

THE SHELL PETROLEUM DEVELOPMENT COMPANY OF NIGERIA LIMITED.

JOINT INVESTIGATION REPORT FOR INCIDENT NO: 1320947 JIV report S/N: 00823

(Note: As practicable as possible the JIT report is to be signed in the field by all the participating parties)

A. GENERAL INFORMATION:

1. Spill incident Number: 1320947 2. Type of incident* OIL SPILL
 3. Name of Location 30" NEMBE CREEK PIPELINE
 4. Name of nearest community OPOMAKIRI 5. State: RIVERS 6. LGA DEGEMA
 7. Type of Production facility/Installation OIL PIPELINE 8. Asset owner/District PIPELINE

B. INCIDENT INFORMATION:

9. Details of incident

- a. Date of incident: 18TH JANUARY, 2015
 b. Start date/time of investigation: 26TH JANUARY, 2015/13:39 HOURS
26TH JANUARY,
 c. Investigation End date: 2015 Actual investigation duration, days: ONE(1) DAY
 d. Description of spill point environment

- | | | |
|---|--|---|
| <input type="checkbox"/> Firmed soil | <input checked="" type="checkbox"/> Loose soil | <input checked="" type="checkbox"/> Recently excavated area |
| <input type="checkbox"/> Under water | <input checked="" type="checkbox"/> Swampy | <input type="checkbox"/> Exposed pipe surface |
| <input type="checkbox"/> Well Platform (on Water) | | <input type="checkbox"/> Drill Rig |

Additional observations around the spill point: **ON ARRIVAL AT SITE, THE JOINT INVESTIGATION TEAM OBSERVED A COFFERDAM CONSTRUCTED AROUND THE SPILL POINT BY THE RESIDENT PIPELINE MAINTENANCE TEAM ON BEHALF OF THE SPDC ASSET OWNER, PREPARATORY TO THE JOINT INVESTIGATION VISIT. ALSO, A STEEL CASING (WITH A 1.5M² CROSS-SECTIONAL AREA) WHICH HAD BEEN INSTALLED AROUND THE SPILL POINT BY UNKNOWN PERSON(S), WAS NOTICED. IMPACTED**

- e. Description of leak point (tick as applicable); **SOIL ON SITE IS DARK BROWN SILTY CLAY WITH ORGANIC MATTER.**
- | | | |
|--|---|---|
| <input type="checkbox"/> Drilled hole | <input type="checkbox"/> Hack saw cut | <input type="checkbox"/> Tear (_____) |
| <input type="checkbox"/> Complete Rupture | <input type="checkbox"/> Inward dent, | <input type="checkbox"/> Well head tampering |
| <input type="checkbox"/> Failed Weld-on illegal hot tap valve, | <input type="checkbox"/> Failed Clamp | <input type="checkbox"/> Missing Pipeline/Flowline |
| <input checked="" type="checkbox"/> Crude oil theft (illegal bunkering) point, | | <input type="checkbox"/> Third party tampering with Clamp |
| <input type="checkbox"/> Third party tampering with valve setting, | | <input type="checkbox"/> Third party tampering with flange, |
| <input type="checkbox"/> Corrosion | <input type="checkbox"/> Saver-pit over flow, | <input type="checkbox"/> Surge vessel overflow, |
| <input type="checkbox"/> Bulging Outward | <input type="checkbox"/> Flare System/Bund wall failure | <input type="checkbox"/> Accidental 3 rd party equipment |
| impact | <input type="checkbox"/> Valve Failure | <input type="checkbox"/> com unit failure |
| <input type="checkbox"/> Relief valve failure | <input type="checkbox"/> Others (specify) _____ | <input type="checkbox"/> Cold vent |

f. Incident caused by:

- Third party interference (Sabotage ; crude theft ; Line theft ; Accidental 3rd party damage
 Operational Others (including Mystery spills) _____

*This can be: a) Oil Spill b) Drilling fluid/Chemical c) Siltation d) construction e) Encroachment f) Fire.

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g. Spill point coordinates

Measuring unit <u>M</u>		<u>MINNA (MID-BELI)</u>	
Northing:		Easting:	
<u>63637.68</u>		<u>507381.08</u>	
/		/	

C. RISK ASSESSMENT

10. Type of environment:

- Land Swamp Water Seasonal swamp Shoreline/Waterfront

i. Type of environment to which oil has spread:

- Land Swamp Water River (identify) _____

ii. Weather condition

- Rain Sunny Dry Wet Windy Hot Cool

11. Distance from the nearest sensitive habitat

- Government reserved and designated protected area [,m]
- Drinking water source [,m]
- Built up area [,m]
- Farmlands [,m]
- Fish Farm/Pond [,m]
- Fishing net [,m]
- Others (specify). MANGROVE VEGETATION

IMPACTED BY SPILL.

12. Containment measures put in place;

- Booms Trench Dyke Natural depression Pit None
 Others: COFFERDAM CONSTRUCTED AROUND SPILL POINT.

13. Any pictures or video coverage? [Y] [N]

14. Further response/repair initiated as at the time of JIV? [Y] [N]

If yes to item 14, give brief description:

RECOVERY OF FREE PHASE OIL WITHIN COFFERDAM CONSTRUCTED AROUND SPILL POINT WAS DONE.

15. Was there any disruption to the investigation? [Y] [N]

If yes to item 15 give brief description:

NOT APPLICABLE

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D. TYPE/NUMBERS OF PROPERTIES, IF ANY, FOUND WITHIN THE AREA OF SPREAD OF OIL

16. Structures / Properties

S/N	Type of Structures	Description	Size	Number	Comments
NONE WITHIN AREA OF IMPACT					

17. Crops/Economic Trees

S/N	Type of crops	Young	Medium	Matured	Quantity	Comments
1.	MANGROVE VEGETATION			✓	WITHIN AN AREA OF 0.38 Ha.	WITHIN SPILL-IMPACTED REGION.

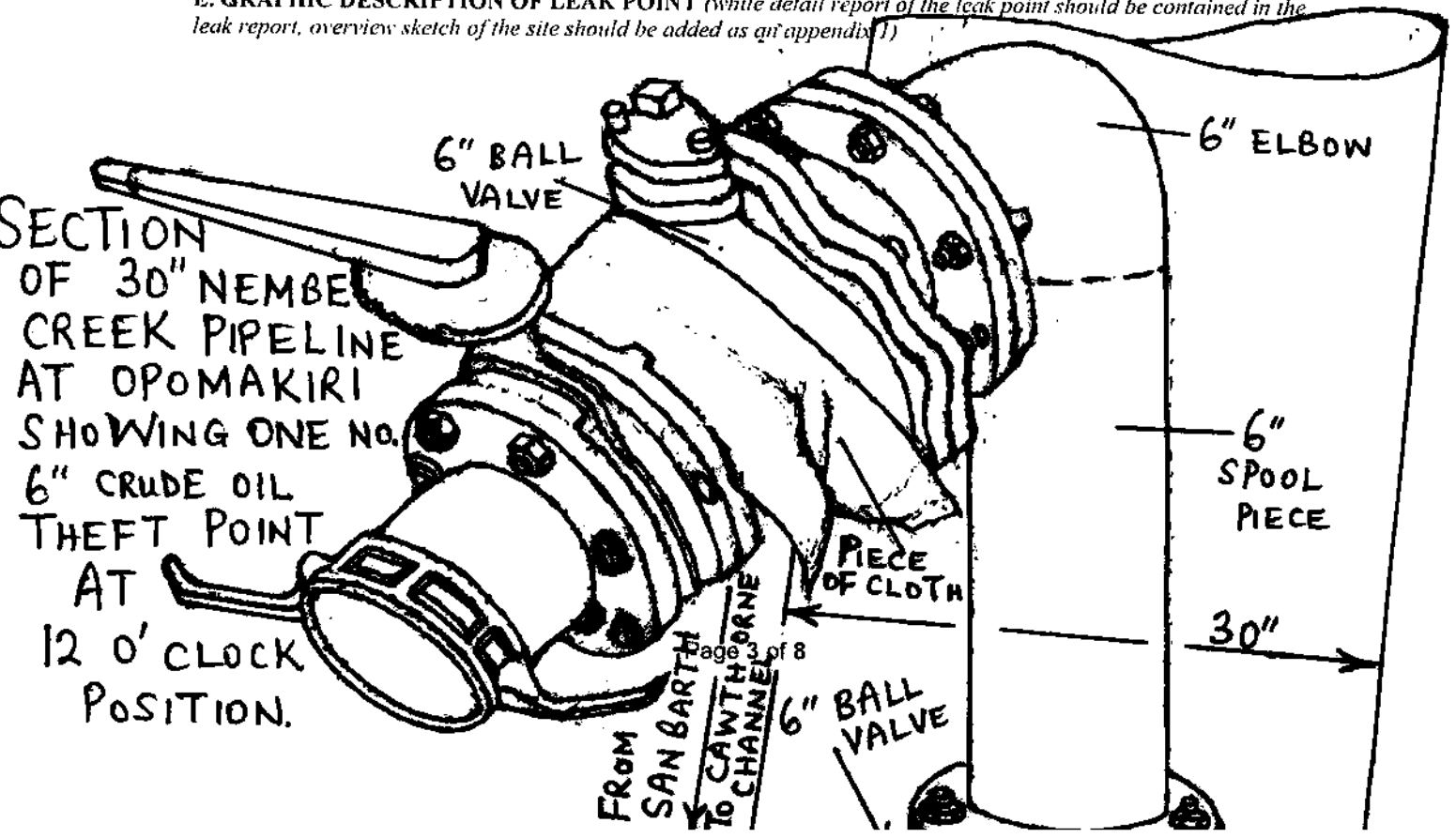
18. Fish/Nets/Ponds

S/N	Fish/Nets/Ponds	Description	Quantity/Size	Comments
NONE WITHIN AREA OF IMPACT				

19. Others (Specify) i.e. Animal Traps

S/N	Others	Description	Quantity/Size	Comments
NONE WITHIN AREA OF IMPACT				

E. GRAPHIC DESCRIPTION OF LEAK POINT (while detail report of the leak point should be contained in the leak report, overview sketch of the site should be added as an appendix 1)



APPENDIX A**IMPACTED AREA COORDINATES (MINNA MID-BELT)****30" NEMBE CREEK PIPELINE AT OPOMAKIRI (INCIDENT NO. 1320947).**

Point	x	y
34	507410.68	63639.46
35	507265.08	63894.12
36	507198.53	63909.00
37	507181.98	63958.80
38	507078.38	63947.95
39	507000.71	63951.80
40	506900.70	63955.81
41	506730.29	63884.42
42	506704.29	63720.17
43	506752.02	63543.13
44	506711.13	63447.37
45	506746.02	63327.49
46	506869.79	63251.66
47	506878.90	63185.29
48	506728.73	63014.19
49	506672.98	62888.97
50	506742.95	62732.15
51	506504.39	62752.92
52	506452.50	62705.10
53	506494.94	62657.09
54	506598.37	62584.99
55	506614.93	62542.57
56	506677.58	62533.99
57	506694.52	62589.02
58	506781.67	62673.09
59	506835.51	62770.67
60	506743.15	62829.84
61	506717.31	62859.38
62	506704.46	62905.49
63	506819.44	63052.71
64	507188.57	63933.58
66	506786.73	63336.62
67	506740.61	63393.86
68	506777.81	63495.15
69	506772.43	63574.42
70	506745.32	63697.10
71	506730.50	63808.22
72	506761.93	63865.67
73	506809.68	63885.96
74	506902.61	63918.83
75	507020.48	63913.00
76	507056.15	63927.73
77	507133.78	63905.45
78	507381.08	63637.68
79	507369.94	63614.55
80	506701.71	63848.44

81	506763.10	63506.60
82	506731.35	63480.14
83	506713.35	63384.89
84	506789.55	63292.81
85	506672.08	62912.87
86	506709.33	62820.80
87	506752.72	62763.64
88	506714.62	62660.99
89	506670.17	62634.53
90	506625.72	62626.06
91	506598.21	62632.41
92	506550.58	62705.45
93	506756.96	62980.60
94	506894.54	63124.54
95	506941.11	63210.26
96	506930.52	63252.60
97	506894.54	63285.40
98	506752.72	63457.91
99	506791.88	63532.00
100	506737.91	63841.03
101	506949.57	63924.64

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G. INCIDENT INFORMATION:

20. Impacted Area Details

- Total calculated area of impact 11.99Hq
- Impact within SPDC R.O.W YES
- Impact outside SPDC R.O.W YES

21. Volume of oil recovered before completion of JIV (V_{rec}):

Recovered oil V_{rec} :	<u>25.16</u>	Barrels
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Controlled recovery/evacuation from source with no impact to environment:

<u>Nil</u>	Barrels
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22. Net Estimated Spilled Volume V_{est}(bbls)* =	<u>216.2</u>
Estimated Reported Volume** V_{rep}(bbls)=	<u>217 BARRELS</u>

***Notes:**

- Volume estimation was done using an excel based tool. (see attached for details on the calculation)
- Reported spilled volume is an estimate

Write other relevant notes taken into consideration for estimating the spilled in the box below:

NOT APPLICABLE

Calculation of the respective estimated volume is to be done on site as far as practicable using the new spill volume estimation software on site: Conversion of m^3 to barrels is Volume (m^3) x 6.29; **Round up estimated volume to next whole number using the following rules:

- Any spill volume in excess of 1 bbl is rounded up to the next whole number.
- Any spill volume in less than 1 bbl is rounded up to the next 0.1 bbl.

Examples: Calculated volume = 15.3 bbl ----- Reported volume = 16 bbl
 Calculated volume = 0.35 bbl ----- Reported volume = 0.4 bbl
 Calculated volume = 0.01 bbl ----- Reported volume = 0.1 bbl.

Wherever this estimation tool is not applicable please refer to paragraph 6c (Deviations) of the JIV procedure to use appropriate steps for column estimation; record the calculation in a plain sheet of paper and attach to the JIV report.

ESTIMATION OF OIL SPILL VOLUME

A OIL SPILLED ONSHORE/OFFSHORE (Leak stopped at source)

Impacted Area Details:

Total Calculated Area of Impact

- i Impact within SPDC R.O.W
- ii Impact outside SPDC R.O.W

119,850.00	m ²
	m ²
	m ²

1 Volume of oil recovered before completion of JIV (V_{rec})

- i Estimated Recovered oil (Net)

25.16	bbbls
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Estimated Recovered oil (Net) V_{rec}	25.16 bbbls
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2 Computation of estimated residual volume on site

a Computation of volume of free phase oil (on land or confined water body)

- i Total area occupied by pool of free phase oil
- ii Average depth of pool of free phase oil
- iii Emulsification factor (If applicable, else 0%) ^

5,096.00	m ²
0.002	m
	%

Estimated Volume of pool of free phase oil, V_{pool}

10.19	m ³
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Estimated Volume of pool of free phase oil, V_{pool}	64.11 bbbls
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b Computation of estimated volume of infiltrated oil in the soil (V_{int})

1 Volume of infiltrated oil at spill point (V_{int a})

- i Total area covered by the oil (infiltration)
- ii Average depth of infiltration above leaking facility i.e. pipeline/flowline
- iii Soil type
- iv P_e (effective porosity of the soil)

1.00	m ²
1.800	m
Silty or sandy clay	▼
	12
	%

- v Cause of spill

Third party interference	▼
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vi Calculation of days for infiltration below the leaking point on pipeline or flowline		
Incident Date	JIV Date	Days on Site
1/18/2015 13:19	1/26/2015 17:10	8
If 'cause of spill' is operational, use 1 week as worst case scenario except where 'days on site' exceeds 7.		7

Infiltration of oil types in various soil types vs time.			
Soil type	Approximate time to reach 1m depth below ground level		
Oil type	Sand	Loam	Clay
Bonny Medium	3 weeks	3 years	> 10 years
Bonny Light	2 days	2 months	> 10 years

- vii Oil type

Bonny Light	▼
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- viii Average depth of infiltration below leaking facility i.e. pipeline/flowline

0.002	m
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- ix Total depth below ground surface of infiltration of oil

1.802	m
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Estimated Volume of infiltrated oil, V_{int a}

0.22	m ³
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Estimated Volume of infiltrated oil, V_{int a}	1.36 bbbls
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2 Volume of infiltrated oil at second spill point (if applicable) (V_{int b})

- i Total area covered by the oil (infiltration)
- ii Average depth of infiltration above leaking facility i.e. pipeline/flowline
- iii Soil type
- iv P_e (effective porosity of the soil)

	m ²
	m
- Select -	▼
	0
	%

- v Average depth of infiltration below leaking facility i.e. pipeline/flowline

0.000	m
-------	---

- vi Total depth below ground surface of infiltration of oil

0.000	m
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Estimated Volume of infiltrated oil, V_{int b}

0.00	m ³
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Estimated Volume of infiltrated oil, V_{int b}	0.00 bbbls
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3 Volume of infiltrated oil outside immediate spill point(s) region ($V_{inf,c}$)

- i Total Area covered by the oil (infiltration) 17,278.00 m²
- ii Total Area of the pool of free phase oil in touch with soil 26.00 m²
- iii Soil type Silty or sandy clay
- iv P_e (effective porosity of the soil) 12%
- v Average depth below ground surface of infiltration of oil 0.002 m

Estimated Volume of Infiltrated oil, $V_{inf,c}$	4.55 m ³
Estimated Volume of infiltrated oil, $V_{inf,c}$	28.63 bbls

4 Volume of infiltrated oil outside immediate spill point(s) region (superficial impact, $V_{inf,d}$)

- i Total Area covered by the oil (infiltration) 3,800.00 m²
- ii Total Area of the pool of free phase oil in touch with soil m²
- iii Average depth below ground surface of infiltration of oil 0.002 m

Estimated Volume of infiltrated oil, $V_{inf,d}$	0.67 m ³
Estimated Volume of infiltrated oil, $V_{inf,d}$	4.19 bbls

Estimated Total Volume of infiltrated oil, V_{inf}	5.43 m ³
Estimated Total Volume of infiltrated oil, V_{inf}	34.18 bbls

c Computation of volume of oil on open water based on standard coloration

- i Total area of oil on open water 93,676.00 m²
- ii Table of average depth of oil on water based on coloration

[Link to Coverage Visual Aid](#)

Spill Factors from USCG FOG (2006 Edition)		Visual Aid	
	Thickness (mm)	Percentage coverage (%)	Volume (m ³)
Barely Visible	0.00004		0.0000
Silvery	0.00008		0.0000
Slight Color	0.00015	30%	0.0042
Bright Color	0.0003		0.0000
Dull	0.001	60%	0.0562
Dark	0.002		0.0000
Black oil	0.1	10%	0.9388
Emulsion (30% Oil)	1		0.0000
Percent Total:		100%	0.9972

Estimated Volume of oil on open water, V_{wat}	1.00 m ³
Estimated Volume of oil on open water, V_{wat}	6.27 bbls

3 Calculation of evaporated volume

Evaporation Factors (E-Factor) for SPDC Crude oil		
Residence time of spilled oil (days on site)	Oil type	
	Bonny Light	Bonny Medium
< 1 day	10%	5%
1-7 days	25%	15%
> 7 days	40%	25%

- i Was oil recovery before JIV completion done before JIV date? No
- ii Estimated volume available for evaporation 129.72 bbls
- iii E-factor 40%

Estimated Volume of evaporated oil, V_{evap}	86.48 bbls
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Net Total Estimated Spilled Volume, V_{Est}	216.20 bbls
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23. GENERAL STATUS OF THE SITE

A. Joint investigation of the incident site found that there is no residual impact after the initial response and JIT therefore recommend that the site be closed out <input type="checkbox"/>
B. Investigation of the incident site showed that there is residual impact on site requiring further works <input checked="" type="checkbox"/>

24. REPRESENTATIVES

This report was filled, agreed and signed by the following joint investigation representatives:

- Host Community:
- Department of Petroleum Resources [DPR]:
- National Oil Spill Detection and Response Agency [NOSDRA]:
- State Ministry of Environment [SME]:
- Nigeria Police Force [NPF]:
- Shell Petroleum Development Company [SPDC]:
- Signatories agree with reported findings:
- Separate DPR form has been filled out with same findings

Tick as applicable

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25. Appendix 1: Overview sketch of the site

