discharge of treated effluent into the environment.

Olkaria III operations require that every person who discharges effluent into the environment (Narasha Wetland) and are therefore affected by the regulations as stipulated in the condition 3 of the "Conditions of License" of the EIA dated 2007 (Appended in this report, Appendix 2).

(d) The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 Legal Notice No. 61

These Regulations prohibit any person from making or causing to be made any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment.

Regulation 3 outlines the following factors to consider in determining whether noise is loud, unreasonable, unnecessary or unusual:

- Time of the day;
- Proximity to residential area;
- Whether the noise is recurrent, intermittent or constant;
- The level and intensity of the noise;
- Whether the noise has been enhanced in level or range by any type of electronic or mechanical means;
- Whether the noise can be controlled without much effort or expense to the person making the noise.

There are several activities currently undertaken within Olkaria III facility that could generate loud noise. The activities are mainly in OEC units at the plant, drilling rigs and Olkaria III second plant construction site.

OrPower 4 Inc OEC unit produces low noise levels during most of its operation due to the automation process of its plant. Noise levels go up during the release of Non Condensable Gases (NCG) which occurs periodically at scheduled periods.
The Environmental Management and Coordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006 Legal Notice No. 160

These Regulations apply to conservation of biodiversity which includes: conservation of threatened species, inventory and monitoring of biological diversity and protection of environmentally significant areas, access to genetic resources, benefit sharing and offences and penalties.

Part II of these Regulations deal with conservation of biological diversity. It mandates NEMA in consultation with the relevant lead agencies, to impose bans, restrictions or similar measures on the access and use of any threatened species in order to ensure its regeneration and maximum sustainable yield.

Olkaria III power plant is located within the boundaries of Hells Gate National Park. This is a protected area with several endangered and threatened species of wildlife. OrPower 4 Inc. is therefore obligated to ensure their operations do not contravene any requirements of these regulations.

2.3.3 The Occupational Safety and Health Act, 2007

This is an Act of Parliament to provide for the safety, health and welfare of all workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes.

It applies to all workplaces where any person is at work, whether temporarily or permanently. It therefore applies to all OrPower 4 Inc. places of work, including the Olkaria III Second Plant construction site, which need to be registered by the Directorate of Occupational Safety and Health (DOSH) as work places (Section 6 (6) and Section 44). The Act defines a workplace as any land, premises, location, vessel or thing, at, in, upon, or near which, a worker is, in the course of employment.

OrPower 4 Inc. has complied with this law and has registered both the operating plant and the second plant under construction as workplaces.

Section 6 (3) and (4) requires that an occupier of a work place undertakes a risk assessment and submits a report of this risk assessment to the area occupational safety and health officer. The purpose of this Act is to:

- Secure the safety, health and welfare of persons at work; and
- Protect persons other than persons at work against safety and health arising out of, or in connection with the activities of persons at work.

The Occupational Safety and Health Act 2007 (OSHA 2007) revoked the Factories and Other Places of Work Cap.514.

The Factories and Other Places of Work Act had over the years passed several subsidiary rules and regulations for effective implementation of the Act. All shall, as long as it is not inconsistent with OSHA 2007, remain in force until repealed or revoked by subsidiary legislation under the provisions of OSHA 2007 and shall for all purposes be deemed to have been made under this OSHA.

(a) General duty of persons in control of certain premises in relation to harmful emissions in to atmosphere Article 19 (1) of the Act, 2007

This section of the Act stipulates the duties that a facility such as Olkaria III should ensure to prevent harmful emissions of poisonous, harmful, injurious or offensive substances to the atmosphere.
It relates to the preventive measures taken by the facility to the following:

- The operations of the plant in relation to the purpose of emission;
- The supervision of any operation involving the emission of substance from the plant.

Olkaria III being a geothermal plant, operations would have emissions of substances to the atmosphere. Control and measure of harmful substances in the air is therefore important as stipulated in the Conditions of License given in the Plant’s EIA License in 2007.

**b) The Factories and Other Places of Work (Health and Safety Committees) Rules, 2004**

These rules are described in Legal Notice No. 31 of the Kenya Gazette Supplement No. 25 of 14 May 2004 and apply to all factories and other workplaces that regularly employ twenty or more employees. Among other items, the rules state that:

- The occupier of every plant or other workplace shall establish a Health & Safety Committee;
- The Committee shall consist of safety representatives from the management and the workers;
- The plant occupier shall appoint a competent person from the management staff to be responsible for safety, health and welfare in the plant or workplace; and the person appointed shall be the secretary to the Committee;
- Every member of the Health & Safety Committee shall undertake a prescribed basic training course in occupational health and safety within a period of six months from the date of appointment or election, and thereafter further training from time to time;
- The occupier of every plant or workplace shall cause a health and safety audit of the workplace to be carried out at least once in every period of twelve months by a registered health and safety adviser.

The Rules govern formation (Rule 4), duties and functions (Rule 6) of Health and Safety Committees and undertaking of Health and Safety audits (Rule 13).

The Rules outline representation of workers in an H&S Committee as follows (Rule 4 (2)-c):

- Work places with between twenty and one hundred regular employees' not less than three safety representatives each from management and the workers;
- Work places with between one hundred and one thousand employees' not less than five safety representatives each from management and the workers;
- Work places with more than one thousand workers, not less than seven safety representatives each from the management and the workers in the committee.

Each registered work place at Olkaria III plant thus requires forming a H&S Committee in accordance to these Rules.

At the plant, it was noted that the Health and Safety Committee has members from all departments. This forms the foundation for the OrPower 4 Inc. health and safety management system.

Rule 13 requires a health and safety audit to be carried out once every period of twelve months by a registered health and safety adviser.

**c) The Factories and Other Places of Work (Medical Examination) Rules, 2005**

These are described in Legal Notice No. 24 of the Kenya Gazette, Supplement No. 22 of April 2005. The Medical Examination Rules apply to all those employees in employment or have been in employment in every workplace, to which the provisions of the Factories and Other Places of Work Act (Cap 514) apply. The Rules describe the following:

- Occupations requiring medical examination;
Duties of employer and employees as to medical examination;
Reports on examination;
Certificate of redeployment;
Certificate of fitness;
Notification of occupational diseases;
Offences and penalties.

Olkaria III plant employees therefore undergo regular checkups to ensure the good health of employees. According to the plants management, medical exams are carried out at the beginning of October, every year.

(d) The Factories and Other Places of Work (Noise Prevention and Control) Rules, 2005

These rules are described in Legal Notice No. 25 of the Kenya Gazette Supplement No. 22 of April 2005 and apply to every plant, premises, place, process and operations to which the provisions of the Factories and Other Places of Work Act apply. These Rules describe the following:

- Permissible noise levels;
- Noise prevention programme;
- Noise measurements and records;
- Information on noise and training of workers;
- Noise measuring equipment;
- Engineering controls;
- Installation and maintenance of machinery or plant;
- Means of communication;
- Hearing protection;
- Noise hazard areas;
- Workers responsibility in noise hazard areas;
- Duties of the occupier;
- Medical examination and hearing tests;
- Compensation and notification of occupational hearing impairment;
- Noise programme review;
- Offences and penalties.

OrPower 4 Inc. carries out weekly records of noise levels at different stations at the plant to monitor the noise levels. Further from monitoring present at the plant are numerous personal protective equipment signages in areas where noise levels are above acceptable limits to ensure hearing protection of persons within these areas.

(e) The Factories and Other Places of Work (Fire Risk Reduction) Rules, 2007

These Rules provide for fire preparedness and protection in a workplace in accordance to Section 78 of OSHA. The rules outline the following aspects relevant to Olkaria III operations:

- Fire safety policy (Rule 34);
- Fire safety audit (Rule 38);
- Colour coding of pipes (Rule 32);
- Maintenance & inspection of fire extinguishers (Rule 30);
- Provision of fire fighting appliances (Rule 29);
- Training in fire safety Rule 21);
- Formation of fire fighting teams (Rule 20).

The audit team observed that the fire extinguishers at Olkaria III to have been inspected on 05/06/2012 by a fire protection specialist and were in good condition at the time of audit.
The Factories and Other Places of Work (Hazardous Substances) Rules, 2005

These regulations cover specifications for factories and workplaces where hazardous substances are handled. Provisions are made for exposure limits, protection of workers and the environment, maintenance of equipment and future guidelines on hazardous substances.

Hazardous substances are defined as any chemical, waste, gas, medicine, drug, plant, animal or micro-organisms which are likely to be injurious to human health or the environment.

There are operations at Olkaria III which handle hazardous substances and will need to abide by this rule. These include, but not limited to:

- Olkaria III plant 1 No storage and maintenance of Pentane chemical, oils and lubricants used during operations;
- Plant 1 No fuel (petroleum) refill tank;
- Olkaria III plant 2 No construction site, open chemical storage area.

Operations are as observed during audit inspection on the 10th to 13th of September, 2012 (Refer to Appendix 3, photo plate).

2.4 Administrative Framework

In 2001, the Government established the administrative structures to implement the Act (EMCA). The main administrative structures are described in the following sections:

2.4.1 The National Environmental Council

The National Environmental Council (the Council) is responsible for policy formulation and directions for the purposes of the Act. The Council also sets national goals and objectives and determines policies and priorities for the protection of the environment.

2.4.2 The National Environmental Management Authority

The responsibility of NEMA is to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of government in the implementation of all policies relating to the environment.

In addition to NEMA, the Act provides for the establishment and enforcement of environmental quality standards to be set by a technical committee of NEMA known as the Standards and Enforcement Review Committee (SERC).

2.4.3 Provincial and District Environmental Committees

The Provincial and District Environmental Committees also contribute to decentralised environmental management and enable the participation of local communities. These environmental committees consist of the following:

- Representatives from all the ministries;
- Representatives from local authorities within the province/district;
- Two farmers/pastoral representatives;
- Two representatives from NGO's involved in environmental management in the province/district;
- A representative of each regional development authority in the province/district.
2.4.4 Public Complaints Committee

EMCA also establishes a Public Complaints Committee, which provides the administrative mechanism for addressing environmental harm. The committee has the mandate to investigate complaints relating to environmental damage and degradation. Its members include representatives from the Law Society of Kenya, NGOs and the business community.
3 ENVIRONMENTAL AUDIT, 2012

3.1 Plant History, Location and operations

OrPower 4 Inc. has operated the Olkaria III geothermal power plant since the year 2000. The power station initially generated 13MW of electricity which was boosted to 48MW of electricity in 2004.

In 2010 OrPower 4 Inc. obtained a certification license for variation; to increase power generation from 48MW to 100MW by NEMA.

Ormat Projects, a sister company to OrPower 4 Inc is currently constructing the additional Olkaria III second plant to the south east of the existing plant, within the larger plant facility area.

OrPower 4 Inc. Company currently has three (3No) departments that ensure smooth operation of the Olkaria III Power plant. The departments are as follows:

a. Operations Department in charge of Operations of the plant;
b. Maintenance Department in charge of the following;
   • Mechanical maintenance;
   • Electrical maintenance;
   • Instrumentation and control.
c. Administration Department in charge of all staff and administration of the plant.

3.2 Olkaria III Plant Profile

Olkaria III Plants details

Table 3-1 Olkaria III power plant details

<table>
<thead>
<tr>
<th>Name</th>
<th>Olkaria III Geothermal Energy Generating Power Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>OrPower 4 Inc. Limited</td>
</tr>
<tr>
<td>Address</td>
<td>P O Box 1566- 20117 Naivasha Kenya</td>
</tr>
<tr>
<td>Telephone</td>
<td>254 050 50663/4</td>
</tr>
<tr>
<td>Fax</td>
<td>254 050 50668</td>
</tr>
<tr>
<td>e-mail</td>
<td><a href="mailto:orpower4office@ormat.com">orpower4office@ormat.com</a></td>
</tr>
<tr>
<td>Physical address</td>
<td>Off Moi South Lake Road, Naivasha</td>
</tr>
<tr>
<td>Date of Audit</td>
<td>10 September 2012</td>
</tr>
<tr>
<td>Facility staff number</td>
<td>31No Staff</td>
</tr>
</tbody>
</table>

3.3 Environmental setting

3.3.1 Project Location

The Olkaria III plant is located about 120 km northwest of Nairobi. Administratively, the Plant is located within Hells Gate location, Central division of Naivasha Municipality of Nakuru County of Kenya.
3.3.2 Geographical setting

Olkaria III power plant partly lies within Hell's Gate National Park, Malella- Ngati and Kongoni farms, within the zone that was gazetted as a geothermal resource area in 1971. The park is spectacularly scenic, its main attractions being the Hell's Gate cliff face, Hell's Kitchen and Ol Njorowa Gorge.

The Olkaria geothermal area covers an area of 75 km², and has a potential to produce at least 400MWe. The Olkaria III plant is one of the 7 designated fields in the Greater Olkaria geothermal area, and covers an area of approximately 11.9 km².

The plant lies within the park that is situated at 1,560- 2,187 meters above sea level.

3.3.3 Ecological setting

Land use in Olkaria area is predominantly reserved for wildlife under the management of the Kenya Wildlife Service (KWS).

Wildlife species inhabiting the park include zebra, impala, Thompson's gazelle, Grant's gazelle, eland, giraffe, waterbuck, dikdik, buffalo and warthogs, as well as predators such as lion and leopard.

In addition, there are over 100 species of birds to be found in the park of which one can see as you make your way to the Power plant located on the south western slopes of Olkaria hill, the highest feature in the area.

The geothermal field is in close proximity with to Lake Naivasha, flower farms including the Oserian Flower Development Company (ODC). The natural ecology is characterized with different *acacia* species such as the *Acacia Xanthophlela, Acacia Drepanolobium* and the *Leleshwa (Tarchonanthus)* commonly used for charcoal making in the area.

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3.4 Socio-economic Environment

3.4.1 Community around the plant

Neighbouring the Olkaria III power plant is the Maasai community. Most of Maasai homesteads are found to the south and south east of the Olkaria III field, while the flower farms to the north.

From the site surveys, the environment team observed an increase in the proximity of the Maasai settlements from the Narasha Village as from the previous audits' observations.

From the consultation with the OrPower 4 Inc. Environmental Officer, this increase is due to the influx of locals working at the power plant during construction of the Olkaria III second plant. This proximity could pose an issue to OrPower 4 Inc. future expansion plans.

3.4.2 Plant's Social benefits

OrPower 4 Inc. has aided in the development of Narasha Primary school that within the Narasha community area neighbouring the Olkaria III plant. The school has a nursery and classes from standard 1-8, currently having 9no teachers, 5no of them coming from the Teachers Service Commission (TSC).

The school was started by OrPower 4 Inc. and has employed 4 teachers currently. OrPower 4 Inc. supports several programmes including:

- Lunch programmes for the students;
- Co-curricular activities, such as music; and
• Gender development support among others.

In addition, OrPower 4 Inc. also gives out bursaries to well performing pupils and needy; targeting girl child to good Secondary Schools in a way to encourage education in the area.

OrPower supports this community as part of its Community Social Responsibility (CSR) programme.

3.5 Operations and energy production process

3.5.1 Background

The operation department is in charge of all operations and procedures within the facility. This department has 7No employees working in different capacities and shifts. Refer to Appendix 4 for OrPower 4 Inc. company’s organogram (May, 2012).

The employees under this department are trained on Occupational Health and Safety, First Aid and Fire emergency management. The plant operates at a 24 hour basis to ensure power is produced as described in this section of the report.

The Plant’s power generating process is as follows:

• Production;
• Separation;
• Condensate discharge.

3.5.2 Production

Operations at the facility begin at the production wells. There are a total of 10No production wells and 3No re-injection wells serving the Olkaria III power plant. 1No production well is dormant. Some of pads and wells have been set aside to be utilised in the future. (Refer to Appendix 1, the geothermal site reserve for your reference).

It is from the production wells that high temperature- pressurised steam is tapped and transported through metallic pipes for utilisation at the facility. Steam from the wells is directed to an Ormat Energy Converter (OEC) where the second process of energy generation occurs.

3.5.3 Separation

The geothermal fluid at this point of production is directed to the separator, where steam and hot water are separated. Dry steam from the separator is directed to the vaporizer where heat is exchanged or transferred to the motive fluid/ chemical known as Pentane. Once pentane acquires the energy, it rotates the first turbine and there after the second turbine.

3.5.4 Condensate discharge

The geothermal brine from the separator is mixed to the condensate and channelled to a pre-heater, where Pentane is preheated before it goes to the main heat exchanger known as the vaporizer. In this way the system extracts available heat from the brine.

The spent fluids from the process are directed to the re-injection well.

The plant operates a binary system where the geothermal heat is used to vaporise and pressurise a secondary motive fluid (Pentane) which then drives the turbine. This process is enclosed and the recyclable. The pentane therefore contained in a closed cycle.
3.6 Maintenance

The maintenance department is in charge of maintenance of all equipment used within the operational facility. This department has three divisions, namely:

- Mechanical division;
- Electrical division;
- Instrumentation and control division.

Maintenance department carries a total of 11 employees, 3 of which are under instrumentation and control, 6 under the mechanical division and 2 under the electrical division.

The instrumentation division ensures that all equipment and instruments used in the facility are calibrated and approved by the Kenya Bureau of Standards (KEBS). This ensures quality in the plant operations.

Some of the roles under this department are as follows:

- Scheduled maintenance of plant equipment;
- Servicing of run down equipment;
- Fixing the failures at the plant with spares.

The instrument and control division ensures that regular monitoring of wells using instruments such as thermometers, control valves and pressure gauge to check temperatures, flow, quantities and pressure is done.

3.7 Administration

The administration department is in charge of the general oversight of the plant management. The department has a total of 12 employees, who work under different capacities, these are:

- Plant Manager,
- Human Resources and Administration Manager and
- Chief Accountant;
- Assistant Accountant;
- Project Accountant;
- Administration Secretary;
- Project Secretary;
- 3 Store Keepers; and
- 2 Drivers.

The administration department is in charge of training personnel of the plant on safety and emergency response management.

Currently the following trainings have been carried out:

- Environmental management;
- Environmental impact Assessment/ Audit training;
- Occupational Fire safety training;
- First Aid training;
- Occupational Health and Safety committee training; and
- Peer education training.
As part of the company's policy, regular training of staff is implemented annually where staffs from all departments undergo general safety and emergency training. Training certificates are available at the Plant's administration office and were shown to the audit team during the audit.

3.8 Materials and outputs from the production process

3.8.1 Raw materials

The raw materials for use at the plant during the energy production constitute the geothermal fluids at both high temperature and pressure. These fluids include:

- Brine; and
- Super heated steam.

Pentane as a raw material at start is used in the process as a heat exchanger fluid in the closed cycle. The fluid is recycled within the binary system. This ensures very minimal wastage and contamination of the chemical to the natural environment.

Other materials used during the process for lubricating moving parts of equipment and oiling generators and other plant machinery are:

- Lubricants (T32);
- Oils (T68).

3.8.2 By-product and waste generated

The by-products from the plant operations are as follows:

- Noise emission;
- Hydrogen Sulphide and Non-condensable gases such as carbon dioxide gases;
- Collection from accidental spillages within oil skids, where spillage has occurred.

The wastes generated from the plant operations are as follows:

- Food waste from domestic use;
- Scrap metal from worn out equipment and materials;
- Domestic waste from maintenance, such as old cleaning rags;
- Plastics from equipment wrapping and bottles used mainly during construction on site.

OrPower 4 Inc. has specific waste handlers that are registered by NEMA to handle the respective by-products from the plant. These are:

- Jammar Kenya Enterprise Limited who handle waste (used oils) from the Plant; and
- Stepkia Garbage Collectors who pick up industrial waste, such as plastics and scrap metal from the power plant.
4 OLKARIA III SECOND PLANT

OrPower 4 Inc. Olkaria III geothermal plant is currently under expansion in a measure to increase capacity from the current 48MW to an additional 36MW power production from the second plant currently under construction.

4.1 Construction activities

Construction activities at the site received approval from NEMA on 22nd of March, 2010. Construction activities at the site are being done by an international contractor (Civicon Limited) and overseen by Ormat Projects Company. Currently the site is fenced off and the following observations were made:

- Project Office is present at the site with Ormat Projects supervising the construction activities;
- The construction area is cleared of vegetation for the construction works, landscaping (tree planting) needs to be done as the construction activities continue, to ensure growth of the trees around the site area;
- Occupational health and safety of the workers on site is observed as workers had the appropriate PPE within the site as they worked;
- The EMP from the Olkaria III EIA report is to be incorporated into the site management plan to ensure all mitigation measures and requirements are followed;
- Liaison between the contractor (Civicon Limited) on site and OrPower 4 Inc. Environmental Health and Safety Officer should be maintained by having regular meetings to bring the contractor up to speed with the requirements according to the EMP;
- Construction monitoring reports were not available at the time of audit. It is recommended that regular monitoring of construction activities is done to ensure proper management of Environmental issues on a timely manner.

Site inspection at the site was carried out on 30th July, 2012 by Department of Occupational Safety and Health Services (DOSHS) under the Ministry of Labour of Kenya.

The Environmental Audit inspection was carried out from 10th to the 19th of September, 2012 with the guidance of the OrPower 4 Inc Environmental Officer and the Safety Officer of Civicon Limited during construction.

4.1.1 Environmental Management

At the new site not much of environmental management has taken place as the area is under construction.

As was noted in the Environmental audit of 2010, the expansion phase of OrPower 4 Inc. power plant within the fenced and cleared area would have less environmental impact. It is important that the plants management ensures that the area is restored with indigenous vegetation and high canopy trees to cover the plant and also to increase the aesthetics of the park.

Due to the heavy truck movement in the plant area, dust reduction measures on roads should be implemented to mitigate against dust which cause poor visibility which may result to animals being knocked as well as cause dust to blow towards the work area in Plant 1 where there are operational offices; this may cause lead to health issues to staff at plant.
4.1.2 Occupational Health and Safety

All workers at the site were observed to be in proper respective Personal Protective Equipment (PPE) at the time of inspection by the Audit team.

The Contractor’s (Civicon Limited) Safety Officer, being his first month at the site, had limited information at the time of the audit on the activities at the site in relation to occupation health and safety. The audit team held meetings with the Safety Officer and the following issues were discussed:

• Safety procedures to be followed in accordance to the DOSHS certificate requirements;
• Training of workers, all workers are to be trained on basic safety procedures during construction;
• Emergency Response Plan at the second plant should be in place incase of any emergency;
• HIV/AIDS policy (during construction phase and operation of plant two) should be prepared and put in place at the construction site;
• Noise survey at the second plant (during construction) should be carried out to ensure that persons in areas of excessive noise level are well informed and protected;
• Liaison among the project stakeholders including: Ormat Projects (project supervisors) and OrPower 4 Inc. who eventually will operate the plant should be maintained.

Recommendations for the above named issues are included in the revised Environmental Management Plan (EMP) in Chapter 7 of this report. Refer to photo plates (Appendix 3) for images taken at the site.
5 FINDINGS AND RECOMMENDED CORRECTIVE ACTIONS

5.1 Olkaria III Power plant

5.1.1 Environmental management

(a) Hydrogen Sulphide

Hydrogen Sulphide gas is one of the by-products produced from the Olkaria III plant operations. From the operation technology adopted at the OrPower 4 Inc. plant, minimal waste and by-product from the process is released to the atmosphere.

From the previous Environmental Audit study of 2010 and of 2011, the Olkaria III plant area was found to have hydrogen Sulphide levels ranging from 0.013ppm to 0.38ppm, with the highest values coming from the steam vents.

During this year's audit, a trend analysis of the emissions recorded in the year 2012 has been analysed for comparison and monitoring purposes. The following tables illustrate the trend in emission levels for the year 2012.

It is noted that the highest acceptable limit to be 10 ppm exposure being for 8 hours, according to the recommended occupation exposure limits for Hazardous Chemical Substances as stipulated in the Occupational Safety and Health Act (OSHA) of 2007.

Table 5-1 presents the summary of emission levels from the plant as per the monitoring points within the plant operation area.

Figure 5-1 illustrates the trend analysis of hydrogen sulphide levels recorded at the plant.
Table 5-1 Summary of Emission levels from the Olkaria III Power plant (for the year 2012) per monitoring areas

<table>
<thead>
<tr>
<th>MONTH</th>
<th>JAN</th>
<th>FEB</th>
<th>MARCH</th>
<th>APRIL</th>
<th>MAY</th>
<th>JUNE</th>
<th>JULY</th>
<th>AUGUST</th>
<th>SEPT</th>
</tr>
</thead>
<tbody>
<tr>
<td>FENCE CORNERS OF OEC UNITS</td>
<td>0.063</td>
<td>0.18</td>
<td>0.11</td>
<td>0.006</td>
<td>0.07</td>
<td>0.11</td>
<td>0.122</td>
<td>0.045</td>
<td></td>
</tr>
<tr>
<td>TURBINES/ GENERATOR AREAS OF OEC UNITS</td>
<td>0.13</td>
<td>0.17</td>
<td>0.39</td>
<td>0.25</td>
<td>0.15</td>
<td>0.18</td>
<td>0.26</td>
<td>0.18</td>
<td></td>
</tr>
<tr>
<td>WORKSHOP/ MAINTENANCE/ STORAGE AREA</td>
<td>0.05</td>
<td>0.11</td>
<td>0.052</td>
<td>0.001</td>
<td>0.005</td>
<td>0.001</td>
<td>0.002</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>WELLS A1 TO C2 INCLUDING SEPARATOR</td>
<td>0.17</td>
<td>0.3</td>
<td>0.33</td>
<td>0.28</td>
<td>0.148</td>
<td>0.042</td>
<td>2.2</td>
<td>0.082</td>
<td></td>
</tr>
<tr>
<td>OEC UNIT VAPORIZERS</td>
<td>0.146</td>
<td>3.1</td>
<td>1.8</td>
<td>3.5</td>
<td>0.021</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

LEGAL LIMITS: 10 ppm

NB: ppm- Parts per million
From the illustrations above, it was noted that the highest value recorded at the site was 3.5 ppm emanating from the OEC number 4 C2 Vaporizer/condensate pump on the fourth week of July, 2012. High level of Hydrogen sulphide at the plant calls for immediate action to stop any leakage from the identified equipment.

The areas with highest emission levels from the plant in 2012 were:

- OEC Turbines/Generator areas; and
- Wells A1 to C2.

OrPower 4 Inc. carried an Air Quality Analysis in July of 2012 for the plant and from the report other gases such as Radon gas, Carbon dioxide and dust emissions were analysed. The report concluded, from the indicated result, there was no health risks to workers at the site with the levels of emissions recorded then.

It is however recommended that the monitoring of hydrogen sulphide gases from the plant be analysed further in a measure to ensure safe limits such as for this year are maintained.

(b) Non-Condensable Gases

From the binary system used in Olkaria III power plant, Non-condensable gases (NCG) are released at particular periods during operations.

At the plant site, the NCG are released through a Non-Condensable Gas Control valve (NCC-V) that is monitored and controlled.

(c) Noise Levels

Noise levels are monitored at different points within the plant area in order to ensure the effect on the health of the workers is minimized. From the site inspection, the audit team noted the signage to caution workers present at the plant, especially in areas where noise levels were above 85 dbls.

Table 5-2 presents the maximum levels recorded at the Olkaria III power plant during the 2012 period to the month of August.
Table 5-2 Maximum noise vibration levels between January and August of 2012

<table>
<thead>
<tr>
<th>Month</th>
<th>Location of Source</th>
<th>Highest Level of Noise Vibration (in dBA)</th>
<th>Legal Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>OEC #2 Turbine Generator Area</td>
<td>88.2-100.7</td>
<td>90dBA</td>
</tr>
<tr>
<td>February</td>
<td>OEC #2 Turbine Generator Area</td>
<td>89.9-100.9</td>
<td>90dBA</td>
</tr>
<tr>
<td>March</td>
<td>OEC #2 Turbine Generator Area</td>
<td>89.3-101.1</td>
<td>90dBA</td>
</tr>
<tr>
<td>April</td>
<td>OEC #2 Turbine Generator Area</td>
<td>89.2-101.2</td>
<td>90dBA</td>
</tr>
<tr>
<td>May</td>
<td>OEC #2 Turbine Generator Area</td>
<td>89.2-102.3</td>
<td>90dBA</td>
</tr>
<tr>
<td>June</td>
<td>OEC #2 Turbine Generator Area</td>
<td>95.2-102.3</td>
<td>90dBA</td>
</tr>
<tr>
<td>July</td>
<td>OEC #2 Turbine Generator Area</td>
<td>90.7-102.6</td>
<td>90dBA</td>
</tr>
<tr>
<td>August</td>
<td>OEC #2 Turbine Generator Area</td>
<td>87.7-102.3</td>
<td>90dBA</td>
</tr>
</tbody>
</table>

The areas where data was collected are as follows:

- Fence Corners, OEC #3; to OEC #6;
- OEC #1 to OEC #6 Turbine Generator Area;
- Substation compound;
- Plant Fence area, Tree nursery;
- New Storage Facility;
- New main gate;
- NCD Banda;
- Maintenance Office;
- New Workshop;
- Well 401 and 307;
- Oserian Askari Gate;
- Project Office;
- Corner Fence, Hells Kitchen.

From the table 5-2 above, the highest range levels recorded this year range between 95.2-102.3dBA, the noise vibrations coming form Ormat Energy Converter (OEC) number 2 turbine generator area.

Appropriate PPE/ ear protection is used by staff working within the turbine generator area as the levels recorded go above the legal exposure limits (refer to Appendix 3, Photo plates).

(d) Dust Emission

Dust emissions from the plants operations is minimal considering very few vehicles access the site. The roads around the Olkaria III plant are all-weather roads that are prone to erosion especially during the dry season.

Increased construction activities at the Olkaria III Second Plant have caused dust emissions to increase at the site. Heavy trucks and buses carrying the workers frequent the site during the day, this further causes dust.

Spraying of water using a water truck at intervals as a method of mitigating the impacts on dust emissions is done close to the site, though with the scarcity of the water in the area, this mitigation measure has been difficult to maintain.
From the air quality survey of 2012 (Appendix 7 of this report) the measured result of dust levels at all sections surveyed are within the recommended threshold limit values (TLV). These values are summarized in the table 5-3 below.

Table 5-3 Suspended Particulate Matter (Dust)

<table>
<thead>
<tr>
<th>Location</th>
<th>Measured Levels</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside MCC No. 6</td>
<td>1.23mg/m³</td>
<td>Within limits</td>
</tr>
<tr>
<td>Outside MCC No. 1 &amp; 2</td>
<td>2.24mg/m³</td>
<td>Within limits</td>
</tr>
<tr>
<td>A Pad at ORP 7</td>
<td>1.03mg/m³</td>
<td>Within limits</td>
</tr>
<tr>
<td>Hill between W401 and W307 (control)</td>
<td>2.65mg/m³</td>
<td>Within limits</td>
</tr>
<tr>
<td><strong>Threshold Limit Value</strong></td>
<td><strong>10mg/m³</strong></td>
<td></td>
</tr>
</tbody>
</table>

Adopted from OrPower 4 Inc. Air Quality Analysts Report, July 2012 (Appendix 7 of this report)

The particle size being assessed is the **total inhalable dust** within and around the plant.

**5.1.2 Health and Safety management**

The PPE provided to staff and casual workers includes the following (as and when required, and in accordance with the identified risks in each work area):

- Safety shoes;
- Helmets;
- Hand gloves;
- Dust masks;
- Ear plugs;
- Goggles;
- Overalls.

The Company has provided fire extinguishers that are periodically inspected by a Fire protection specialist, throughout the plant. During the audit carbon dioxide, foam and water fire extinguishers were observed within the plant 1 site, the inspection record on the cylinders indicating the last inspection being on 05/06/2012.

Within the new plant section, the company has a water hydrant system installed for fire prevention and control. The hydrants are strategically placed within the power generation area inside the plant area, areas that are well accessible. Refer to Appendix 3, photo plates for reference. OrPower 4 Inc. has also installed a deluge system at the motive fluid storage area.

"Deluge" systems are systems in which all sprinklers connected to the water piping system are open, in that the heat sensing operating element is removed, or specifically designed as such. This system is used for special hazards where rapid fire spread is a concern such as the motive fluid area in the plant, as they provide a simultaneous application of water over the entire hazard.
5.2 Work areas within the Plant 1

5.2.1 Maintenance / Storage Workshops

There is one maintenance workshop and two storage areas within Plant 1. The maintenance workshop provides various maintenance services at the Olkaria III power plant.

The following observations were made:

<table>
<thead>
<tr>
<th>Item</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction materials:</td>
<td>Concrete structure with Iron sheet roofing with ceiling.</td>
</tr>
<tr>
<td>Activities:</td>
<td>General repairs and maintenance.</td>
</tr>
</tbody>
</table>
| Housekeeping:         | • Mechanical workshop: Equipment are spaced and well organized in the work area, minor fuel spillage on the floor and welding being undertaken within a cordoned area within the workshop;  
                        | • Old control room having bird droppings.                                                          |
| Solid waste:          | Waste from the mechanical workshop including metal, wires and plastic shavings are kept at a storage area outside awaiting transportation by licensed waste handlers. |
| Waste oil:            | Waste oil around oil skids and fuel storage area was noted.                                        |
| Lighting:             | Natural and Electric.                                                                             |
| Ventilation:          | Natural.                                                                                           |
| Fire extinguishers:   | Mechanical workshop: Several powder and 
Co2 type, all in the new international colour and recently serviced in June of 2012. |
| First aid box:        | One in the administration/ operations block as well as in the maintenance workshop equipped as per the First Aid Rules. |
| Safety and Emergency procedures: | Procedures were present though in very small writing among a very congested notice board within the maintenance workshop. |
| PPE:                  | Provided and used.                                                                                |
| Safety signage:       | Signages present "No smoking, use of PPE, Emergency Exits".                                       |

5.2.2 Administration/ operations block

The following observations were made:

<table>
<thead>
<tr>
<th>Item</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction materials:</td>
<td>Permanent structures of concrete, with GCI roofing with ceiling.</td>
</tr>
<tr>
<td>Washrooms:</td>
<td>Ordinary flush WC units for gents and ladies.</td>
</tr>
<tr>
<td>Lighting and ventilation:</td>
<td>Electric lights and natural ventilation.</td>
</tr>
<tr>
<td>Safety and Emergency procedures:</td>
<td>Procedures were present though in very small writing among a very congested notice board within the operations room.</td>
</tr>
</tbody>
</table>

**Recommendation:** Management to ensure the procedures are well visible and understood by every person visiting and working in the plant.
6 PUBLIC CONSULTATION

6.1 General consultations

Consultation is useful for gathering environmental data, understanding likely impacts, determining community and individual preferences, selecting alternatives and designing viable and sustainable mitigation and compensation plans.

When the project operations do affect the area negatively, corrective measures and improvement can be addressed through consultations.

6.2 Employee Consultations

Employee consultations were undertaken through interviews with the GIBB team. Representatives from all departments were interviewed.

The interview covered the following:

- Operational procedures per department;
- Training on fire fighting and First Aid;
- Capability on emergency response;
- Health and safety;
- Personal protection equipment and uniforms;
- Occupational health;
- History of spillage;
- Safety at the work place;
- Shift duration.

Employees were generally pleased with the welfare and operations concerning the plant.

6.3 Public Consultations

The Public Consultation exercise for Olkaria III power plant was guided by the following legislation:

- The Environmental Management and Co-ordination Act (EMCA) of 1999;
- EIA Regulations as outlined in Section 68 of the Act and Regulation 31;
- Immediate neighbouring facilities around the station.

Consultations were conducted through open ended questionnaires. The following were the response:

6.3.1 Narasha Primary School

The Audit team visited the Narasha Primary School to consult with the schools management, situated in the Narasha Community land and the following observations were made:

- OrPower 4 Inc. began the school and continues to assists in school building and construction activities. Currently the school Administration block is under construction with the assistance from the Constituency Development Fund (CDF);
The company has employed 4 teachers that teach at the primary school. An additional 5 more teachers are employed by the Teachers Service Commission (TSC);

OrPower 4 Inc. also assists in lunch programmes for pupils and teachers from the school and the teachers were very delighted to have such support from the company;

OrPower 4 Inc. supports the school co-curricular activities such as the music programme and bus transport;

The company is supporting five girls to Secondary level education in order to encourage gender empowerment in the community;

The community gets free transportation incase of a medical or health concern that may arise;

The head teacher informed the audit team that few illnesses have been reported in the school and community at large;

The head teacher had several requests from OrPower 4 Inc. including:

- A health care facility to be built close to the school to ensure health care is brought close to the community;
- The sustainability of the school to be ensured as too much of the school's management is left to OrPower 4 Inc.;
- OrPower 4 Inc. to encourage the community to grow food (maize and beans) by starting at the school's compound then spread the activities to the rest of the community;
- If possible, OrPower 4 Inc. to construct housing for teachers close to the school to avoid the long treks from the Olkaria Gate to the school and also increase the availability of teachers during the whole week of school.

### 6.3.2 Narasha Villagers

The audit team visited few homesteads within the Narasha Community village to find out their responses to Olkaria III operations and relations with the community. The following observations were made:

- The community was happy with OrPower 4 Inc. as they were good neighbours to both the community and the Hells Gate National Park;
- One of the community members, Mr. Peter Katambe, informed the team of some of the benefits the community gains from OrPower 4 Inc. operations and community associations. These gains were:
  - Educating the children of Narasha Community;
  - Construction of Narasha Primary School;
  - Awarding of bursaries to well performing students from the community to advance to secondary school and further;
  - Employing the men and women of Narasha to the OrPower 4 Inc. operations and construction of Olkaria III second plant.
- The community brought out the issue of smoke and smell from the plant's operations, saying the Olkaria III plant has very minimal emission as compared to the other power generating plants within Olkaria;
- The community felt that the livelihood has improved as several income generating activities are carried out since the beginning of the plant's operations;
- The community had a request to the company; they were asking if it would be possible for OrPower 4 Inc. to support in encouraging agricultural activities such as planting of maize and beans to ensure food security in the area.
6.4 Hells Gate National Park Management - Kenya Wildlife Service

As part of the Environmental Audit, the audit team visited the KWS Hells Gate National Park management for their comments on OrPower 4 Inc. operation and relations to the park. The following were noted:

- KWS were concerned about the growing geothermal expansions within the Hells gate National park in relation to the wildlife displacement from their natural habitats;
- The management was also concerned about the aesthetics of the park with the land use rapidly changing from scenic attractions to the industrial scene of construction and operational activities from these power generating plants. Such attractions are the Hell's Kitchen and the Hobley's Volcano that are close to the Olkaria III power plant;
- The management was also concerned about the increased construction activities in the park in relation to the expansion plans of the different plants in Olkaria; Some of the impacts noted by the management were:
  - Increased soil erosion and dust along the all-weather road network within the park;
  - Increased disturbance of animals within the park;
  - Traffic security issues at the park gates with the influx of casuals working within the construction sites.
- KWS noted that OrPower 4 Inc. vehicles do follow the park rules of speed limit of 40 km/hr to avoid any incidents with the crossing animals such as the zebras;
- The park management noted the good relationship between OrPower 4 Inc. and the park, informing the audit team of the joint activities such as the mammal census within the park, games (wheel barrow race) that are carried out in collaboration with the Park's management;
- Other assistance that the park gets from OrPower 4 Inc. includes providing vehicles for the mammal monitoring and machinery for park development activities.

Appendix 9 of this report shows the comments from the KWS representative from Hells Gate National Park.

6.4.1 Other stakeholders

Identified stakeholders from previous audits conducted were

- KenGen;
- Oserian Flower Company; and
- Lake Naivasha Riparian Association (LNRA).

However, the respective comments from the three stakeholders were not available at the time of writing this report.
7 ENVIRONMENTAL MANAGEMENT PLAN

7.1 Detailed corrective actions plan

The environmental corrective action plan presented in Table 7-1 collates and summarises the recommendations made in Chapter 5. The Plan also suggests a time period within which the actions should be implemented and the persons responsible for specific actions.

It must be emphasised that these timings and allocations for responsibility have been proposed as a starting point. It is expected that the Company management will continuously review the plan, so that more realistic target dates, based on availability of funds for corrective actions, as well as personnel resources, can be proposed.

In order to monitor the Hydrogen Sulphide (H₂S) levels from the plant, it is recommended that future air quality analysis reports to include analysis of H₂S gases at the power plant so as to ensure no health risks to workers and to maintained present air quality standards.

7.2 Environmental monitoring during construction

Environmental monitoring should be an on-going activity as a part of the company operations and construction activities in Plant 2. Monitoring should not only focus on meeting legal compliance, but should go further and be used as a tool to predict unforeseen impacts resulting from the activities and operations of the company.

Comprehensive environmental report should be prepared every quarter of the annual year, giving an indication of the trends for each of the various environmental and safety parameters, based on the monitoring data collected. All safety, health and environmental parameters being monitored should be consolidated into a monitoring plan and this plan must be continuously updated.

7.3 Construction of Olkaria III Second Plant

7.3.1 Environmental management plan

It is the responsibility of the project manager to incorporate mitigation measures into the contract documents.

The plant safety, health and environmental manager will have the primary responsibility for environmental health and safety issues.

Upon completion of the construction activities in plant 2, all temporary buildings, including concrete footings and slabs, all construction materials and debris will be removed from the site and the area reinstated, as required. The project office could later be used during operations of the second plant.

Environmental due diligence should be incorporated into the project implementation, as follows:

- Control of the residual risk of accidental environmental damage;
- Prevention of the negative environmental impacts during construction.
The contractor’s Environment, Safety and Health Officer will have the primary responsibility for the environmental due diligence, he will be required to include environmental health and safety considerations in monthly progress reports and indicate progress in the implementation of mitigation measures as outlined in the EMP.

The construction risks to be monitored will include, but not be limited to the following issues:

- Handling of hazardous materials such as chemicals as part of construction activities;
- Movement of machinery and equipment;
- Occupational health and safety;
- Collection and disposal of wastes;
- Management of pollution incidents.

During construction and operation, the Environment Health and Safety Officer will be required to monitor the implementation of the proposed mitigation measures as outlined in the EMP.

During the beginning of the operations phase, the Contractor’s EHS Officer should be in liaison with Opower 4 Inc EHS Officer where all appropriate documentation on health and safety at the new site should be discussed and handed.

Any adverse impacts that arise should be mitigated on an on-going basis. These should be included in an updated EMP.

Table 7-2 outlines the Environmental Management and Mitigation Plan during construction.

### 7.3.2 Mitigation and management during commissioning and operation

During the commissioning and operation, environmental due diligence will be incorporated to minimise any negative environmental impacts.

The commissioning and operation risks to be monitored will include, but not limited to the following issues:

- Occupational health and safety;
- Waste handling and disposal;
- Energy consumption;
- Maintenance.

The following activities are recommended to be undertaken after completion of the construction phase:

- Close-down audit to verify that the proposed mitigation measures have been implemented;
- Inclusion of an environmental management and monitoring programme in the site overall EMP.

All relevant technical information showing that the construction was undertaken in compliance with the set design standards and any deviations must be provided to the plant management.

Further, all technical information on energy use, saving and environmental performance will be outlined and highlighted during hand-over. These will be incorporated into the environmental management plan for the whole plant.

Table 7-3 outlines the Environmental Management and Mitigation Plan during operation.
### Table 7-1 Detailed Corrective Actions Plan

<table>
<thead>
<tr>
<th>Issue</th>
<th>Remedial Measure</th>
<th>Mechanism for implementation</th>
<th>Responsibility</th>
<th>Timescale</th>
<th>Cost (Ksh.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material Safety Data Sheets (MSDS):</td>
<td>Provide signage and relevant instructions for each chemical, oil or lubricant, indicating the minimum PPE required for handling and storage of the materials, and distribute to all persons handling chemicals.</td>
<td>Liaise with the suppliers to provide MSDS.</td>
<td>Stores Manager / ESO</td>
<td>1 month.</td>
<td>To be notified</td>
</tr>
<tr>
<td>Safety and Emergency procedures</td>
<td>Management to ensure the procedures are well visible and understood by every person visiting and working in the plant</td>
<td>Print out visible procedures and place them in the respective department walls</td>
<td>Plant Manager Maintenance / ESO</td>
<td>1 month</td>
<td>To be notified</td>
</tr>
<tr>
<td>Housekeeping:</td>
<td>Implement a more rigorous cleaning programme and review the use of the old control room.</td>
<td>Ensure daily cleaning.</td>
<td>ESO</td>
<td>1 month</td>
<td>To be notified</td>
</tr>
<tr>
<td>Waste oil flowing into the drains:</td>
<td>Ensure all waste oil is directed into an oil interceptor before being discharged into the drains. Periodic monitoring of the discharge from the oil interceptor must be done to ensure compliance.</td>
<td>• Review designs and implement; • Revised policy.</td>
<td>Maintenance Manager, ESO</td>
<td>2 month</td>
<td>To be notified</td>
</tr>
<tr>
<td>Oil skids/ spillage of waste oil:</td>
<td>Institute handling and housekeeping procedures to spillage at the oil skids close to the generator and at the fuel tank near the maintenance workshop.</td>
<td>Ensure daily cleaning.</td>
<td>Plant Manager Maintenance / ESO</td>
<td>1 month</td>
<td>To be notified</td>
</tr>
<tr>
<td>Concrete blocks allowing seepage of oil into the subsurface:</td>
<td>Monitor any seepage in the concrete block beneath the fuel tank. Reconstruct the hard standing using concrete pavement where necessary. Conduct soil gas survey to ascertain the extent of the contamination into the soil.</td>
<td>Review designs and implement.</td>
<td>Plant Manager Maintenance / ESO</td>
<td>1 month</td>
<td>To be notified</td>
</tr>
<tr>
<td>First Aid:</td>
<td>Ensure that the First Aid Kits are placed at strategic locations within the plant.</td>
<td>Produce a layout of first aid box locations and display at strategic locations</td>
<td>ESO</td>
<td>1 month</td>
<td>To be notified</td>
</tr>
<tr>
<td>Hydrogen Sulphide analysis</td>
<td>Ensure the emission levels from the site are analysed during the future air quality surveys</td>
<td>Ensure the inclusion of the gas assessment in the TOR for the survey request.</td>
<td>Plant Manager Maintenance / ESO</td>
<td>1 year</td>
<td>To be notified</td>
</tr>
</tbody>
</table>
### Table 7-2 Environmental Management Plan during Construction

<table>
<thead>
<tr>
<th>Environmental issue</th>
<th>Standards and guidelines</th>
<th>Management and mitigation</th>
<th>Monitoring requirements</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil erosion:</td>
<td>EMCA</td>
<td>• Ideally plan construction during dry season; • Sprinkle water daily on the work site and road leading to the site; • Provide suitable drainage.</td>
<td>Daily auditing and spot checks; Report monthly.</td>
<td>ESO, Plant Manager and Contractor.</td>
</tr>
<tr>
<td>Noise, dust and emissions:</td>
<td>The Public Health Act (Chapter 242, Part IX); Factories Act</td>
<td>• Sprinkle water daily to minimise airborne dust; • Provide dust masks to all personnel on work site where necessary; • Maintenance of machinery and equipment to manufacturer’s standards and specification; • Avoid use of machinery during night periods and weekends.</td>
<td>Daily auditing and spot checks; Report monthly.</td>
<td>ESO, Plant Manager and Contractor.</td>
</tr>
<tr>
<td>Waste management:</td>
<td>EMCA; The Public Health Act (Chapter 242, Part IX); Factories Act</td>
<td>• The Supervising project manager should develop a site waste management plan; • The Supervising Engineer should be responsible for responsible disposal of construction waste.</td>
<td>Daily auditing and spot checks; Report monthly.</td>
<td>ESO, Plant Manager and Contractor.</td>
</tr>
<tr>
<td>Water utilisation (poor water management)</td>
<td>EMCA; The Public Health Act (Chapter 242, Part IX); Factories Act</td>
<td>• Proper supervision of construction personnel by the Contractor; • All Contractors’ water handling facilities should be checked before operation.</td>
<td>Daily auditing and spot checks; Report monthly.</td>
<td>ESO, Plant Manager and Contractor.</td>
</tr>
<tr>
<td>Fire and Safety:</td>
<td>The Penal Code (Chapter 63); The public Health Act (Chapter 242).</td>
<td>• Place portable fire extinguishers at suitable locations, according to the activities in the construction programme; • Mark and sign-post all emergency exits; • Ensure safety warnings are prominently displayed on site, such as “No smoking”, “No naked flames”; • Provide and enforce the use of PPE; • Carry out emergency training of staff and perform fire drills at the Plant; • Ensure that an adequately stocked First Aid box is on site at all times; • Maintain an incident/accident register, in accordance with the Factories and Other Places of Work Act.</td>
<td>Daily auditing and spot checks; Report monthly.</td>
<td>ESO, Plant Manager and Contractor.</td>
</tr>
<tr>
<td>Traffic management:</td>
<td>EMCA; The Public Health Act (Chapter 242, Part IX).</td>
<td>• Provide temporary road signs or notices to indicate on-going works.</td>
<td>Daily auditing and spot checks</td>
<td>ESO, Plant Manager and Contractor.</td>
</tr>
<tr>
<td>Environmental issue</td>
<td>Standards and guidelines</td>
<td>Management and mitigation</td>
<td>Monitoring requirements</td>
<td>Responsibility</td>
</tr>
<tr>
<td>---------------------</td>
<td>--------------------------</td>
<td>--------------------------</td>
<td>------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Visual impacts.</td>
<td>EMCA</td>
<td>The new development will be visible but the impact will be minimal as the area is already built up. Develop a tree planting programme for the site surrounding area.</td>
<td>Final inspection.</td>
<td>ESO, Plant Manager and Contractor.</td>
</tr>
<tr>
<td>Monitoring reporting</td>
<td>EMCA</td>
<td>Preparation of Quarterly report on environmental and health and safety concerns at the Plant 2 during construction</td>
<td>Daily auditing and spot checks; Report Quarterly.</td>
<td>ESO, Plant Manager</td>
</tr>
<tr>
<td>Table 7-3: Environmental Management Plan during Operation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire and safety:</td>
<td>EMCA</td>
<td>The Plant Supervisor should ensure the following: • Place portable fire extinguishers at suitable locations, according to the activities in the construction programme; • Mark and sign-post all emergency exits; • Ensure safety warnings are prominently displayed on site, such as &quot;No smoking&quot;, &quot;No naked flames&quot;; • Provide and enforce the use of personal protective equipment (PPE); • Install a temporary fire alarm and ensure that fire procedures are known to all the site staff; • Ensure that an adequately stocked First Aid box is on site at all times; Maintain an incident/accident register, in accordance with the Factories and Other Places of Work Act.</td>
<td>Daily auditing and spot checks; Report monthly.</td>
<td>ESO, Plant Manager.</td>
</tr>
<tr>
<td>Facility maintenance and monitoring:</td>
<td>EMCA, Local authority By-laws</td>
<td>Maintenance of machinery and equipment to manufacturer's standards and specification.</td>
<td>Daily auditing and spot checks; Report monthly.</td>
<td>ESO, Plant Manager.</td>
</tr>
<tr>
<td>Waste water:</td>
<td>EMCA; Local authority By-laws</td>
<td>Disposal by separation in the oil interceptor and monitoring effluent periodically to ensure compliance with standards.</td>
<td>Quarterly</td>
<td>ESO</td>
</tr>
<tr>
<td>Traffic congestion:</td>
<td>EMCA, Traffic Act.</td>
<td>Plan itineraries for traffic on a daily basis and avoid peak traffic periods at the KWS Olkaria gate.</td>
<td>Daily auditing and spot checks; Report monthly.</td>
<td>ESO, Plant Manager.</td>
</tr>
<tr>
<td>Solid waste management:</td>
<td>EMCA; Local authority By-laws</td>
<td>Good housekeeping and disposal of solid wastes by professional refuse handlers.</td>
<td>Daily auditing and spot checks; Report monthly.</td>
<td>ESO, Plant Manager</td>
</tr>
</tbody>
</table>

OrPower 4 Inc
Olkaria III Final Environmental Audit Report
000671
7-3 December 2012
8 CONCLUSION

The NEMA Environmental Audit has been completed in accordance to relevant legislation. This report presents issues that should be addressed in order to ensure environmental sustainability and compliance with the existing legal requirements.

This report has addressed issues associated to the operations, housekeeping, environmental management and protection by OrPower 4 Inc.

The summary of main issues of concern the Environmental Audit considered include the following:

- Lack of Environmental Management plan at the facility's second plant currently under construction;
- Noise, dust emissions and odours;
- Safety/ emergency prevention and control procedures/ measures.

The risks during construction of the Olkaria III Second plant to be monitored will include, but not be limited to the following issues:

- Handling of hazardous materials as part of construction activities;
- Movement of machinery;
- Occupational health and safety;
- Collection and disposal of wastes;
- Management of pollution incidents.

Key environmental management and mitigation measures proposed include the following:

- Document comprehensive environmental management plan and procedures;
- Provide adequate fire fighting equipment and First Aid boxes;
- Make visible, the emergency procedures;

Olkaria III power plant environmental audit for 2012 was carried out on 10 -19 September 2012 with minor issues being observed in Plant 1 that is currently under operation.

As indicated in the EMP for Plant 2, several mitigation measures are to be put in place so as to ensure environmental compliance and safety of the workers during construction.