

THE SHELL PETROLEUM DEVELOPMENT COMPANY OF NIGERIA LIMITED.

JOINT INVESTIGATION REPORT FOR INCIDENT NO: 959872 JIV report S/N: 0044

(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: 959872 2. Type of incident* OIL SPILL
 3. Name of Location NEMBE 1 WELL 23T FLOWLINE
 4. Name of nearest community GWESUO 5. State: BAYELSA 6. LGA NEMBE
 7. Type of Production facility/Installation OIL FLOWLINE 8. Asset owner/District SWAMP 2 / NEMBE

B. INCIDENT INFORMATION:

9. Details of incident

- a. Date of incident: 12TH APRIL, 2013
 b. Start date/time of investigation: 16TH APRIL, 2013
 c. Investigation End date: 16TH APRIL 2013 actual investigation duration, days: ONE (1) DAY
 d. Description of spill point environment
 Firmed soil Loose soil Recently excavated area
 Under water Swampy Exposed pipe surface
 Well Platform (on Water) Drill Rig
 e. Description of leak point (tick as applicable);
 Drilled hole Hack saw cut Tear (_____),
 Complete Rupture Inward dent, Well head tampering
 Failed Weld-on illegal hot tap valve, Failed Clamp Missing Pipeline/Flowline
 Crude oil theft (illegal bunkering) point, Third party tampering with Clamp
 Third party tampering with valve setting, Third party tampering with flange,
 Corrosion Saver-pit over flow, Surge vessel overflow,
 Bulging Outward Flare System/Bund wall failure Accidental 3rd party equipment
 impact Valve Failure com unit failure Cold vent
 Relief valve failure Others (specify) _____
 f. Incident caused by:
 Third party interference (Sabotage; crude theft; Line theft; Accidental 3rd party damage)
 Operational Others (including Mystery spills) _____

g. Spill point coordinates

Measuring unit <u>(meter)</u> <u>(MINNA MID-BET)</u>	
Northing: <u>(m)</u>	Easting: <u>(m)</u>
<u>50751.19</u>	<u>427403.10</u>

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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). **NOT APPLICABLE**

12. Containment measures put in place:

- Booms
 Trench
 Dyke
 Natural depression
 Pit
 Others: _____

13. Any pictures or video coverage?

[Y] [N]

14. Was there any disruption to the investigation?

[Y] [N]

If yes give brief description:

NOT APPLICABLE

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

15. Structures / Properties

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

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16. Crops/Economic Trees

S/N	Type of crops	Young	Medium	Matured	Quantity	Comments
NONE WITHIN AREA OF IMPACT						

17. Fish/Nets/Ponds

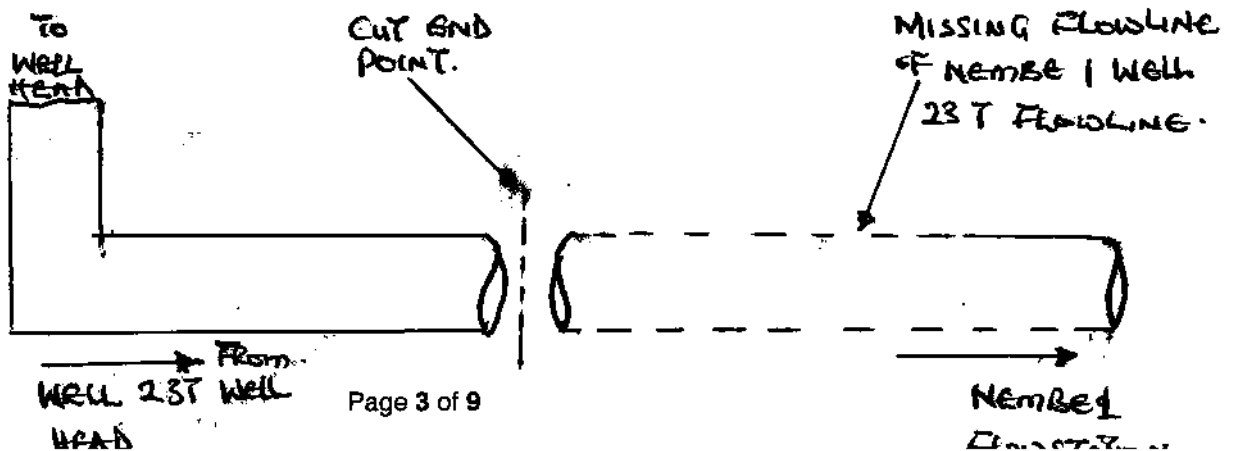
S/N	Fish/Nets/Ponds	Description	Quantity/Size	Comments
NONE WITHIN AREA OF IMPACT				

18. 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)

SECTION OF NEMBE 1 WELL 23T FLOWLINE AT EWESHO
SHOWING MISSING FLOWLINE.



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F: TABLE SHOWING SOME OF COORDINATES TAKEN DURING JIV FOR AREA CALCULATION

19. Impacted area boundary coordinates (if more, Print and attach as an appendix)

(MINNA MID - BFT)

S/N	Northing (METRE)	Easting (METRE)
5	50742.03	427384.56
8	50723.55	427396.85
9	50702.00	427409.12
10	50683.52	427424.49
12	50683.46	427442.99
16	50760.43	427396.96
17	50768.16	427405.27
18	50692.22	427454.48

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G. INCIDENT INFORMATION:

20. Impacted Area Details

- Total calculated area of impact 0.27Ha
- 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>NIL</u>	Barrels
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22. Computation of estimated residual volume on site

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

- i. Area (m^2) occupied by pool of free phase oil NOT APPLICABLE
- ii. Average Depth (m) of pool of free phase oil NOT APPLICABLE
- iii. Emulsification factor: _____
- iv.

Estimated Volume of pool of free phase oil. V_{pool} :	<u>NOT APPLICABLE</u>	barrels
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b. Computation of estimated volume of infiltrated oil in the soil (V_{inf}).

1. Estimated Volume of infiltrated oil at spill point ($V_{inf a}$)

- i. Area* (m^2) of soil covered by the oil: NOT APPLICABLE
- ii. Average Depth (m) above leaking facility i.e. pipeline/flowline: NOT APPLICABLE
- iii. Soil type: CLAY iv. P_e (effective porosity of the soil): 8%
- v. Cause of spill: THIRD PARTY INTERFERENCE vi. Oil type: BONNY LIGHT
- vii. Oil Residence time on site, day: (4) FOUR DAYS
- viii. Average depth of infiltration below leaking facility i.e. pipeline/flowline: NOT APPLICABLE
- ix. Estimated depth of infiltration around spill point: NOT APPLICABLE
- x.

Estimated Volume of infiltrated oil at spill point. $V_{inf a}$:	<u>NOT APPLICABLE</u>	barrels
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2. Estimated Volume of infiltrated oil at second spill point [if applicable] ($V_{inf b}$)

- i. Area* (m^2) of soil covered by the oil: NOT APPLICABLE
- ii. Average Depth (m) above leaking facility i.e. pipeline/flowline: _____
- iii. Soil type: NOT iv. P_e (effective porosity of the soil): _____
- v. Cause of spill: APPLICABLE Oil type: NOT APPLICABLE
- vii. Oil Residence time on site, day: _____
- viii. Average depth of infiltration below leaking facility i.e. pipeline/flowline: NOT APPLICABLE
- ix. Estimated depth of infiltration around spill point: APPLICABLE
- | | | |
|---|-----------------------|---------|
| Estimated Volume of infiltrated oil at spill point. $V_{inf b}$: | <u>NOT APPLICABLE</u> | barrels |
|---|-----------------------|---------|

3. Estimated Volume of infiltrated oil outside immediate spill point(s) region ($V_{inf c}$)

NEMBE 1 WELL 23T FLOWLINE AT EWASUO (959872)

COMPUTATION OF ESTIMATED SPILLED VOLUME IS BASE

ON THE FORMULA: V_s (VOLUME SPILL) $Q (\bar{T}_2 - \bar{T}_1) + f APL$ AS FOLLOWS

THE EQUATION: $V_s = Q (\bar{T}_2 - \bar{T}_1) + f APL$ WHERE

V_s = VOLUME OF OIL SPILLED IN METERS CUBE (m^3)

Q = OIL FLOWRATE IN THE FLOWLINE.

\bar{T}_2 = AUTOMATIC SHUT DOWN TIME.

\bar{T}_1 = TIME THE INCIDENT OCCURRED.

f = FRACTION OF OIL IN FLOWLINE

AP = CROSS-SECTIONAL AREA OF THE FLOWLINE

CALCULATION! -

* NET FLOWLINE FLOW RATE FOR NEMBE 1 WELL 23T = 490 BARRELS

* NET FLOWRATE PER HOUR = $\frac{490 \text{ BARRELS}}{24 \text{ HOUR}} = 20.42 \text{ BARREL/HOUR}$

* NET FLOWRATE IN (m^3 /HOUR) = $\left(\frac{20.42}{6.29}\right) m^3/\text{HOUR} = 3.25 m^3/\text{HOUR}$

THUS $Q = 3.25$ METER PER HOUR.

* $(\bar{T}_2 - \bar{T}_1)$ = DURATION OF LEAK [BASED ON ONGOING PRODUCTION FLOW INTERNAL BETWEEN DETECTION OF PRESSURE DROP DUE TO LEAK AND AUTOMATIC SHUT DOWN SYSTEM. (WELL HEAD - EQUIPPED)] = 3 MINUTES.

= 3 minutes = $\left(\frac{3}{60}\right)$ HOUR = (0.05 HOUR)

* THE PRODUCT, f = FRACTION OF OIL IN FLOWLINE, ESTIMATED AS 0.104 (BASED ON FLOWLINE PRESSURE OF 10 BARS)

* AP = CROSS-SECTIONAL AREA OF FLOWLINE (4" DIAMETER, EQUIVALENT TO 10CM) = πR^2 ($R = 0.05m$) = $\pi \times (0.05)^2 = 0.0079 m^2$.

* LENGTH OF FLOWLINE FROM THE CUT-THROUGH POINT TO THE POINT OF CLOSURE (UPSTREAM AND DOWNSTREAM) = 2.4 KM = 2,400M

ESTIMATED SPILL VOLUME: $V_s = Q (\bar{T}_2 - \bar{T}_1) + f APL$
= $(3.25 \times 0.05) + (0.104 \times 0.0079 \times 2.400)$

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- i. Area (m²) of soil covered by the oil: NOT
- ii. Area (m²) of the pool of free phase oil in touch with soil: NIL
- iii. Average Depth (m) below ground surface of infiltrated oil: APPLICABLE
- iv. Soil type: CLAY
- v. P_e (effective porosity of the soil): 8%

vi. Estimated Volume of infiltrated oil. At V_{inf} : NOT APPLICABLE barrels

23. Computation of estimated volume of oil on open water based on standard coloration.

- i. Total area of oil on open water: NIL
- ii. Table of average depth of oil on water based on coloration (***Spill Factors from USCG FOG (2000 Edition)*)

	Thickness (mm)	Percentage coverage	Volume (m ³)
Barely Visible	0.00004		
Silvery	0.00008		
Slight Color	0.00015	<u>NOT</u>	
Bright Color	0.0003		
Dull	0.001	<u>APPLICABLE</u>	
Dark	0.002		
Black oil	0.1		
Emulsion (30% Oil)	1		

iii. Estimated Volume of oil on open water. V_{wat} : NOT APPLICABLE Barrels

24. Calculation of evaporated volume:

- i. Estimated Volume available for evaporation within surface area: NOT APPLICABLE
- ii. E-Factor: 25%
- iii. Estimated Volume of evaporated oil. V_{evap} : NOT APPLICABLE Barrels

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

25. Net Estimated Spilled Volume V_{Est} (bbls) = V_{evap} (bbls) + V_{wat} (bbls) + V_{inf} (bbls) + V_{pool} (bbls) + V_{recf} (bbls) =
13.42 BARRELS

Estimated Reported Volume V_{rep} (bbls) =**
14 BARRELS.

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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 m³ to barrels is Volume (m³) 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.

26. GENERAL STATUS OF THE SITE

A. Joint investigation of the incident site found that there is no residual impact after the initial response and 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"/>

27. REPRESENTATIVES

This report was filled, agreed and signed on the 16/04/2013 by joint investigation representatives from

- 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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28. Appendix 1: Overview sketch of the site

