

THE SHELL PETROLEUM DEVELOPMENT COMPANY OF NIGERIA LIMITED.

JOINT INVESTIGATION REPORT FOR INCIDENT NO: 1287506 JIV report S/N: 00784

(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: 1287506 2. Type of incident* OIL SPILL
 3. Name of Location ALAKIRI WELL 19T WELL HEAD
OFIOMINA-AMA
 4. Name of nearest community ALAKIRI 5. State: RIVERS 6. LGA OKRIKA
 7. Type of Production facility/Installation WELL HEAD 8. Asset owner/District SWAMP 1

B. INCIDENT INFORMATION:

9. Details of incident

- a. Date of incident: 16TH NOVEMBER, 2014
 b. Start date/time of investigation: 24TH NOVEMBER, 2014 / 16:20 HOURS
 c. Investigation End date: 24TH NOVEMBER 2014 Actual investigation duration, days: ONE (1) DAY
 d. Description of spill point environment

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

Additional observations around the spill point: ON ARRIVAL AT SITE, CRUDE OIL STAINS WERE NOTICED ON THE BODY OF THE WELL HEAD AND ITS HAND AND GUARD RAILS ALTHOUGH NO RESIDUAL SPILL IMPACT WAS OBSERVED IN THE ENVIRONMENT, FRESH MARKS WERE NOTICEABLE ON THE TREE CAP WITH ITS INTERNAL THREAD TAPE CONSPICUOUSLY EXPOSED INDICATING THAT THE TREE CAP WAS TAMPERED WITH BY UNKNOWN PERSON(S). THE BEAN CAP ON THE

- e. Description of leak point (tick as applicable): 19T ARM WAS ALSO OBSERVING MISSING.
- | | | |
|---|--|---|
| <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 checked="" 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 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"/> Cold vent |
| <input type="checkbox"/> Relief valve failure | <input checked="" type="checkbox"/> Others (specify) <u>BEAN CAP</u> | |
- CRUDE OIL DROPLETS WERE OBSERVED INTERNALLY AT THE POSITION OF THE MISSING BEAN CAP. THE IS A NON-PRODUCING ONE.
- REMOVAL BY UNKNOWN PERSON(S).

- 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 (m) <u>Minna Mid belt</u>	
Northing:	Easting:
<u>72689.07</u>	<u>512664.16</u>
<u>[Signature]</u>	<u>[Signature]</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). [,m]

NO RESIDUAL IMPACT WAS OBSERVED ON SITE AS AT TIME OF JOINT INVESTIGATION VISIT

12. Containment measures put in place;

- Booms
 Trench
 Dyke
 Natural depression
 Pit
 None
 Others: NOT APPLICABLE (NO RESIDUAL IMPACT OBSERVED ON SITE AS AT TIME OF JIV).

13. Any pictures or video coverage?

[] []

14. Further response/repair initiated as at the time of JIV?

[] []

If yes to item 14, give brief description:

NOT APPLICABLE

15. Was there any disruption to the investigation?

[] []

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
	NOT APPLICABLE				

17. Crops/Economic Trees

S/N	Type of crops	Young	Medium	Matured	Quantity	Comments
	NOT APPLICABLE					

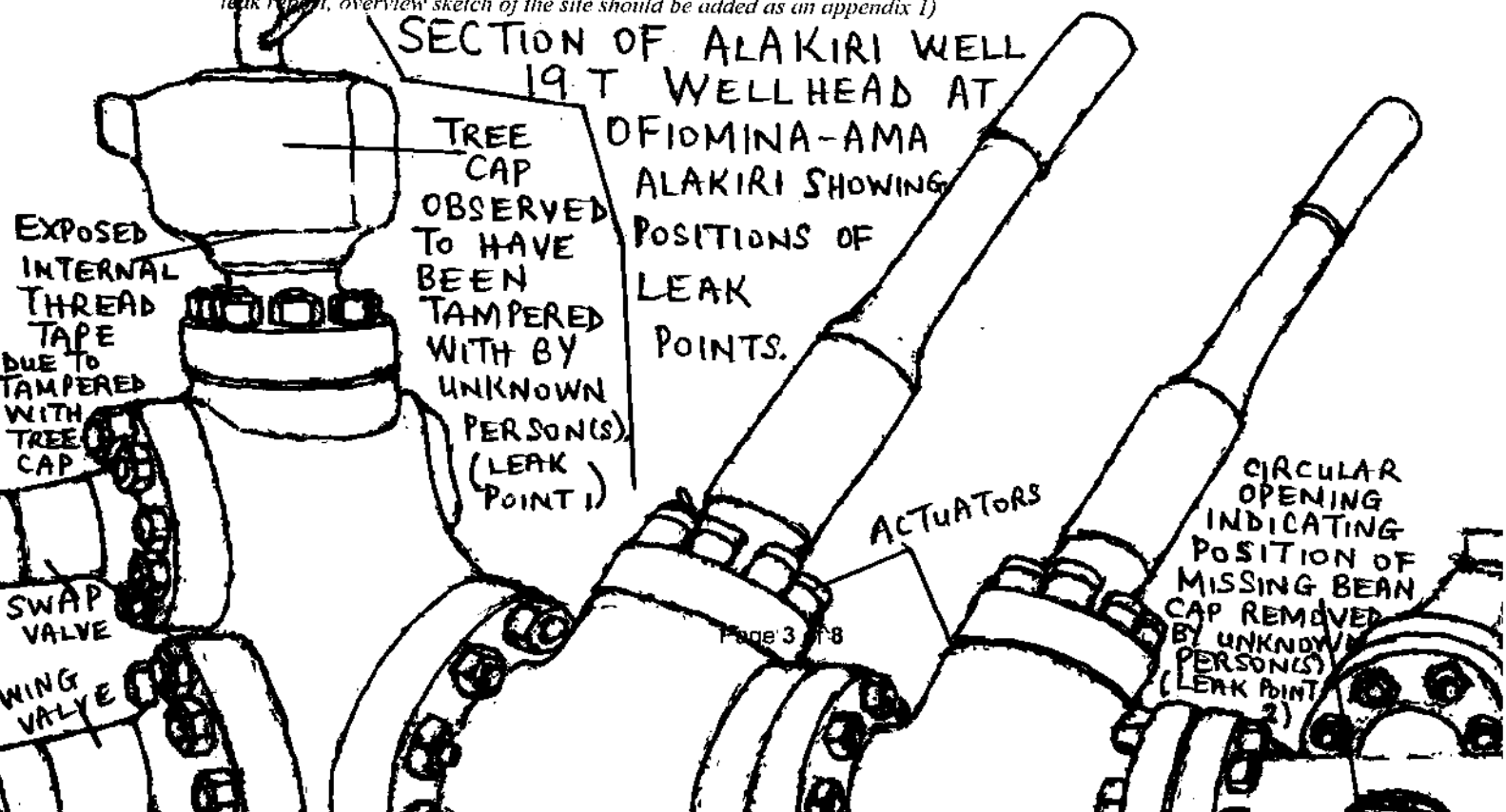
18. Fish/Nets/Ponds

S/N	Fish/Nets/Ponds	Description	Quantity/Size	Comments
	NOT APPLICABLE			

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

S/N	Others	Description	Quantity/Size	Comments
	NOT APPLICABLE			

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)



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G. INCIDENT INFORMATION:

20. Impacted Area Details

- Total calculated area of impact NIL (NO RESIDUAL IMPACT AS AT TIME OF JIV)
- Impact within SPDC R.O.W NIL
- Impact outside SPDC R.O.W NIL

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

Recovered oil V_{rec} :	<u>NIL</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>15.85</u>
Estimated Reported Volume** V_{rep}(bbls)=	<u>16 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:

SINCE NO RESIDUAL IMPACT WAS OBSERVED ON SITE AS AT TIME OF JOINT INVESTIGATION VISIT, SPILLED VOLUME WAS ESTIMATED WITH THE AID OF CERTAIN PARAMETERS PROVIDED BY THE ASSET OWNER, USING THE FORMULA EXPLAINED IN THE ATTACHED APPENDIX A.

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.

APPENDIX A

ESTIMATION OF SPILLED VOLUME IS BASED ON THE

FORMULA: $V_s = A_o T C_o \sqrt{\frac{2 \Delta P_o}{\rho}} f$ WHERE

V_s = VOLUME SPILLED (m^3)

A_o = SURFACE AREAS OF THE LEAK POINTS:

NOTE: FOR LEAK POINT 1, SURFACE AREA IS COMPUTED OVER A 1MM ALLOWANCE AROUND THE WELLHEAD TREE CAP TAMPERED WITH BY UNKNOWN PERSONS; THUS

A_1 (LEAK POINT 1 AREA) = DIFFERENCE IN AREAS OF TWO CONCENTRIC CIRCLES WITH A DIFFERENCE IN RADII OF 1MM (0.001M) WITH SMALLER RADIUS BEING HALF OF A 4" DIAMETER ($4 \frac{1}{2} = 10 \text{cm} / 2 = 5 \text{cm} = 0.05 \text{m}$) AND LARGER RADIUS, $(0.05 + 0.001) \text{m}$

$= 0.051 \text{m}$.

THUS, $A_1 = \pi \times 0.051^2 - \pi \times 0.05^2 = 0.0082 - 0.0079 = 0.0003 \text{m}^2$.

A_2 (LEAK POINT 2 AREA) IS ESTIMATED AS A PERCENT OF A CIRCULAR AREA OF 4" DIAMETER BEING THE VOID LEFT BY REMOVAL OF

THE BEAN CAP (BY UNKNOWN PERSONS). THEREFORE, $A_2 = 0.01 \times \pi \times 0.05^2 = 0.01 \times 0.007855 = 0.00007855 = 0.0001 \text{m}^2$.

TOTAL AREA, $A_o = A_1 + A_2 = 0.0003 + 0.0001 = 0.0004 \text{m}^2$.

T = LEAK DURATION. SINCE THE WELL IS NON-PRODUCING, AN ESTIMATE IS MADE OF THE TIME INTERVAL IT TOOK FOR THE ASSET OPERATIONS TEAM WHO WERE ALREADY AT ANOTHER WELL LOCATION TO SECURE WELL 19T ON RECEIPT OF A SPILL REPORT = 150 SECONDS.

C_o = DISCHARGE COEFFICIENT = 0.62.

ΔP_o = DIFFERENTIAL PRESSURE = PRESSURE ACROSS LEAK POINTS - ATMOSPHERIC PRESSURE. SINCE WELL IS NON-PRODUCING, APPLICABLE PRESSURE IS CLOSED-IN TUBING HEAD PRESSURE (C.I.T.H.P)

= 800 POUNDS PER SQUARE INCH (PSI) = $(800 / 14.5) \text{BARS} = 55.17 \text{BARS}$.

ATMOSPHERIC PRESSURE IS 1 BAR. THEREFORE, $\Delta P_o = (55.17 - 1) \text{BARS} = 54.17 \text{BARS} = (54.17 \times 100,000) \text{NEWTONS}/\text{M}^2 = 5,417,000 \text{N}/\text{M}^2$.

ρ = OIL DENSITY = $850 \text{KG}/\text{M}^3$.

f = OIL FRACTION (GIVEN BASE SEDIMENT AND WATER, BSW OF 40%)
 $= (100 - 40)\% = 60\% = 0.6$

$V_s = 0.0004 \times 150 \times 0.62 \times \sqrt{\frac{2 \times 5,417,000}{850}} \times 0.6 = 2.52 \text{m}^3$

$\approx (2.52 \times 6.29) \text{BARRELS} = 15.85 \approx \underline{\underline{16 \text{ BARRELS}}}$

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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 checked="" type="checkbox"/>
B. Investigation of the incident site showed that there is residual impact on site requiring further works <input type="checkbox"/>

24. REPRESENTATIVES

<p>This report was filled, agreed and signed by the following joint investigation representatives:</p> <ul style="list-style-type: none">• Host Community: <input checked="" type="checkbox"/>• Department of Petroleum Resources [DPR]: <input type="checkbox"/>• National Oil Spill Detection and Response Agency [NOSDRA]: <input checked="" type="checkbox"/>• State Ministry of Environment [SME]: <input checked="" type="checkbox"/>• Nigeria Police Force [NPF]: <input type="checkbox"/>• Shell Petroleum Development Company [SPDC]: <input checked="" type="checkbox"/>• Signatories agree with reported findings: <input checked="" type="checkbox"/>• Separate DPR form has been filled out with same findings <input type="checkbox"/> <p style="text-align: right;"><i>Tick as applicable</i></p>
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25. Appendix 1: Overview sketch of the site

