MINISTRY OF PETROLEUM RESOURCES

DEPARTMENT OF PETROLEUM RESOURCES

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Ref. No: PI/SE/7132/Vol.47

Date: 2nd July 2012

The Managing Director
MSL Oilfield Services Ltd
Unit 14
Brickfield Trading Estate
Brickfield Lane
Chandlers Ford
Hants SO534 DP
United Kingdom

Dear Sir,

APPROVAL TO USE MPCD SKIPPER INDUSTRY 95 FOR OPERATIONS IN THE OIL AND GAS INDUSTRY IN NIGERIA

We refer to the application dated 14th February 2012 in respect of the above submitted by Swisscon Oil and Gas Nig Ltd and are pleased to inform you of the acceptance of the technical products data including the MSDS submitted on the chemical, *MPCD SKIPPER INDUSTRY 95*, as well as the result of the acute toxicity test carried out under Nigerian environmental conditions.

2. Consequently, we wish to convey to you, this Department's **Approval** for the use of *MPCD SKIPPER INDUSTRY 95* in the Nigerian oil and gas industry. This approval is to afford you the opportunity to use the chemical for the purpose intended, as a Remediation/Oil Spill Cleaning product. Also note that this approval is subject to periodic review, as deemed necessary by this Department.

3. Please note that the use of *MPCD SKIPPER INDUSTRY 95* shall be governed by the relevant regulations as contained in the Environmental Acts/Laws of Nigeria as well as the provisions of the Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (EGASPIN, 2002). This approval notwithstanding, the user of chemical shall not be exonerated from any damage done to the environment on account of the use of this chemical.

4. Furthermore, any change in the composition or reformation of the chemical, affecting the data submitted, should be promptly communicated to the Director of Petroleum Resources for the purpose of re-certification, as such changes automatically render this approval invalid.

Yours faithfully,

Uto Iheukwumere
For: Director of Petroleum Resources

FINAL REPORT ON MPCD APPLICATION TRIAL PROJECT

AT

B-DERE PILOT PROJECT SITE

SUBMITTED BY:

SWISSCON OIL&GAS SERVICES

1.0 PROJECT IDENTIFICATION

PROJECT TITLE	PRODUCT PILOT TEST REMEDIATION OF CONTAMINATED LAND
CONTRACTOR	SWISSCON OIL SERVICES LTD
PRODUCT NAME	MOLECULAR POTENTIALLY CHAIN DISINTEGRATOR (MPCD)
CLIENT	SPDC
PROJECT START DATE	OCTOBER ,2013
PROJECT END DATE	MARCH, 2014

Prepared by:	***Reviewed by:***	***Authorized by:***
Ezekiel I	***Name: Tonye Fubara***	***Name: Chief Paxy Elekima***
Project Supervisor	***Business Development Mgr.***	***Managing Director***
Sign:	***Sign:***	***Sign***
Date:	***Date:***	***Date:***

2.0 Table of content

3.0 INTRODUCTION

The Niger Delta region has a considerable legacy of land contamination. Such land may be remediated in response to various drivers. For example, landowners may wish for the lands to be remediated so as to embark on their agricultural practices, or there may be direct regulatory requirement to remediate.

Remediation of contaminated land can be an expensive and technically challenging process. The Industry has developed a range of different remediation techniques to address differing conditions on each site.

In the past, the contaminated land sector has tended to rely primarily on heavy engineering solutions such as the Thermal Desorption Units (TDU).

These techniques usually offer relatively quick-fix solutions which can be very expensive and have high environmental and social impacts.

The industry is looking at ways to improve remediation working practices that will rely less on this technology but a much improved working practices are tied up with the concept of sustainability and environmental friendliness.

This Pilot Test project therefore, seeks to provide that alternative technology in the use of Molecular Chain Disintegrator (MPCD) that is both environmental friendly, sustainable and cost effective.

4.0 Test project Objectives

The overall objective of this trial project is to demonstrate the effectiveness of MPCD product as an additive amendment in the bio-remediation of petroleum hydrocarbon contaminated land.

5.0 Technology Name

Enhanced bioremediation using MPCD

5.1 Technology description:

The MPCD is a hydrocarbon disgregant. On its application the hydrocarbon chain is broken down more available for rapid breakdown by bacteria. The process of application involves dilution of the concentrate with water on a MPCD: Water ratio 1:100. The solution is then applied evenly to the impacted

soil or water using a spray gun or spate pump. The soil is then turned severally for aeration and temperature conditioning for optimal performance..

6.0 Product name/Information

6.1.0 MPCD (Molecular Potentially Chain Disintegrator)

The MPCD is a non-flammable, biodegradable dispersant based on a dilution of surfactants in water, sodium bicarbonate and sodium metasilicate.

MPCD is an aqueous solution, red-pink, presenting a density slightly heavier than water. This characteristic requires an initial agitation of the product to dissolve in water.

The oil spill dispersant is applied in the field by means of a strong spraying apparatus, using a standard automatic dosing machine to disperse the adequate ratio water/dispersant. The dispersant can be dissolved and used indistinctly in fresh and sea water.

The MPCD is environmentally safe for its application in presence of field crews. It is also safe for aquatic fowl, marine mammals and sub aquatic species in general.

6.1.2 Remediation Additive

MPCD formulation solutions are modified to meet different global environmental requirements. MPCD is environmentally safe and its end products are also environmentally friendly. The Co^2 and H_2O are reused by the fungi and bacteria in the soil while the biomass serves as nutrient in the soil.

6.1.3 Non - Flammable:

No flash or fire point as determined by the standard laboratory closed cup method (ASTM D56).

6.1.4 Chemical Composition

Environmentally conscious in that the product contains no highly toxic solvents and is classified as readily/rapidly biodegradable.

- Sodium Carbonate
- Sodium Metasilicate
- Alcohol Ethoxylate
- Dye Water

7.0 Scope of work

The scope of work for the trial project included the treatment of Petroleum hydrocarbon contaminated site using Molecular Potential Chain Disintegrator (MPCD) amendment.

The contaminated portion of land has an approximate size of 75m by 30m, and an approximate depth of vertical contamination estimated to be about 5m.

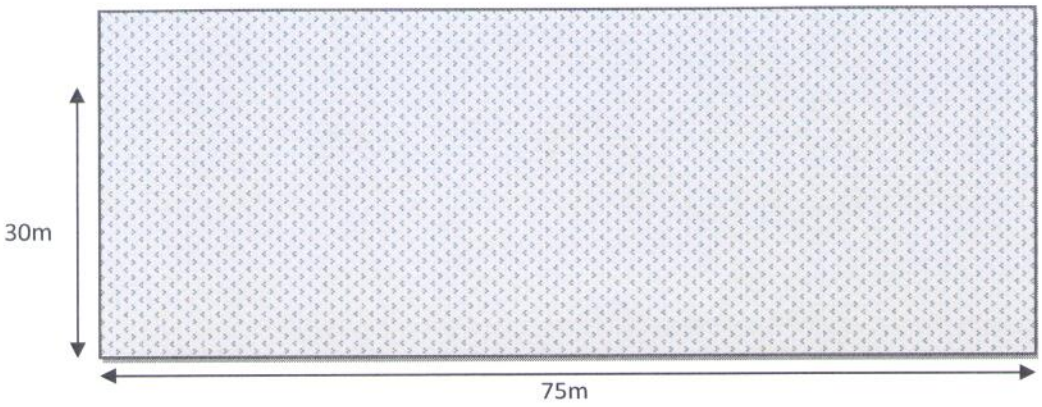


Fig 1: Site layout

7.1 Estimated volume of treatable material

The estimated volume of contaminated soil material to be treated by the technology assuming a uniform or homogenous impact of the total area of trial portion is about 11,250 m^3

8.0 Project Design

The project execution design was a combination of in-situ and ex-situ treatment of contaminated portion. This was because the portion of test was not uniformly contaminated at the same level of contaminant concentration.

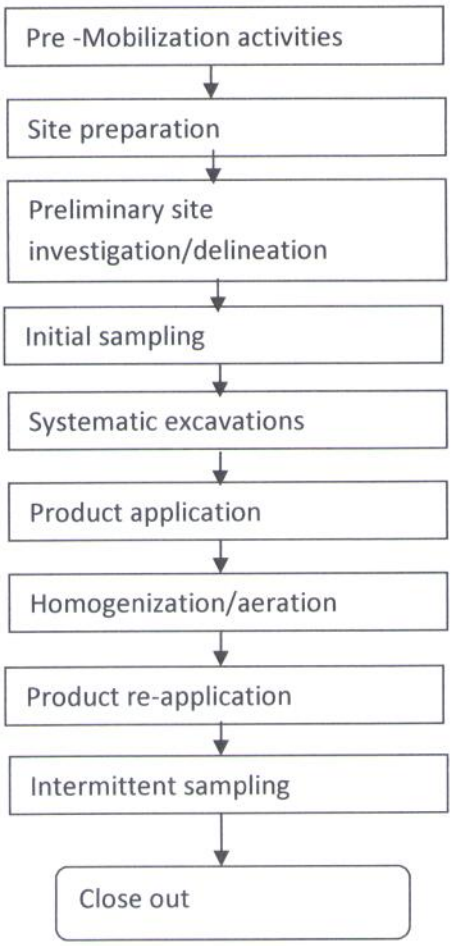
8.1.0 In-situ Treatment

The in-situ treatment was applied to areas delineated to be less heavily contaminated.

8.1.1 Ex-situ Treatment

Ex-situ treatment was applied to areas delineated as HOT Spots (heavily contaminated)

8.2 Process flowchart



Activity	Duration in weeks										
	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10-14	W14-20
Pre – mobilization activities and site preparation											
Initial sampling											
Preliminary siteinvestigation/delineation											
Systematic excavations											
1st product application											
Land farming /homogenization											
2nd product application											
Land farming /homogenization											
3rd product application											
Land farming /homogenization											
Second sample collection											
Backfilling of pits											
Site monitoring /Housekeping											
Final sampling and clos-out											

Fig 2: Activity time schedule

9.0 Execution Procedure

9.1 Pre mobilization activity

Prior to the commencement of work on site, the client and the community land owners did a lot of consultation in the effort to acquire a freedom to operate FTO agreement form the land owners so as to ensure a smooth execution of the trial project.

The fallout of such several meeting was:

- Payment of Community homage
- Granting of FTO
- Employment of community labour on the project

9.2 THE TERMS OF AGREEMENT REACHED BETWEEN THE PARTIES WERE AS FOLLOWS.

- (FTO) freedom to operate with the Communities was signed under the supervision of SPDC in the Month of September 2013.
- The sum N30,000 as Community Homage was paid to both Communities
- The client (Shell Petroleum Development Company Ltd), directed that Swisscon Oil & Gas Services should employ four (4) Community labourer between B-DERE and GIO Communities.
- Two security personnel were to be employed one each from the two communitities.

Plate 1: Site after bush clearing

10.2.0 Equipment mobilization

Heavy equipment and other non-heavy equipment were mobilized to site on 12/Oct 2013.

Among these included the following on the list:

1. Heavy duty excavator
2. Pressure washer pump
3. Water pump with hoses
4. Water storage containers (GP Tanks)

10.2.1 Site delineation /Trial pits

Site delineation was the next activity after the bush clearing. The delineation of the site was aimed at categorizing the site into heavy contamination, medium contamination and light contamination according to the level of contaminant s concentration across the entire site.

The method employed in the delineation was digging of trial pits which helped to reveal the vertical profile of the soil and other relevant site contamination information.

This trial pits helped to give visual information such as:

- Visual levels of vertical contamination at each point or area
- Presence of Hydrocarbon odour
- Soil profile
- Depth of observable contamination

10.2.2 Trial pits formation plan

The trial pits were strategically distributed across the site so as to give a fair representation of the site condition as shown on the sketch below.

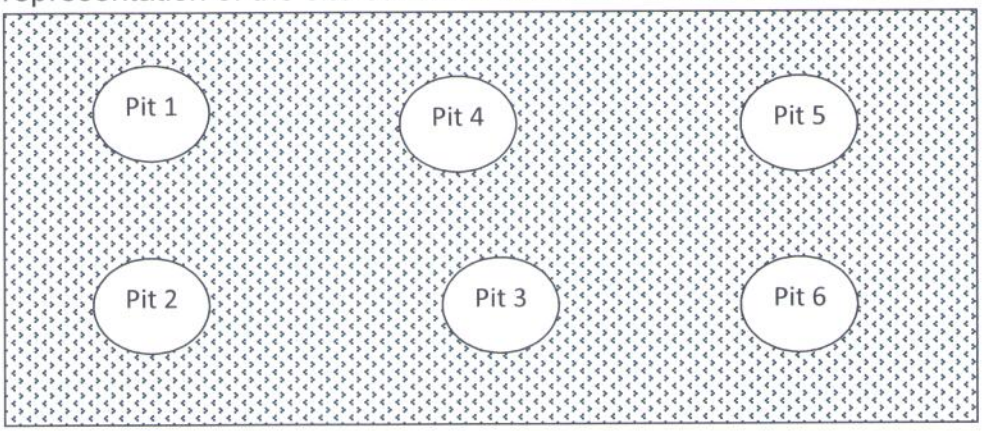


Fig 4: Trial pits locations

Profile	Trial pits position					
	1	2	3	4	5	6
Depth of impact	2 m	2.5m	3.5	2.5m	3.5	4m
Soil colour	Brownish	Dark	dark	brownish	Dark brown	dark
Odour	Nil	yes	yes	yes	yes	yes
Visual impact	Not visible At 2m depth	Visible beyond 2m depth	Visible beyond 2m	Not visible At 2.5m	Visible beyond 2m	Visible beyond 3m depth

			depth	depth	depth	

Fig 5: **Trial pits soil profile**

Plate 2a: View if trial pits during site delineation

Plate 2b: View if trial pits during site delineation

10.3.0 Hot spot areas

The hot spots areas were areas that had the heaviest contaminations. These areas were identified after the formation of the trial pit. These were areas that revealed deeper levels of vertical contamination of about three meters and

beyond. The hot spot areas were also identified to be areas where the cooking pits were located. The cooking pits were pits dug by the local illegal refiners of crude oil. These locations had the heaviest visually observed contamination. These areas also had some carbonized materials which was burnt soils mixed with crude oil.

About four areas were identified as hot spots.

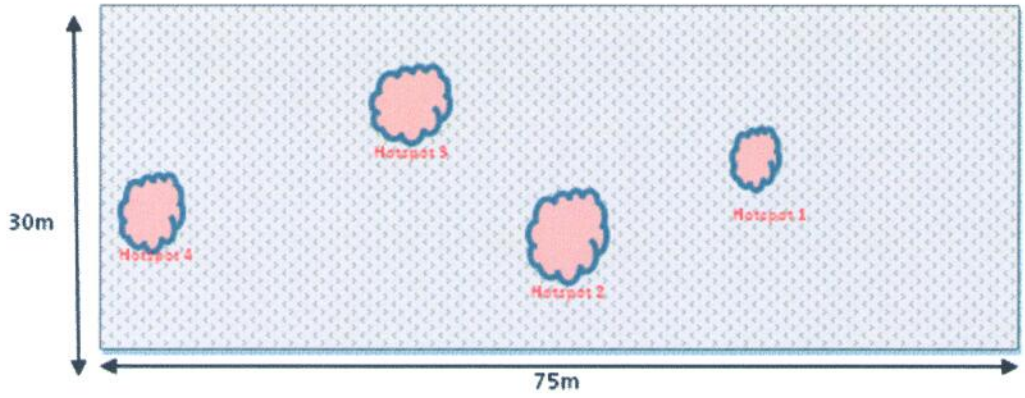


Fig 6: Hot spot locations

10.3.1 Hot Spot Excavation/Treatment

The hot spots were treated using the ex-situ bioremediation technique. The identified spots were dug out to remove all contaminated soil within the spot. The excavated heap was piled on the available areas for treatment. This heap was spread out to a continent level of approximately 0.5 – 0.8 m height. This spreading was to allow for easy nutrient application and subsequent aeration with the heavy equipment.

Volume of excavated materials

The volume of excavated material from the hot spot pits is a indicated:

Hot spot 1

Length of pit 25m

Breadth of pit 20 m

Depth 5m

Volume of material = 2,500m^3

Hot spot 2

Length of pit 20m

Breadth of pit 15m

Depth 5m

Volume of material = 1,500m^3

Hot spot 3

Length of pit 10m

Breadth of pit 5 m

Depth 3m

Volume of material = 150m^3

Hot spot 4

Length of pit 5m

Breadth of pit 3 m

Depth 3m

Volume of material = $45m^3$

Approximate Total volume of material = 4,195 m^3

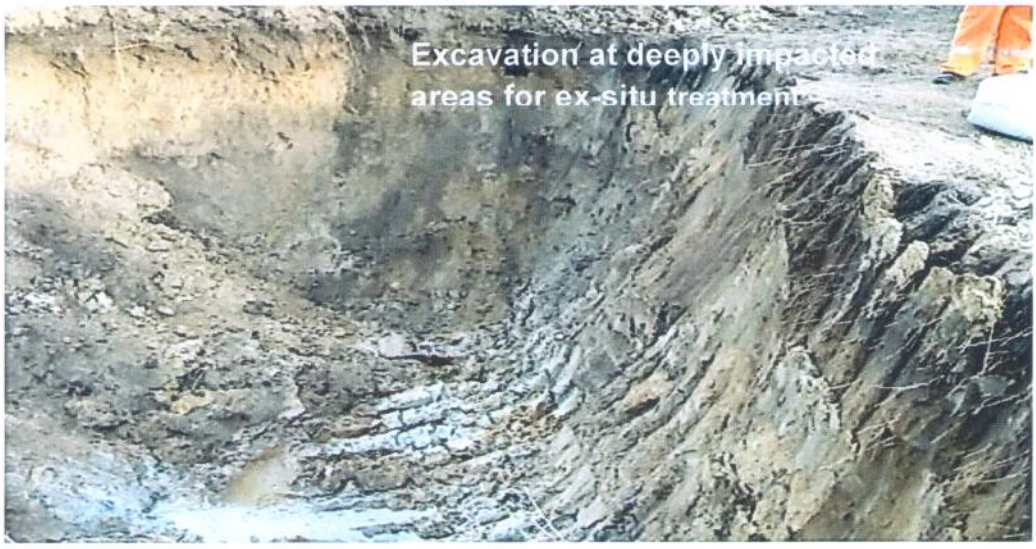


Plate 3a: Excavation process in Hot spot areas

Plate 3b: Excavation process in Hot spot areas

Plate 4: Free phase oil in the excavated pits

Plate 5: Free phase oil collected over water after excavation

11.0 Free phase crude oil Recovery

During the excavation of the hot spot areas, free phase oil was discovered in the pits due to capillary action.

The Initial action upon this development was to sort for response material assistance such as sorbent sheets and booms from the client, but unfortunately, this was not granted.

11.1 Manual recovery

The alternative means was to resolve to manual recovery by engaging the community labour. Access to the pit was created by the excavator by slopping the pit.

The recovered oil was transported by fifty litters jerry cans to designated storage facility located at the military camp for onward evacuation by the client.

Plate 5: Picture of Excavated pits after manual recovery of oil

12.0 In-situ General Treatment

The remainder portion of the site after the identification of the hot spot areas was treated in-situ. The site was subdivided into portions and a systematic excavation by the use of heavy duty excavator was employed.

Each sub-divided portion was dug up to a depth of about 2 meters that is, the excavator dug up contaminated soil at the same spot vertically, and two buckets down to remove contaminated soil. The removed soil was placed on untilled areas, homogenised and treated with MPCD amendment and the dug up pit was backfilled with treated materials. The process was repeated for all the areas under treatment until the site was uniformly tilled and treated.

Owing to the loose nature of the soil and the process of homogenization, the mix when applied was able to gain a high percentage of penetration into the soil.

Plate 6: In –situ Homogenization process

13.0 MPCD Application Method

Equipment required.

The equipment used for the product application included

1. Diesel powered pressure washer rated at 2500 psi with a flow rate of 15-20 lt/min.
2. Water storage facility to allow mixing of product/water.
3. 2'' water pumps with hoses.

Product preparation

Product may be supplied as super concentrate or pre-mix ratio. If product is supplied as super concentrate, then the product should be pre mixed with water to produce 1% MPCD solution

13.1 Mode of Application

The pressure washer was used for the application of MPCD on the treatment areas. The Pressure washer sprays the product "like rain" allowing the Product to soak in completely to the soil. The nozzle of the pressure washer was aimed at sufficient distance away from the soil to prevent erosion of the soil.

Plate 7: Product application process

Plate 7 b: Product application process

14.0 Land Farming/Homogenization

The soil under reclamation was land farmed successively with heavy equipment after each round of MPCD application to allow for proper aeration and hence, biodegradation process.

Plate 8: Soil tilling process

15.0 Backfilling of ecavated pits

The backfilling of ecavated pits was undertaken after the recovery of the free phase oil and treatment of the excavated soil. The contaminated soil removed from the pits were spread and treated with MPCD product and the treated soil was used in the backfilling of the pits.

After the backfilling of the pits, the pit areas were again landfarmed and MPCD re-applied on the areas.

Plate 9: Excavator Backfilling pits after recovery of free oil.

Plate 10: Site after treatment

16.0 Waste generation and Disposal

Various wastes were generated on site. This waste was handled differently according to the waste stream type.

Partially carbonised Material

This waste stream was found on site mostly at areas that were used as cooking pits by the illegal refineries. It was a caked material of soil mixed with crude oil and partially burnt. This type of material was broken to smaller aggregates and bulked, homogenised with soil and treated with the product.

Plate11: View of Carbonised materials at the site before start of remediation

Carbonised inert Material

The carbonised inert materials were bagged and disposed at designated location for onward carting away by client to disposal location.

Tree stumps

Another type of waste was uprooted tree stumps. The uprooted tree stumps were removed from site and heaped at designated location outside the treatment areas.

Used water containers

Used water containers such as water bottles, water sachets were collected in waste bags and disposed off site.

HSE

Prior to the commencement of work on site, safety induction was conducted on site for all workers. The nature of the job was explained to the workers,

and the inherent hazards were identified and preventive measures discussed and materials provided.

PPEs

The list of PPEs provided for the work included:

- Cover alls
- Safety Boots
- Had Hats
- Hand gloves
- Nose masks

Tools Box Briefing

Tools box briefing was conducted each morning by the safety officer before work commenced for the day. Workers were reminded of the need to work safe and observe all safety precautions on their work places.

Access Control

All workers were made to enter their names in the attendance register each morning.

All visitors to site were recorded on the visitor note book.

Site Security

As a security measure, site security personnel were employed to keep watch of work materials on site. Key community members were also appointed as lead foremen in charge of controlling the work force.

Plate 12: Work force at the site

Results and discussion

Soil Sample Point 1(1m)	N: 04°41'52.8 / E: 007°14'38.0
Soil Sample Point 2 (1m)	N: 04°41'52.5 / E: 007°14'37.9
Soil sample point 3 (1m)	: N: 04°41'51 7 / E: 007°14'38.6
Soil sample point 4 (1m)	N: 04°41'52.2 / E: 007°14'38.8

INITIAL CONTAMINANT CONCENTRATIONS

Parameter	***DPR Target Limit***	***DPR Intervention Value***	***SS1 (1m)***	***SS2 (1m)***	***SS 3(1m)***	***SS4 (1m)***
TPH, mg/kg	*50*	*5000*	20,339.60	35,283.20	11,404.82	18,153.36
PAH, mg/kg	*1.0*	*40*	**1,498.63**	**630.10**	**829.03**	**0.28**
BTEX, mg/kg	*0.05*	*206*	BDL	BDL	BDL	632.80

FINAL CONTAMINAT CONCENTRATIONS

Parameter	***DPR Target Limit***	***DPR Intervention Value***	***SS1 (1m)***	***SS2 (1m)***	***SS 3(1m)***	***SS4 (1m)***
TPH, mg/kg	*50*	*5000*	*1,576*	*877*	*433*	*1,056*
PAH, mg/kg	*1.0*	*40*	*BDL*	*BDL*	*BDL*	*BDL*
BTEX, mg/kg	*0.05*	*206*	*BDL*	*BDL*	*BDL*	*BDL*

3.1 Discussion

Total Petroleum Hydrocarbon

From Results shown above, there is sharp reduction in contaminant levels before and after remediation with MPCD. From TPH values ranges between 11,404.82-*35,283.2 mg/kg before start of remediation work to values of 433- 1,576mg/kg and the end of the remediation process. PAH reduction is from 0.28-1,498.63 mg/kg to Below detection levels at the end of remediation works. The BTEX levels were below detection levels even at the start of the remediation probably because of the fire effect before start of work and remained so after the work. This is an indication that MPCD is an effective product for soil and groundwater remediation.*

4.0 Conclusion

The Remediation process lasted for 5 months and the level of TPH after remediation has been reduced to level below the regulatory value of 5,000mg/kg for soil and 600mg/kg for water. MPCD is therefore recommended as an effective remediation product on Nigerian soil. Having met the objectives and set target for this exercise, the site is closed out for further monitoring by SPDC..