

**OLKARIA V GEOTHERMAL PROJECT**  
**Environment and Social Monitoring Form**

The latest results of the below monitoring items shall be submitted to JICA as part of attachment to Progress Report on once at Pre-construction phase and on quarterly basis at Construction Phase, and on annually base at Operation Phase. The items, standards for contract, measurement points, and frequency for each monitoring parameter are established based on the ESIA Report. Should there be any changes to the Original plan, such change shall be reviewed and evaluated by the environmental consultant.

**(1) General**

**1) Phase of the Project**

- Please mark the current phase.

Pre-Construction Phase     Construction Phase     Operation Phase

**2) Obtainment of Environmental Permits**

Name of permits	Expected issuance date	Actual issuance date	Concerned authority	Remarks (Conditions, etc.)
Water abstraction permits for Olkaria	Permit for domestic water abstraction issued on 26 <sup>th</sup> July, 2017 (Permit Ref. no. WRMA/20/NSA/2GD/23/S)	Permit for abstraction of 795.4m <sup>3</sup> /day of water for domestic use was issued on 26 <sup>th</sup> July 2017, and is valid till 26 <sup>th</sup> July 2022.	Water Resources Authority (WRA)	-The permits for domestic and industrial/commercial water abstraction are valid up to 2022.
	Permit for commercial/industrial water abstraction for Olkaria issued on 24 <sup>th</sup> May 2017. (Permit Ref. no. WRMA/20/NSA/2GD/22/S)	Permit for abstraction of 8,000 m <sup>3</sup> /day of water for commercial & industrial use was issued on 24 <sup>th</sup> May 2017, and is valid till 24 <sup>th</sup> May 2022.		
EIA license	Variation of license validity period issued on 14 <sup>th</sup> March 2019	-Original license dated 12 <sup>th</sup> September 2014, -1 <sup>st</sup> variation of EIA license validity period	National Environment Management Authority(NEMA)	KenGen has acquired variation of the EIA license validity period issued on 14 <sup>th</sup> March 2019, valid for an additional 24 months (up to 14 <sup>th</sup> March 2021).

		dated 14 <sup>th</sup> Nov 2016 -2 <sup>nd</sup> variation of EIA license validity period dated 14 <sup>th</sup> March 2019		
Registration of Work Place by Lot I Contractor (Sinopec International Petroleum Service)	Application for renewal of workplace registration launched on 4 <sup>th</sup> March 2019 as per the attached receipt	The certificate of workplace registration expired on 9 <sup>th</sup> Feb 2019. Payment for renewal received by DOSHS on 4 <sup>th</sup> March 2019	Directorate of Occupational Safety and Health Service (DOSHS)	Awaiting issuance of certificates of work place registration for Sinopec Domes site camp, Sinopec Kedong Ranch quarry & Sinopec Service Kongoni Camp.
Registration of Work Place by Lot II Contractor (H-Young & CO (E.A))	Issued 12 <sup>th</sup> June 2018	Issued 12 <sup>th</sup> June 2018. Expiry date is 12 <sup>th</sup> June 2019.	Directorate of Occupational Safety and Health Service (DOSHS)	Valid certificate of work place registration no. NKU250696/06/18/00.
Registration of Work Place by Lot III Contractor (Sieyuan Electrical Company)	Issued 6 <sup>th</sup> June 2018	Certificate valid from 6 <sup>th</sup> June 2018 to 6 <sup>th</sup> June 2019	Directorate of Occupational Safety and Health Service (DOSHS)	Valid certificate of work place registration no. NKU/299/6/18/00.
<b>Attached approval letter:</b> Attachment 1: EIA license variation for Olkaria V Project issued 14 <sup>th</sup> March 2019. Attachment 2: DOSHS certificate of work place registration issued to Y-Young. Attachment 3: Receipts for renewal of certificate of work place registration issued to Sinopec. Attachment 4: DOSHS certificate of work place registration issued to Sieyuan Electric Company				

### 3) Response/Actions to Comments and Guidance from Government Authorities and the Public

Monitoring Item	Monitoring Results during Report Period	Duration of Report Period	Frequency
Number and contents of formal comments made by the public	There were no formal comments during this monitoring period	1 Day	Upon receipt of comments/complaints
Number and contents of responses from Government agencies			

## (2) Monitoring Results

### 1) Air Quality

#### (A) Hydrogen Sulphide

Location	Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standard	Standards for Contract	Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
Residential Area	H <sub>2</sub> S	ppm	0.001	0.002	0.1		0.1*/(24h)	Daily	Using gas detectors	Limit not exceeded
Workers Area	H <sub>2</sub> S	ppm	0.002	0.004	10		10**/(24h)	Daily	Using gas detectors	Limit not exceeded

\*) WHO Hydrogen Sulphide Guideline for ambient air quality

\*\*\*) WHO Hydrogen Sulphide Guideline for worker

#### (B) Sulfur Dioxide

Location	Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Frequency	Method	Remarks
Residential Area	SO <sub>2</sub>	ppm	0	0	Quarterly	Using testo emission analyzer model 350	Not detectable
Workers Area	SO <sub>2</sub>	ppm	0	0	Quarterly	Using testo emission analyzer model 350	Not detectable

#### (C) Carbon Monoxide

Location	Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Frequency	Method	Remarks
Residential Area	CO	ppm	0	0	Quarterly	Using testo emission analyzer model 350	
Workers Area	CO	ppm	0.33	1	Quarterly	Using testo emission analyzer model 350	Emission due to operation of the diesel generators

**(D) Carbon Dioxide**

Location	Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Frequency	Method	Remarks
Residential Area	CO <sub>2</sub>	ppm	0	0	Quarterly	Using testo emission analyzer model 350	Not detectable
Workers Area	CO <sub>2</sub>	ppm	0	0	Quarterly	Using testo emission analyzer model 350	Not detectable

**(E) Methane**

Location	Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Frequency	Method	Remarks
Residential Area	CH <sub>4</sub>	ppm	N/A	N/A	Daily	Using gas detectors	We have requested for a specialized equipment for monitoring CH <sub>4</sub> gas. The data will be collected and shared by Mid-March 2019.
Workers Area	CH <sub>4</sub>	ppm	N/A	N/A	Daily	Using gas detectors	We have requested for a specialized equipment for monitoring CH <sub>4</sub> gas. The data will be collected and shared by Mid-March 2019.

**(F) Total Suspended Particles**

Location	Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Frequency	Method	Remarks
Residential Area	TSP	µg/m <sup>3</sup>	5	8	Weekly	Using particulate matter in air analyzer equipment	According to Environmental Management and Coordination (Air Quality) Regulations of 2014, the ambient air quality tolerance limit for Total Suspended Particles over a 24-hour time weighted average at residential areas is 200 µg/m <sup>3</sup> . The measured levels do not exceed this limit.
Workers Area	TSP	µg/m <sup>3</sup>	117	299	Weekly	Using particulate matter in air analyzer	According to Environmental Management and Coordination (Air Quality) Regulations of 2014, the ambient air quality tolerance limit for

						equipment	Total Suspended Particles over a 24-hour time weighted average at industrial areas is 500 µg/m <sup>3</sup> The measured levels do not exceed this limit.
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### Complains from Residents

- Are there any complains from residents regarding air quality in this monitoring period?  Yes,  No

If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Complains from Residents	Countermeasures
None	None

## **2)Water Quality**

Measurement Point: Important water body

- Are there any effluents to water body in this monitoring period?  Yes,  No

If yes, please attach “KenGen Analysis Data Form for Effluent Quality Analysis” and fill in the items not to comply with NEMA Guideline (Environmental Management and Coordination (Water Quality) Regulations of 2006).

### (A) Effluent Water Quality (Outlet)

Location	Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standard	Standards for Contract	Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
	TSS	mg/L			30*		-	Monthly	Sampling	
	COD	mg/L			50*		-	Monthly	Sampling	
	BOD	mg/L			30*		-	Monthly	Sampling	
	DO	mg/L			None		-	Monthly	Sampling	
	pH	-			6.5-8.5*		-	Monthly	Sampling	
	oil	mg/L			Nil*		-	Monthly	Sampling	
	phenol	mg/L			0.001*		-	Monthly	Sampling	

\*) Environmental Management and Co-ordination (Water Quality) Regulations, 2006

**Note:** There was no effluent discharge from the project site within the Jan-Feb-Mar period

**(B) Local Drinking Water Supply Source (Ambient)**

Location	Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standard	Standards for Contract	Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
Sieuyan Site	TSS	mg/L	ND		30*			Quarterly	Sampling	
	COD	mg/L	153.66		None		-	Quarterly	Sampling	
	BOD	mg/L	51.20		None		-	Quarterly	Sampling	
	DO	mg/L	1.65		None		-	Quarterly	Sampling	
	pH	-	6.20		6.5-8.5*		-	Quarterly	Sampling	
	oil	mg/L	Nil		None		-	Quarterly	Sampling	
	phenol	mg/L	<0.001		0.002		-	Quarterly	Sampling	
	Lead	Mg/l	<0.001		0.01		-			

\*) Environmental Management and Co-ordination (Water Quality) Regulations, 2006

**Note:** Sieuyan provides bottled water to the workers, and the analysis results are for bottled water.

Location	Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standard	Standards for Contract	Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
H-Young Site	TSS	mg/L	ND		30*		-	Quarterly	Sampling	
	COD	mg/L	230.40		None		-	Quarterly	Sampling	
	BOD	mg/L	76.80		None		-	Quarterly	Sampling	
	DO	mg/L	2.08		None		-	Quarterly	Sampling	
	pH	-	6.88		6.5-8.5*		-	Quarterly	Sampling	
	oil	mg/L	Nil		None		-	Quarterly	Sampling	
	phenol	mg/L	<0.001		0.002		-	Quarterly	Sampling	
	Lead	mg/L	<0.001		0.01		-			

\*) Environmental Management and Co-ordination (Water Quality) Regulations, 2006

**Note:** Lot 2 Contractor (H-Young) has a water treatment plant at the site, and the water is treated through reverse osmosis process.

Location	Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standard	Standards for Contract	Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
Sinopec Site	TSS	mg/L	ND		30*		-	Quarterly	Sampling	
	COD	mg/L	192.0		None		-	Quarterly	Sampling	
	BOD	mg/L	64.4		None		-	Quarterly	Sampling	
	DO	mg/L	1.87		None		-	Quarterly	Sampling	
	pH	-	7.63		6.5-8.5*		-	Quarterly	Sampling	
	oil	mg/L	Nil		None		-	Quarterly	Sampling	
	phenol	mg/L	<0.001		0.002		-	Quarterly	Sampling	
	Lead	mg/L	<0.001		0.01		-	Quarterly		

\*) Environmental Management and Co-ordination (Water Quality) Regulations, 2006

**Note:** Lot 1 Contractor ( Sinopec) has a water treatment plant.

### (C) Important Water Bodies (Ambient)

Location	Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standard	Standards for Contract	Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
Lake Naivasha at Oserian Jetty	TSS	mg/L	2		30*		-	Monthly	Sampling	
	COD	mg/L	144		None	"	-	Monthly	Sampling	
	BOD	mg/L	48		None	"	-	Monthly	Sampling	
	DO	mg/L	1.60		None			Monthly	Sampling	
	pH	-	7.75		6.5-8.5*			Monthly	Sampling	
	Oil	mg/L	Nil		None			Monthly	Sampling	
	Phenol	mg/L	<0.001		Nil*			Monthly	Sampling	
	Lead	Mg/L	<0.001		0.01				Sampling	

\*) Environmental Management and Co-ordination (Water Quality) Regulations, 2006

### 3)Water Use

Usage	Unit	Amount Permitted by WRA	Pumped Amount	Reused Amount	Total Water Usage	Measured Frequency	Measured Method	Note (Reason of excess of the standard)
Industrial	m <sup>3</sup>	8,000m <sup>3</sup> /day (720,000m <sup>3</sup> for 90 days)		N/A	Lot I (Sinopec): 4987.9 m <sup>3</sup> Lot II (H-Young): 7622 m <sup>3</sup> Lot III (Sieyuan): 888.4 m <sup>3</sup> Total water consumed (Jan, Feb, Mar 2019): 13,498.3 m <sup>3</sup>	Monthly	Installed flow meters	Water used during the period under review was within the limits permitted by Water Resources Authority (WRA)
Domestic	m <sup>3</sup>	795.4m <sup>3</sup> /day			-			KenGen does not provide domestic water to the Contractors
Other	m <sup>3</sup>							

Item	Monitoring Results during Report Period	Note (issues to be arisen and its measures, if any)
Hydrology (Lake Levels)	The Lake Naivasha water levels readings for the months of January & February 2019 were 1888.814 and 1888.599 meters above sea level (masl) respectively.	Water Resources Authority (WRA) in Kenya restricts water abstraction if lake Naivasha levels fall below 1885.3 masl. The recorded values were within the allowable levels that allows for maximum abstraction as per the WRA permit.

### 4)Noise

#### Noise Level

Location	Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standard	Standards for Contract	Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
Residential Area	Leq (day)	dB(A)	43.5	46.1	50 (6am-6pm)*		55 (6am-10pm)***	Daily	Spot	Average noise



									measurement using noise meter	levels do not exceed the limit.
Residential Area	Leq (night)	dB(A)	N/A	N/A	35 (6am-6pm)*		45 (10pm-6pm)***	-	-	We do not have night activities
Workers Area	Leq (day)	dB(A)	64.9	70.3	85 (8hrs)**		-	Daily	Spot measurement using noise meter	Noise levels do not exceed the occupational threshold.

\*) Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations of 2009 for Residential Area (Outdoor)

\*\*\*) Occupational Safety and Health Act (OSHA) 2007 for Worker (8 hrs)

\*\*\*WHO Noise Guideline for Residential Area (Outdoor)

### Complaints from Residents

- Are there any complaints from residents regarding noise in this monitoring period? Yes, No

If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Complaints from Residents	Countermeasures
There were no complaints regarding noise during this monitoring period.	N/A

### **5)Solid Waste**

Measurement Point: Disposal Sites for Sludge (including drilling mud)

- Are there any wastes of sludge in this monitoring period? Yes, No

If yes, please report the amount of sludge and fill in the results of solid waste management Activities.

Item	Generated from	Unit	Value	Solid Waste Management Activities
Amount of Domestic refuse	Site offices and dining area for workers on site	Kgs	8kg per day	The contractor has provided a waste containment site where he holds the waste before final disposal.
Clinic waste	H-Young clinic	Kgs	4kgs in the	Transport to Finlays Incinerator

			quarter	
Plastic waste	Cooling tower fills	Kgs	3,500 per quarter	Transported by licensed waste handler
Rock wool	Steam line	m <sup>3</sup>	5 per quarter	At domes holding site. To be disposed by a licensed waste handler
Iron waste	cuttings	Kgs	300	At domes holding site. To be disposed by a licensed waste handler
Timber	Packaging	Kgs	6000 per quarter	The metallic scraps are accumulated up to a maximum of 20 tones and transported back to the contractors scrap yard for disposal at Nairobi.
Amount of metallic scraps	Power plant steel fixing construction (rebars)	Tonnes	6 ton	The metallic scraps are accumulated up to a maximum of 20 tones and transported back to the contractors scrap yard for disposal at Nairobi. During the period under review, only 6 tonnes had accumulated due to reduced rebar activities
Amount of Sludge	Oil spills from diesel generators and equipment maintenance	Litres	1400 litres	Transported back to Nairobi to be used for heating purposes of the contractor's boilers asphalt additives once they accumulate to a maximum of 1000litres. In the period under review we had 220litres on site.

**\* KenGen is to develop Waste Management Procedure for the Project which Contractor and KenGen shall comply for waste management.**

**A copy of Waste Management Procedures is requested to submit to JICA together with this monitoring form as soon as it is finally developed.**

## **6) Soil erosion**

<b>Item</b>	<b>Monitoring Results during Report Period</b>	<b>Note (issues to be arisen and its measures, if any)</b>
Soil erosion	<ul style="list-style-type: none"> <li>Controlled excavation works to minimize soil erosion</li> <li>Slope protection with geo-cell installation, soil filling, grassing &amp; watering</li> <li>Cut-off drains provided to contain run-off during rains in April-May-June 2019.</li> <li>Culverts are provided appropriately to prevent erosion of access roads</li> </ul>	

## **7) Public Safety**

<b>Item</b>	<b>Unit</b>	<b>Value</b>	<b>Notes</b>
Amount of Car	No.	0	No car accident was reported at the construction site within the period under review.

Accidents			
Use of work permits	No.	-	Lot 2 Working at height is ongoing and high awareness is in place. All necessary PPE'S are utilized as required
			Lot 2 Falling objects is ongoing with hand and power tools securement and tethering. All workers at height are using tool poche.
			Lot 1 continued issuing permits to work (PTW) for hot works and work at heights.
Use of PPEs	No.	All workers	All workers have appropriate PPEs
Fatality	No.	1	One fatality involving the Mechanical Works Manager (Mr. Gedion Gachichio Wathobio) for Lot II Contractor (H-Young) reported on 1 <sup>st</sup> February 2019. Incident investigation report to establish the root causes for the fatal accident prepared. Corrective actions implemented to avoid similar occurrence. (The incident investigation report has been attached).

Note: A joint Environment, Health, Safety (EHS) committee with representatives from Lot 1, 2 & 3 contractors, Consultant and KenGen was established in July 2018 and is operational. The joint committee meets at least once per month to discuss and address any EHS issue in regard to the Olkaria V project.

### **8) Protected Areas and Ecosystems**

Item	Monitoring Results during Report Period	Note (issues to be arisen and its measures, if any)
Flora (both in and around the HG National Park)	-Controlled excavation of the sites to minimize impacts on flora -Grassing along slopes to restore habitats -Invasive plant species (such as <i>Nicotiana glauca</i> ) have colonized disturbed areas such as spoil banks.	Control/Remove invasive plant species
Fauna (both in and around the HG National Park)	-A baby Klipspringer antelope was rescued stuck on loose soil along OW-917 to OW-922 HDPE pipe route, and was later handed over to Kenya Wildlife Service (KWS)	-
Hell's Gate National Park	-Review of Hell's Gate-Mt. Longonot Ecosystem Management Plan 2017 -2027 is ongoing	The review covers geothermal resource development and conservation
Landscape	-Controlled excavation of the sites to minimize landscape changes. Top soil piled for future use in rehabilitation of degraded/cleared sites. -Landscaping of the disturbed sites in has commenced at the power plant area	

	-The steam pipes claddings are coated with colours that camouflage to the surrounding environment	
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### **9) Social considerations and others (excluding resettlement and livelihood restoration)**

<b>Item</b>	<b>Monitoring Results during Report Period</b>	<b>Note (issues to be arisen and its measures, if any)</b>
Working Condition	Work was executed as per required labour standards	
Employment and economic opportunities	Within the period under review, there was no new employment or economic opportunities.	
Education Scholarship	Through SCC, Lot II (H-young) has offered two (2) university and one secondary education scholarship to local community as a way of empowering them. This was with effect from July 2018.	
Infectious disease	None	
Misdistribution with unfair distribution of benefits and damages	For the period under review, there was fairness in the distribution of benefits through the SCC.	-

**(End)**