REPORT ON REMEDIATION ACTIVITIES

AT

10'' KWALE/AKRI PIPELINE, AGWE ETITI, DELTA STATE

(2014/LAR/051/181, 2014/LAR/030/103 & 2014/LAR/147/553)

SUBMITTED BY

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TO

HSE DEPARTMENT

NIGERIA AGIP OIL COMPANY (NAOC)

SPILL DATES	-	**29/01/2014, 23/02/2014 & 04/07/2014**
CONTRACT START DATE	-	**08/03/2016**
CONTRACT END DATE	-	**24/03/2016**
PURCHASE ORDER NO	-	**4600025116 & 4600025120**

DOCUMENT CONTROL AND HISTORY

Date	Revision	Security	Client
	REV 0	Confidential	Nigeria Agip Oil Company (NAOC)

APPROVAL

	Name	Position	Signature	Date
Prepared By	Justice Barima	Project Coordinator		
Reviewed By	Faith Izevbizua	Project Manager		
Approved By	Lesi Maol	Managing Director		

EXECUTIVE SUMMARY

Giolee Global Resources Limited was commissioned by the Nigerian Agip Oil Company (NAOC) to carry out Remediation along the 10" Kwale/Akri Pipeline. The 10" Kwale/Akri Pipeline is located in Agwe Etiti, Ndukwa East Local Government Area of Delta State with GPS coordinates N 05.641790 and E 006.61565. Agwe Etiti is bound to the west by Keonokpo community, to the east by Odugri community and north east by Ishukwa community. The major sources of livelihood of the Agwe Etiti people are farming and fishing. The site is primarily used for the NAOC ROW and is surrounded by grasses and farmlands. The distance from the site to the nearest human habitation is about 500m with the predominant soil type being sandy soil.

Three oil spill incidents have occurred on the 10" Kwale/Akri Pipeline (29/01/2014 & 23/02/2014 and 04/07/2014) which impacted 1.05 Hectares of land with an estimated 32 barrels of crude oil. The three spill incidents were reported to be caused by Sabotage. NAOC Right of Way (ROW) and third areas were impacted by the oil spill incidents.

This remediation project commenced with a kick-off meeting held in Kwale Gas plant on 11th February 2016, followed by community consultation with stakeholders of the project (Giolee Global Resources, NAOC, DPR, DSMEnv, host community). The FTO (freedom to Operate) was secured through the services of PAF on 4th March 2016 at Kwale Gas plant.

Mobilization to site was on 08/03/2016. The project involved two major phases. The first phase consisting of active remediation of the impacted site while the second phase involved monitoring of the site for any changes.

A pre and post remediation monitoring was carried out by Giolee Global resources ltd. The pre-remediation sampling revealed that among the eight (8) pre-remediation samples collected, only two (2) had TPH concentrations of 8715mg/kg and 8179mg/kg respectively which were above the DPR intervention value of 5000mg/kg while six were below the DPR intervention value. The post-remediation sampling revealed that the TPH concentration of all soil samples collected were below 10mg/kg.

The remediation activity at 10" Kwale/Akri pipeline in Agwe Etiti was successfully carried out in line with the work scope without any accidents affecting personnel, equipment or the environment. Samples collected before, during and after the remediation project offer further proof of the success of the project.

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LIST OF ABBREVIATIONS AND ACRONYMS

DPR	-	Department of Petroleum Resources
DSMEnv	-	Delta State Ministry of Environment
FTO	-	Freedom to Operate
JIV	-	Joint Investigation Visit
TPH	-	Total Petroleum Hydrocarbons
NOSDRA	-	National Oil Spill Detection and Response Agency
PPE	-	Personal Protective Equipment
OSE II	-	Oil Spill Eater II

CHAPTER ONE
INTRODUCTION

1.1 General

Giolee Global Resources Limited was commissioned by Nigerian Agip Oil Company (NAOC) to carry out Remediation along the 10" Kwale/Akri Pipeline**.** The 10" Kwale/Akri Pipeline is located in Agwe Etiti, Ndukwa East Local Government Area of Delta State.

Three oil spill incidents have occurred on the 10" Kwale/Akri Pipeline (29/01/2014 & 23/02/2014 and 04/07/2014) which impacted 1.05 Hectares of land with an estimated 32 barrels of crude oil spilled. The three spill incidents were reported to be caused by Sabotage. The NAOC Right of Way (ROW) and third areas were impacted by the oil spill incidents.

This project commenced with a kick-off meeting held in Kwale Gas plant on 11th February 2016. Following that was community consultation with all stakeholders of the project, Giolee Global Resources, NAOC, DPR, DSMEnv, and the host community, to secure the FTO (freedom to operate). The FTO was secured through the services of PAF on 4th March 2016 at Kwale Gas plant.

Giolee successfully mobilized to site on 08/03/2016. The project involved two major phases. The first phase consisting of active remediation of the impacted site while the second phase involved monitoring of the site for any changes.

1.2 Objectives

The primary aim of this project was to remediate and restore the contaminated site back to a state acceptable by the relevant regulatory bodies.

The secondary aim of this project was to show NAOC's determination and efforts to reduce environmental degradation caused by its activities to the barest minimum.

1.3 Scope of Work

The work scope for the remediation project covered the following;

- Mobilization/ site recognizance visit
- Site preparation/Induction of community workers
- Clearing and removal of dead/ impacted vegetation
- Manual tilling and homogenization of impacted soil
- Application of OSE II
- Collection of soil/ surface water sample
- Construction/Breaking of windrows
- Demobilization /Reporting

CHAPTER TWO
SITE DESCRIPTION

2.1 Site description

The 10" Kwale/Akri Pipeline is located in Agwe Etiti, Ndukwa East Local Government Area of Delta State with GPS coordinates N 05.641790 and E 006.61565. Agwe Etiti is bound to the west by Keonokpo community, to the east by Odugri community and north east by Ishukwa community. The major sources of livelihood of the Agwe Etiti people are farming and fishing.

The site is primarily used for the NAOC ROW and is surrounded by grasses and farmlands. There is a pond on the western part of the spill point. The distance from the site to the nearest human habitation is about 500m with the predominant soil type being sandy soil.

Plate 2.1: Site overview

CHAPTER THREE
INITIAL ASSESSMENT

2.1 Pre-remediation sampling by Giolee Global Resources

Pre-remediation sampling was conducted sampling before the commencement of the remediation activity on 10th March 2016. Eight (8) soil samples were collected and analyzed for physicochemical, TPH, PAH, BTEX, heavy metals and microbiology with TPH being the contaminant of concern.

2.1.1 Pre-remediation Laboratory Result

Total Petroleum Hydrocarbon

Two (2) samples, KW-Top-C and KW-Bottom-C, out of the eight (8) samples collected had TPH concentrations of 8715mg/kg and 8179mg/kg respectively which were above the DPR intervention value of 5000mg/kg.

All other parameters analyzed for complied with their respective DPR limits.

CHAPTER FOUR
PROJECT EXECUTION

4.1 Project team

The project execution team for the successful execution of the 10" Kwale/Akri pipeline remediation project was made up of NAOC and Giolee personnel with the support of community labor (see Table 4.1).

Table 4.1 Project Team

Name	Company	Responsibility
Arubasa Mamoke	NAOC	Client Site Representative
Jack E.M	NAOC	Client Site Representative
Henry Iduma	NAOC	Client Site Representative
Happy Onofu	NAOC	Client Site Representative
Jonah Shekwolo	Giolee	Project Manager
Justice Barima	Giolee	Project Supervisor
Boniface Ite	Giolee	HSE Officer

4.2 Materials/Equipment

The following materials/equipment were used for the execution of this project

- Pumps and accessories
- Machetes, Rake and Fork Shovels and Spades
- Waste bags.
- OSE II Biological Enzyme (Nutrient)
- Absorbent pads
- Drums

4.3 Methodology

Remediation at the impacted site followed the LAR remedial activity, as planned in the work scope. The project commenced with the review of relevant documents such as the work execution plan, project HSE plan and site maps by relevant personnel before mobilization. These documents were approved by the relevant authorities prior to issuance of permit to work.

The following activities were carried out during the execution of the project.

4.3.1 Mobilization

Mobilization of personnel and equipment from Giolee Global Resources Limited to the site was on 8th March 2016 and the actual project work started 9th March 2016 and ended 24th March 2016. Site HSE induction was carried out by Giolee safety officer for all

personnel involved in the project. Tool box meeting was carried out daily before the commencement of work activities.

4.3.2 Site preparation

The first activity carried out during site preparation was clearing of the site. The site clearing involved cutting down and clearing vegetation and removal of dead logs on the site to facilitate easy movement.

Muster points and caution signs were also set up around the project site for the safety of personnel on site.

Plate 4.1: Site preparation

4.3.3 Tilling/homogenization

After clearing the impacted area, the soil was tilled manually and homogenized with Rakes, Fork shovels and spades. The tilling and Homogenization was carried out to break large clumps of soil into smaller lumps and promote uniform reception of the OSE II Enzyme nutrient additive.

Plate 4.2: Tilling of Impacted soil

4.3.4 Removal of free phase oil

Pockets of free phase oil was present on the site which were mopped up using absorbent pads, and followed up with the application of OSE II enzymatic nutrient.

Plate 4.3: Mopping of free phase oil with absorbent pads followed by application of OSE II

4.3.5 OSE II Enzymatic Nutrient application

The Oil Spill Eater 11 (OSE 11) was the nutrient additive used on the project. OSE II was mixed in the right proportion with water from the immediate environment. The

application of the Oil Spill Eater II was carried out after tilling and homogenization with the use of pumps and buckets.

Plate 4.4 Mixing of OSEII concentrate

Plate 4.5 Application of OSEII

4.3.6 Construction of windrows

Windrows were constructed on the entire area mapped for the remediation. Windrows were constructed to aerate contaminated soil below the surface and application of OSE II through biodegradation.

Plate 4.6 Construction of windrows followed by application of OSE II

4.3.7 Collection of samples

Samples were collected before remediation commenced, during remediation and after remediation was completed. Composite soil samples were collected from the range of 0 to 0.3m designated as top and 0.3m to 0.5m designated as bottom.

4.3.7.1 Laboratory results

The laboratory results from the samples collected during the remediation project were consistent with the results gotten from the samples analyzed before the commencement of remediation.

All but one sample had TPH concentrations which were considerably lower than the TPH concentrations from the samples collected before remediation. One sample (KW-Top-C) had a TPH concentration of 5402mg/kg which was above the DPR limit of 5000mg/kg.

4.4 Daily Log of Remediation activities

Table 4.2 presents the activities carried out during the remediation project in chronological order.

Table 4.2 Project Execution in Chronological Order

DATE	ACTIVITIES
08/03/2016	❖ Mobilization ❖ Safety briefing ❖ Site Recognizance visit
09/03/2016	❖ Safety Briefing ❖ Induction of community workers ❖ Clearing of impacted areas ❖ Tilling/homogenization of impacted soil ❖ House keeping
10/03/2016	❖ Safety Briefing ❖ Clearing of impacted area ❖ Tilling/homogenization of impacted soil ❖ Collection of soil samples ❖ House keeping
11/03/2016	❖ Safety Briefing ❖ Clearing of impacted area ❖ Tilling/homogenization of impacted soil ❖ Application of enzyme nutrient (OSE 11) ❖ Waste management
12/03/2016	❖ Safety Briefing ❖ Moistening of the soil ❖ Tilling /homogenization of impacted soil ❖ Construction of windrows ❖ General House keeping
13/03/2016	❖ Toolbox Briefing ❖ Tilling/Homogenization of soil ❖ Construction of windrows ❖ Waste management
14/03/2016	❖ Toolbox Briefing ❖ Tilling/Homogenization of soil ❖ Construction of windrows ❖ Application of Nutrient (OSE 11) ❖ Waste management
15/03/2016	❖ Safety Briefing ❖ Tilling/homogenization of impacted soil ❖ Construction of windrows ❖ House keeping
16/03/2016	❖ Safety Briefing

	❖ Clearing of impacted area ❖ Tilling/homogenization of impacted soil ❖ House keeping
17/03/2016	❖ Safety Briefing ❖ Tilling/homogenization of impacted soil ❖ House Keeping
18/03/2016	❖ Safety Briefing ❖ Tilling/homogenization of impacted soil ❖ House keeping
19/03/2016	❖ Toolbox Briefing ❖ Application of nutrient(OSE 11) ❖ Construction of windrows
20/03/2016	❖ Safety Briefing ❖ Breaking of windrows/land farming ❖ House keeping
21/03/2016	❖ Safety Briefing ❖ Breaking of windrows/land farming ❖ House keeping
22/03/2016	❖ Toolbox Briefing ❖ Breaking of windrows/land farming ❖ Collection of samples ❖ House keeping
23/03/2016	❖ General house keeping
24/03/2016	❖ Site inspection by HSE Rep ❖ Demobilization

4.5 HSE Management

HSE management on the project ensured that there were no serious incidents involving Personnel and equipment used on this project. The HSE management on this project also ensured that the site was not further polluted, and the environmental goals of the project were achieved. The HSE management strategies used for this project are discussed below;

4.5.1 PPE

Appropriate PPE was issued to all personnel and visitors with damaged PPE promptly replaced.

4.5.2 Safety inductions

Safety induction was conducted for every personnel (before the commencement of the project) and visitors on the project site. The safety induction was conducted by qualified safety personnel and covered a description of the project, expected hazards

on the work site and mitigating measures, location of muster point, use of PPE and emergency response procedures for fire and first aid.

4.5.3 Permit to work

The company site rep and the Giolee project supervisor for this project ensured that permit was validated weekly in compliance with the rule of prohibiting all site project without valid permit to work.

4.5.4 Waste management

Different types of wastes were generated during the project site. The waste generated include food waste, plastic waste, vegetative waste etc. All waste generated were temporarily stored in designated waste bins before being transported to be disposed in appropriate waste management facilities.

Plate 4.7: Safety Briefing

CHAPTER FIVE
FINAL ASSESSMENT

5.1 Post Remediation Sampling

Post remediation samples were collected after the completion of the remediation project along 10" Kwale/Akri Pipeline by Giolee Global Resources Ltd in line with the project scope of work. The samples were collected to ascertain if TPH levels had been reduced to comply with the relevant regulatory requirements.

Plate 5.1 Site after Remediation

5.2 Laboratory Results

The TPH concentration of all soil samples collected were below 10mg/kg which is indication of the success of the remediation project at the 10" Kwale/Akri Pipeline site.

The graph below shows a visual comparison of the TPH concentration of the samples collected before, during and after remediation

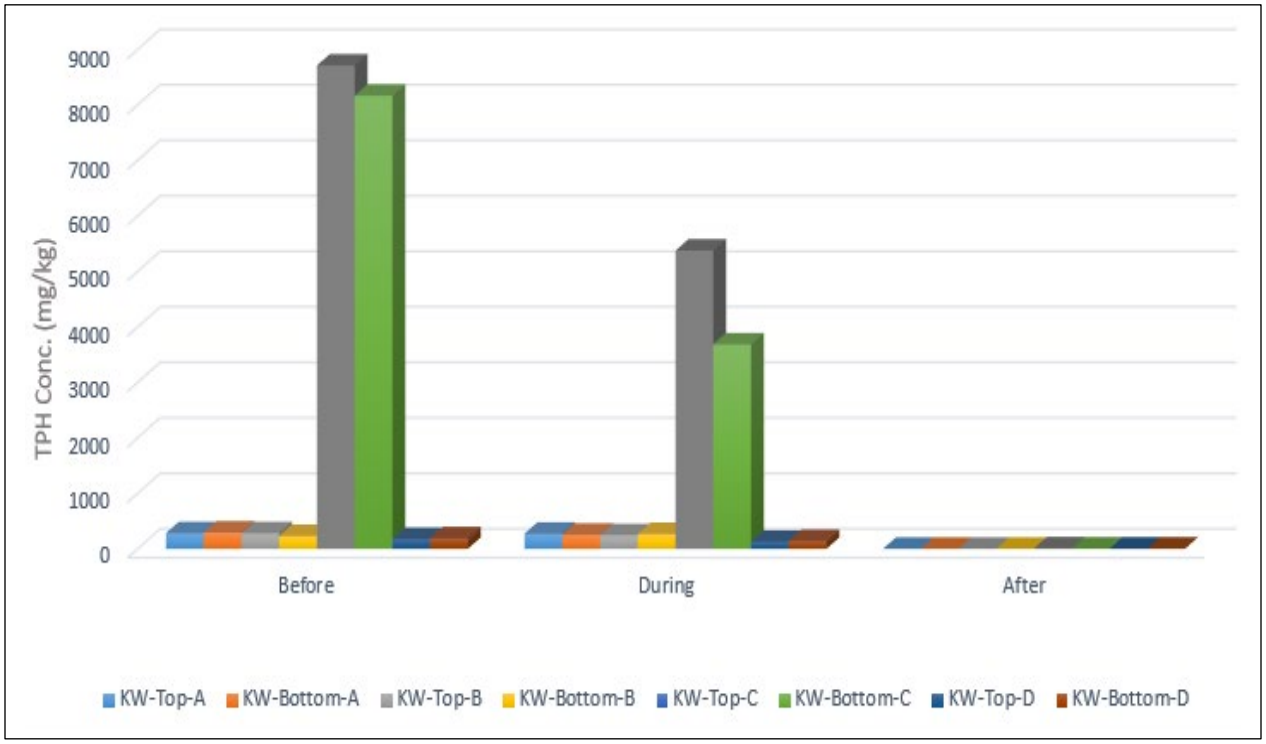

Figure 5.1: TPH concentrations before, during and after remediation

CHAPTER SIX
CONCLUSION

6.1 Conclusion

The remediation activity along 10" Kwale/Akri pipeline at Agwe Etiti was successfully carried out in line with the work scope without any accidents affecting personnel, equipment or the environment.

Samples collected before, during and after the remediation project offer further proof of the success of the project. The final TPH concentrations were all less than 10mg/kg which is considerably lower than concentrations of the same samples before the start of remediation and below the DPR intervention value of 5000mg/kg.

The first phase of the project has been completed. The second phase of monitoring the site has commenced and is expected to last for the next four to six months.

6.2 Project Challenges

The following challenges were observed during the execution of this remediation project;

- Community workers engaged for the project refused to obey orders from the project supervisors. Gentle dialogue and coercion was applied to encourage the workers and to avoid disruptions/crisis during the project.
- Community Workers occasionally refused to properly use issued PPE while working despite HSE inductions and toolbox meetings carried out. Continuous trainings/inductions were conducted for Safety defaulters and gentle dialogue was employed to increase compliance with PPE use.

APPENDIX 1: Other Site pictures

Plate 1: Site preparation

Plate 2: Tilling of Impacted soil

Plate 3: Mopping of free phase oil, and Application of OSE II

Plate 4: Application of OSEII

Plate 5: Construction of windrows followed by application of OSE II

Plate 6: Constructed windrows, followed by application of OSE II

Plate 7: Initial Soil Samples Collection

Plate 8: Sample Collection during remediation

APPENDIX 2: Pre-remediation laboratory analysis result

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SOIL

PARAMETER	Method	KW-Top-A	KW-Bottom-A	KW-Top-B	KW-Bottom-B	DPR Limit	FMENV Limit
Coordinates		N: 05.64212 E: 006.61395	N: 05.64212 E: 006.61395	N: 05.64170 E: 006.61594	N: 05.64170 E: 006.61594		
Physico-chemical							
pH	**ASTMD1293B**	5.98	5.14	5.42	5.48	**NA**	**6-9**
Electrical Conductivity, µS/cm	**ASTMD1125**	144.18	117.61	130.39	98.22	**NA**	**NA**
Anions							
Chloride, mg/kg	**APHA 4500**	31.91	24.82	28.36	17.73	**NA**	**600**
Nitrate, mg/kg	**APHA 4500**	5.38	3.36	6.05	2.02	**NA**	**NA**
Sulphate, mg/kg	**APHA 4500**	19.08	16.80	17.35	12.14	**NA**	**1.0**
Phosphate, mg/kg	**APHA 4500**	1.94	1.62	2.59	0.97	**NA**	**10**
Organics							
Total Hydrocarbon Content, mg/kg	**ASTM D3921**	290.51	299.06	289.65	240.42	**NA**	**NA**
Total Petroleum Hydrocarbon (TPH) , mg/kg	**US EPA 8015**	283.89	295.87	283.18	233.21	**5000**	**NA**
Polycyclic Aromatic Hydrocarbon (PAH) , mg/kg	**US EPA 8270**	0.05	0.02	0.04	0.07	**40**	**NA**
Heavy Metals							
Zinc, mg/kg	**API-RP45**	0.596	0.813	0.191	0.202	**140**	**NA**
Lead, mg/kg	**API-RP45**	0.424	0.424	0.424	0.576	**85**	**NA**
Nickel, mg/kg	**API-RP45**	0.157	0.157	0.157	0.138	**35**	**NA**
Cadmium, mg/kg	**API-RP45**	0.081	0.081	0.074	0.074	**NA**	**NA**
Chromium, mg/kg	**API-RP45**	<0.001	<0.001	<0.001	<0.001	**100**	**NA**

Prepared By: Lab Coordinator (Oshinaike T.)

Reviewed by QA/QC Officer (Sophia O)

Approved by: Managing Director (Lesi Maol)

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SOIL

PARAMETER	Method	KW-Top-C	KW-Bottom-C	KW-Top-D	KW-Bottom-D	DPR Limit	FMENV Limit
Coordinates		N: 05.64179 E: 006.6156	N: 05.64179 E: 006.6156	N: 05.64220 E: 006.61552	N: 05.64220 E: 006.61552		
Physico-chemical							
pH	ASTMD1293B	5.06	5.86	5.92	5.98	NA	6-9
Electrical Conductivity, µS/cm	ASTMD1125	125.84	108.05	133.48	111.42	NA	NA
Anions							
Chloride, mg/kg	APHA 4500	28.36	21.27	28.36	24.82	NA	600
Nitrate, mg/kg	APHA 4500	3.36	2.69	4.70	4.03	NA	NA
Sulphate, mg/kg	APHA 4500	15.61	16.19	19.08	13.88	NA	1.0
Phosphate, mg/kg	APHA 4500	1.62	1.29	2.26	1.62	NA	10
Organics							
Total Hydrocarbon Content, mg/kg	ASTM D3921	8715	8179	184.63	198.44	NA	NA
Total Petroleum Hydrocarbon (TPH) , mg/kg	US EPA 8015	8708	8166	179.83	190.82	5000	NA
Polycyclic Aromatic Hydrocarbon (PAH) , mg/kg	US EPA 8270	4.11	5.88	0.10	0.02	40	NA
Heavy Metals							
Zinc, mg/kg	API-RP45	0.249	0.734	0.363	0.452	140	NA
Lead, mg/kg	API-RP45	0.576	0.424	0.424	0.424	85	NA
Nickel, mg/kg	API-RP45	0.157	0.138	0.177	0.196	35	NA
Cadmium, mg/kg	API-RP45	0.096	0.096	0.103	0.096	NA	NA
Chromium, mg/kg	API-RP45	<0.001	<0.001	<0.001	<0.001	100	NA

Prepared By: Lab Coordinator (Oshinaike T.)

Reviewed by QA/QC Officer (Sophia O)

Approved by: Managing Director (Lesi Maol)

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Client: NAOC
Sample Origin/Site: 10'' KWALE / ARRI
P/L @ AGWE - ETITI
Date Sampled: 10/03/2016
Date Received: 14/03/2016

Service Request: GL/LAB/RES/171
Name of Sampler: JUSTICE BARIMA
Project Status: REMEDIATION SITE
Date of Reporting: 25/03/2016 – 05/04/2016
Sample Type: Soil

MICROBIOLOGY

PARAMETER	Method	KW-Top-A	KW-Bottom-A	KW-Top-B	KW-Bottom-B	DPR Limit	FMENV Limit
Coordinates		N: 05.64212 E: 006.61395	N: 05.64212 E: 006.61395	N: 05.64170 E: 006.61594	N: 05.64170 E: 006.61594		
Microbiology							
Heterotrophic Bacteria Count, x 10^5 CFU/g	**Pour Plate**	0.9	0.4	0.1	0.1	**NA**	**NA**
Hydrocarbon Degrading Bacteria, x 10^3 CFU/g	**Vapour Phase**	0.2	0.1	NIL	NIL	**NA**	**NA**
Heterotrophic Fungi Count, x 10^5 CFU/g	**Pour Plate**	0.3	0.2	0.1	0.1	**NA**	**NA**
Hydrocarbon Degrading Fungi, x 10^2 CFU/g	**Vapour Phase**	0.5	0.2	0.3	0.1	**NA**	**NA**

Prepared By: Lab Coordinator (Oshinaike T.)

Reviewed by QA/QC Officer (Sophia O)

Approved by: Managing Director (Lesi Maol)

Giolee
Global Resources Limited

Client: NAOC
Sample Origin/Site: 10" KWALE / ARRI
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Date Sampled: 10/03/2016
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Service Request: GL/LAB/RES/171
Name of Sampler: JUSTICE BARIMA
Project Status: REMEDIATION SITE
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Sample Type: Soil

MICROBIOLOGY

PARAMETER	Method	KW-Top-C	KW-Bottom-C	KW-Top-D	KW-Bottom-D	DPR Limit	FMENV Limit
Coordinates		N: 05.64179 E: 006.6156	N: 05.64179 E: 006.6156	N: 05.64220 E: 006.61552	N: 05.64220 E: 006.61552		
Microbiology							
Heterotrophic Bacteria Count, x 10^5 CFU/g	**Pour Plate**	0.4	0.3	1.1	0.5	NA	NA
Hydrocarbon Degrading Bacteria, x 10^5 CFU/g	**Vapour Phase**	0.1	NIL	0.3	0.1	NA	NA
Heterotrophic Fungi Count, x 10^3 CFU/g	**Pour Plate**	0.1	0.1	0.7	0.3	NA	NA
Hydrocarbon Degrading Fungi, x 10^2 CFU/g	**Vapour Phase**	0.3	0.1	0.5	0.3	NA	NA

Prepared By: Lab Coordinator (Oshinaike T.)

Reviewed by QA/QC Officer (Sophia O)

Approved by: Managing Director (Lesi Mao)

During Remediation laboratory analysis results

SOIL

PARAMETER	Method	KW-Top-A	KW-Bottom-A	KW-Top-B	KW-Bottom-B	KW-Top-C	KW-Bottom-C	KW-Top-D	KW-Bottom-D	DPR Limit	FMENV Limit
Coordinates		N: 05.64202 E: 006.61595	N: 05.64202 E: 006.61595	N: 05.64170 E: 006.61594	N: 05.64170 E: 006.61594	N: 05.64179 E: 006.61565	N: 05.64179 E: 006.61565	N: 05.64220 E: 006.61552	N: 05.64220 E: 006.61552		
Physico-chemical											
pH	ASTMD1293B	5.30	5.02	5.80	5.60	5.06	5.98	6.10	6.08	NA	6-9
Electrical Conductivity, µS/cm	ASTMD1125	138.64	121.70	140.62	117.76	146.76	139.08	131.60	141.00	NA	NA
Anions											
Chloride, mg/kg	APHA 4500	28.36	24.82	31.91	24.82	35.45	28.36	24.82	28.36	NA	600
Nitrate, mg/kg	APHA 4500	2.96	2.64	1.98	1.64	2.64	2.31	3.30	2.64	NA	NA
Sulphate, mg/kg	APHA 4500	22.94	20.64	16.06	14.33	17.78	23.51	17.78	25.23	NA	1.0
Phosphate, mg/kg	APHA 4500	1.76	1.44	1.28	1.12	1.60	1.44	1.92	1.28	NA	10
Organics											
Total Hydrocarbon Content, mg/kg	ASTM D3921	280.06	259.11	250.46	271.22	5402	3708	131.22	144.88	NA	NA
Total Petroleum Hydrocarbon (TPH), mg/kg	US EPA 8015	273.93	254.51	248.94	267.70	5375	3685	128.73	143.69	5000	NA
Polycyclic Aromatic Hydrocarbon (PAH), mg/kg	US EPA 8270	0.01	0.05	0.02	0.04	2.21	3.34	0.09	0.11	40	NA
Heavy Metals											
Zinc, mg/kg	API-RP45	1.253	0.315	0.175	0.437	0.281	0.415	0.275	0.253	140	NA
Lead, mg/kg	API-RP45	0.217	0.362	0.217	0.217	0.567	0.507	0.408	0.362	85	NA
Nickel, mg/kg	API-RP45	0.056	0.113	0.113	0.094	0.151	0.170	0.132	0.113	35	NA
Cadmium, mg/kg	API-RP45	0.057	0.085	0.085	0.092	0.090	0.096	0.099	0.078	NA	NA
Chromium, mg/kg	API-RP45	<0.001	<0.001	<0.001	<0.001	0.056	0.025	0.058	0.038	100	NA

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Client: NAOC
Sample Origin/Site: 10" KWALE / ARRI
P/L @ AGWE - ETITI
Date Sampled: 22/03/2016
Date Received: 29/03/2016

Service Request: GL/LAB/RES/178
Name of Sampler: JUSTICE BARIMA
Project Status: REMEDIATION SITE
Date of Reporting: 12/04/2016
Sample Type: Soil

MICROBIOLOGY

PARAMETER	Method	KW-Top-A	KW-Bottom-A	KW-Top-B	KW-Bottom-B	KW- Top-C	KW-Bottom-C	KW- Top-D	KW-Bottom-D	DPR Limit	FMENV Limit
Coordinates		N: 05.64202 E: 006.61595	N: 05.64202 E: 006.61595	N: 05.64170 E: 006.61594	N: 05.64170 E: 006.61594	N: 05.64179 E: 006.61565	N: 05.64179 E: 006.61565	N: 05.64220 E: 006.61552	N: 05.64220 E: 006.61552		
Microbiology											
Heterotrophic Bacteria Count, x 10^5 CFU/g	Pour Platz	1.5	0.6	0.2	0.1	2.9	1.6	1.4	1.0	NA	NA
Hydrocarbon Degrading Bacteria, x 10^3 CFU/g	Vapour Phase	0.3	0.1	0.2	0.1	0.5	0.3	0.5	0.3	NA	NA
Heterotrophic Fungi Count, x 10^4 CFU/g	Pour Platz	0.6	0.3	0.2	0.1	0.9	0.5	0.6	0.3	NA	NA
Hydrocarbon Degrading Fungi, x 10^2 CFU/g	Vapour Phase	0.9	0.4	0.7	0.3	0.7	0.3	0.8	0.5	NA	NA

Prepared By: Lab Coordinator (Oshinaike T.)

Reviewed by QA/QC Officer (Sophia O)

Approved by: Managing Director (Lesi Maol)

Post Remediation laboratory analysis results

GIOLEE GLOBAL RESOURCES LTD.

Environmental Consultancy Services

No.18 Uyo Street Rumuomasi, Port Harcourt, Rivers State, Nigeria

E-mail: gioleeglobal@yahoo.com, info@giolee.com, www.giolee.com Tel: +234 (0)8030688362, (0) 7031513161

Service Request: GL/LAB/RES/472
Client: NAOC (AGIP)
Sample Origin/Site: 10" Akri / Kwale P/L @ Agwe Etiti
Project: Remediation

Date Sampled: 17/02/2017
Date Received: 20/02/2017
Sample Type: Soil and Water
Date of Reporting: 15/03/2017

Certificate of Analysis

Enclosed are the results of the sample(s) submitted to our laboratory on the 20th of February, 2017. For your reference, these analysis have been assigned our service request number as stated above and Field ID KW SS1 TOP A, KW SS1 BOTTOM A, KW SS2 TOP B, KW SS2 BOTTOM B, KW SS3 TOP C, KW SS3 BOTTOM C, KW SS4 TOP D, KW SS4 BOTTOM D, KW – WS1, KW – WS2, KW – WS3 and KW – WS4. All analysis were performed according to our laboratory quality assurance program. The test met requirements of Department of Petroleum Resources (DPR), National Oil Spill Detection Response Agency (NOSDRA) and Federal Ministry of Environment (FMEnv).

All results are intended to be considered in their entirety and Giolee Global Resources Laboratory (GGRL) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact us if you have any concern. Our phone numbers are 08036698392, 08034223692. You may also contact us via email at charles.ntor@giolee.com and neeneebari.g@giolee.com.

Respectfully submitted,

Giolee Global Resources Laboratory
Nigeria

Charles Ntor
Environment Manager

Giolee
Global Resources Limited

Service Request: GL/LAB/RES/472
Client: NAOC (AGIP)
Sample Origin/Site: 10" Akri / Kwale P/L @ Agwe Ebiti
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Date Sampled: 17/02/2017
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CASE NARRATIVE

Sample Receipt

Eight (8) soil and four (4) water samples were received for analysis at Giolee Laboratory on the 20th of February, 2017. The samples were received in good condition with a signed chain of custody form. Samples are refrigerated at ≤4°C upon receipt at the laboratory.

State Certifications, Accreditations and Licenses

Agency	Number	Expiry Date
Department of Petroleum Resources	DPR/OGISP/17/5306601/N69178	16/01/2018
Federal Ministry of Environment	FMENV/EA/ES&M/626/1/78	16/09/2019
National Oil Spill detection and Response Agency (NOSDRA)	305	30/06/2017
International Organization for Standardization	NIS ISO 9001:2015/0000458	19/01/2020

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SOIL

PARAMETER	Method	KW-SS1 TOP A	KW-SS1 Bottom A	KW-SS2 TOP B	KW-SS2 Bottom B	KW-SS3 TOP C	KW-SS3 Bottom C	KW-SS4 TOP D	KW-SS4 Bottom D	DPR Limit	FMENV Limit
Coordinates		N 5.64208 E 6.615500	N 5.64208 E 6.615500	N 5.64209 E 6.61530	N 5.64209 E 6.61530	N 5.641908 E 6.615332	N 5.641908 E 6.615332	N 5.641753 E 6.615510	N 5.641753 E 6.615510		
Physico-chemical											
pH	ASTMD1293B	5.10	5.54	5.54	5.48	5.65	5.01	5.53	5.75	NA	6-9
Electrical Conductivity, µS/cm	ASTMD1125	64.4	65.3	49.5	77.9	77.5	68.7	69.6	67.3	NA	NA
Anions											
Chloride, mg/kg	APHA 4500	16.31	16.31	7.09	18.43	18.43	12.76	12.76	11.34	NA	600
Nitrate, mg/kg	APHA 4500	2.88	2.56	1.60	2.24	3.51	1.92	3.20	2.568	NA	NA
Organics											
Total Hydrocarbon Content, mg/kg	ASTM D3921	1.87	1.69	2.14	1.09	10.28	8.44	6.35	7.09	NA	NA
Total Petroleum Hydrocarbon (TPH) , mg/kg	US EPA 8015	1.20	1.05	1.21	0.44	9.97	7.08	5.26	5.79	5000	NA
Polycyclic Aromatic Hydrocarbon (PAH), mg/kg	US EPA 8270	0.70	0.17	0.05	<0.01	0.55	0.60	0.03	0.03	40	NA
Heavy Metals											
Zinc, mg/kg	API-RP45	0.009	0.011	0.021	0.017	0.015	0.019	0.013	0.011	140	NA
Lead, mg/kg	API-RP45	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	85	NA
Nickel, mg/kg	API-RP45	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	35	NA
Cadmium, mg/kg	API-RP45	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	NA	NA
Chromium, mg/kg	API-RP45	0.003	0.004	0.005	0.002	0.005	0.003	0.002	0.003	100	NA

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PARAMETER	Method	KW-SS1 TOP A	KW-SS1 Bottom A	KW-SS2-TOP B	KW-SS2 Bottom B	KW-SS1-TOP C	KW-SS1 Bottom C	KW-SS1-TOP D	KW-SS1 Bottom D	DPR Limit	FMENV Limit
Coordinates		N 5.64208 E 6.615500	N 5.64208 E 6.615500	N 5.64209 E 6.61530	N 5.64209 E 6.61530	N 5.641908 E 6.615332	N 5.641908 E 6.615332	N 5.641753 E 6.615510	N 5.641753 E 6.615510		
Microbiology											
Heterotrophic Bacteria Count, x 10^5 CFU/g	Pour Plate	1.0	0.6	1.7	0.5	2.1	0.8	0.8	0.2	NA	NA
Hydrocarbon Degrading Bacteria, x 10^3 CFU/g	Vapour Phase	0.1	0.1	0.3	0.1	0.3	0.1	0.1	0.1	NA	NA
Heteratrophic Fungi Count, x 10^4 CFU/g	Pour Plate	0.2	0.1	0.2	0.1	0.4	0.2	0.2	0.1	NA	NA
Hydrocarbon Degrading Fungi, x 10^2 CFU/g	Vapour Phase	0.2	0.1	0.3	0.2	0.4	0.1	0.1	0.1	NA	NA

Prepared By: Lab Coordinator (Oshinaike T.)

Reviewed by QA/QC Officer (Ogan Josephine)

Approved by: Managing Director (Lesi Maoi)

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Global Resources Limited

Service Request: GL/LAB/RES/472
Client: NAOC (AGIP)
Sample Origin/Site: 10" Akri / Kwale P/L @ Agwe Etiti
Project: Remediation

Date Sampled: 17/02/2017
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Sample Type: Soil and Water
Date of Reporting: 15/03/2017

WATER

PARAMETER	Method	KW-SW1	KW-SW2	KW-SW3	KW-SW4	DPR Limit	FMENV Limit
Coordinates		N 5.642462 E 6.615650	N 5.641923 E 6.616185	N 5.641420 E 6.616384	N 5.64123 E 6.61353		
Physico-chemical							
pH	ASTMD1293B	6.04	6.28	6.46	6.48	6.5-9.2	6-9
Electrical Conductivity, µS/cm	ASTMD1125	130	58	59.2	57.7	NA	NA
Total Dissolved Solids, mg/l	ASTMD1968	69	31	31	31	2000	2000
Total Suspended Solids, mg/l	ASTMD1968	16	27	24	27	50	30
Turbidity, NTU	APHA 2130	10	18	16	18	NA	NA
Dissolved Oxygen, mg/l	APHA 4500	4.75	4.72	4.34	4.0	NA	NA
Biochemical Oxygen Demand, mg/l	APHA 5210	2.8	2.3	2.5	2.1	NA	30
Chemical Oxygen Demand, mg/l	APHA 5220	4.38	3.53	3.53	4.38	NA	NA
Anions							
Chloride, mg/l	APHA 4500	43.6	19.5	19.85	19.14	600	600
Nitrate, mg/l	APHA 4500	0.69	0.79	0.87	0.98	NA	NA
Organics							
Total Hydrocarbon Content, mg/l	ASTM D3921	0.09	0.10	0.07	0.08	0.01	0.01
Total Petroleum Hydrocarbon (TPH) , mg/l	US EPA 8015	0.07	0.07	0.05	0.06	NA	NA
Polycyclic Aromatic Hydrocarbon (PAH) , mg/l	US EPA 8270	<0.01	<0.01	<0.01	<0.01	NA	NA
Heavy Metals							
Zinc, mg/l	API-RP45	<0.005	<0.005	<0.005	<0.005	15	1
Lead, mg/l	API-RP45	<0.002	<0.002	<0.002	<0.002	0.05	1
Nickel, mg/l	API-RP45	<0.008	<0.008	<0.008	<0.008	NA	1
Cadmium, mg/l	API-RP45	<0.001	<0.001	<0.001	<0.001	NA	1
Chromium, mg/l	API-RP45	<0.001	<0.001	<0.001	<0.001	NA	0.3

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PARAMETER	Method	KW-SW1	KW-SW2	KW-SW3	KW-SW4	DPR Limit	FMENV Limit
Coordinates							
Microbiology							
Heterotrophic Bacteria Count, x 10^3 CFU/ml	Pour Plate	0.2	0.1	0.4	0.1	NA	NA
Hydrocarbon Degrading Bacteria, x 10^2 CFU/ml	Vapour Phase	NIL	NIL	0.1	NIL	NA	NA
Heterotrophic Fungi Count, x 10^2 CFU/ml	Pour Plate	NIL	0.1	0.1	NIL	NA	NA
Hydrocarbon Degrading Fungi, x 10^1 CFU/ml	Vapour Phase	NIL	NIL	NIL	NIL	NA	NA

Prepared By: Lab Coordinator (Oshinaike T.)

Reviewed by QA/QC Officer (Ogan Josephine)

Approved by: Managing Director (Lesi Maol)

APPENDIX 5: Community Certification

AGWETITI COMMUNITY

Ndokwa East L.G.A., Delta State

0803497471 or 08050341405

Our Ref: .....

Your Ref: .....

Date: 24th March 2016

The Environment Manager,
Nigeria Agip Oil Company,
Mile 4, Rumueme,
Port Harcourt.

Through
The HSE Cordinator,
Kwale Gas Plant

Sir,

LETTER OF JOB COMPLETION

I write to certify that, the remediation work on 10inch Kwale/Akri Pipeline at Agwe –Etiti with spill reference nos 2014/LAR/051/181 & 2014/LAR/030/103 and 2014/LAR/147/553, was carried out by GIOLEE GLOBAL RESOURCES LTD. Successfully in accordance with NAOC standard and specification.

On this note of satisfactory job completion, I hereby recommend for payment due her.

Thanking you for your utmost consideration.

CHIEF NWAMDI OLISA
Agwe Etiti Community
N.E.L.G.A Delta State.