

THE SHELL PETROLEUM DEVELOPMENT COMPANY OF NIGERIA LIMITED.

JOINT INVESTIGATION REPORT FOR INCIDENT NO: 1232262 JIV report S/N: 00822

(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: 1232262 2. Type of incident* OIL SPILL
 3. Name of Location BONNY WELL 2L FLOWLINE
 4. Name of nearest community EREREKIRI/OKOLO LAUNCH 5. State: RIVERS 6. LGA BONNY
 7. Type of Production facility/Installation OIL FLOWLINE 8. Asset owner/District SWAMP 1

B. INCIDENT INFORMATION:

9. Details of incident
 a. Date of incident: 15 TH AUGUST, 2014
 b. Start date/time of investigation: 18TH JANUARY, 2015 / 11:30 HOURS
18TH 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 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: **A TOTAL OF THREE (3) FLOWLINES WERE OBSERVED ON SITE, ON EXPOSURE BY EXCAVATION AROUND THE SPILL POINT WITH THE AID OF A SWAMP BUGGY EXCAVATOR WHICH WAS REQUIRED TO LIFT THE AFFECTED FLOWLINE SECTION TO THE SURFACE IN ORDER TO PROPERLY EXAMINE THE SPILL POINT. LONG MARKS WERE NOTICED AT TWO (2) DISTINCT POSITIONS ON**

- THE BONNY WELL 2L FLOWLINE (THE AFFECTED FLOWLINE) RESULTING IN DAMAGE TO THE FLOWLINE**
- e. Description of leak point (tick as applicable);
- | | | |
|---|---|--|
| <input type="checkbox"/> Drilled hole | <input type="checkbox"/> Hack saw cut | <input type="checkbox"/> Tear (_____), POLYETHYLENE |
| <input type="checkbox"/> Complete Rupture | <input type="checkbox"/> Inward dent, | <input type="checkbox"/> Well head tampering COATING AND |
| <input type="checkbox"/> Failed Weld-on illegal hot tap valve, | <input type="checkbox"/> Failed Clamp | <input type="checkbox"/> Missing Pipeline/Flowline SUBSEQUENT |
| <input type="checkbox"/> Crude oil theft (illegal bunkering) point, | | <input type="checkbox"/> Third party tampering with Clamp CORROSION OF |
| <input type="checkbox"/> Third party tampering with valve setting, | | <input type="checkbox"/> Third party tampering with flange, EXPOSED |
| <input checked="" type="checkbox"/> Corrosion | <input type="checkbox"/> Saver-pit over flow, | <input type="checkbox"/> Surge vessel overflow, FLOWLINE |
| <input type="checkbox"/> Bulging Outward | <input type="checkbox"/> Flare System/Bund wall failure | <input type="checkbox"/> Accidental 3 rd party equipment SURFACE AT |
| impact <input type="checkbox"/> Valve Failure | <input type="checkbox"/> com unit failure | <input type="checkbox"/> Cold vent ONE |
| <input type="checkbox"/> Relief valve failure | <input type="checkbox"/> Others (specify) _____ | END OF ONE OF THE SAID MARKS. |

- 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>54648.94</u>	<u>528971.32</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). MANGROVE VEGETATION IMPACTED BY SPILL.

12. Containment measures put in place;

- Booms Trench Dyke Natural depression Pit None

Others: BOOMS WERE INITIALLY DEPLOYED AS AT TIME OF INITIAL RESPONSE TO THE SPILL REPORT BUT IT WAS OBSERVED

13. Any pictures or video coverage?

[Y] [N] (PRIOR TO THE JOINT INVESTIGATION VISIT) ON 5TH SEPTEMBER 2014 THAT THE BOOMS HAD BEEN REMOVED BY UNKNOWN PERSON(S).

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

[Y] [N] (PRIOR TO THE JOINT INVESTIGATION VISIT) ON 5TH SEPTEMBER 2014 THAT THE BOOMS HAD BEEN REMOVED BY UNKNOWN PERSON(S).

If yes to item 14, give brief description:

NOT APPLICABLE

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 APPROXIMATE AREA OF 0.01 HA.	WITHIN SPILL-IMPACTED REGION.

18. Fish/Nets/Ponds

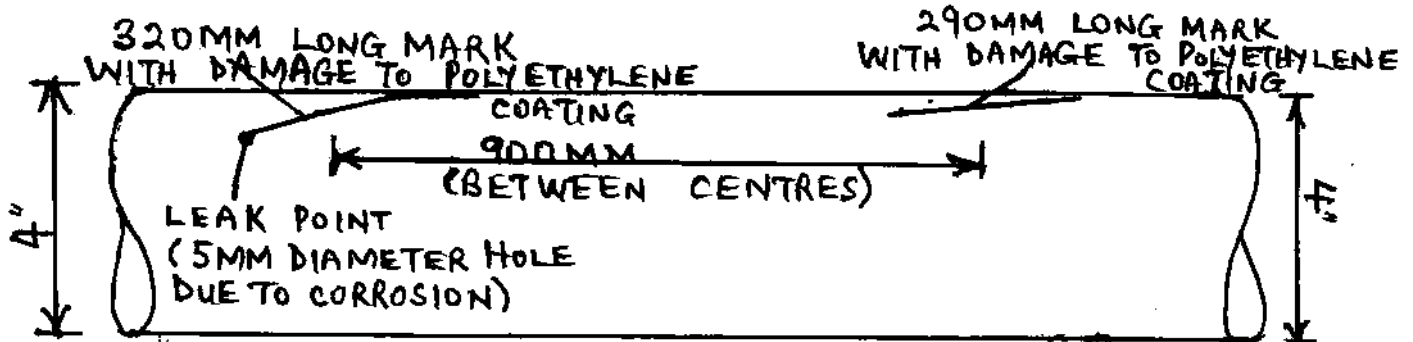
S/N	Fish/Nets/Ponds	Description	Quantity/Size	Comments
NONE WITHIN AREA OF IMPACT				

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)

SECTION OF BONNY WELL 2L FLOW LINE AT EREREKIRI/OKOLO LAUNCH SHOWING TWO (2) NO. MARKS (BETWEEN 12 AND 1 O' CLOCK POSITIONS) WITH LEAK POINT DUE TO CORROSION AT 1 O' CLOCK POSITION.



FROM BONNY WELL 2
 TO OLOMA FLOW STATION.

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G. INCIDENT INFORMATION:

20. Impacted Area Details

- Total calculated area of impact 0.03HA
- 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>0.26</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>2.63</u>
Estimated Reported Volume** $V_{rpt}(bbls)$ =	<u>3 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:

DUE TO THE TIDAL SWAMPY TERRAIN ON SITE AND THE CONSIDERABLE TIME INTERVAL BETWEEN THE INCIDENT AND JIV DATES (OCCASIONED BY THE REQUIREMENT FOR A SWAMP BUGGY EXCAVATOR ON SITE TO EXPOSE AND LIFT TO THE SURFACE, THE AFFECTED FLOWLINE), THE RESIDUAL SPILL IMPACT OBSERVED ON SITE AS AT TIME OF JIV, THOUGH MAPPED, WAS CONSIDERED UNLIKELY TO REPRESENT THE TRUE EXTENT OF IMPACT AND THUS THE JOINT INVESTIGATION TEAM RESOLVED TO ESTIMATE THE SPILLED VOLUME WITH THE AID OF CERTAIN PARAMETERS PROVIDED BY THE ASSET OWNER, USING THE FORMULA EXPLAINED IN THE ATTACHED APPENDIX A. THE ESTIMATE

OF 3 BARRELS, THEREFORE, IS INCLUSIVE OF THE PRE-JIV DATE SPILL-RECOVERED

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.

**VOLUME
OF
0.26
BARREL.**

Wherever this estimation tool is not applicable please refer to paragraph 6c (Deviations) of the JIV procedure to use appropriate steps for volume 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, $V_s = A_o T_c \sqrt{\frac{2\Delta p_o}{\rho}} f$ WHERE

V_s = ESTIMATED SPILLED VOLUME (IN M^3)

A_o = SURFACE AREA OF THE LEAK POINT (IN M^2) COMPUTED AS FOLLOWS:

THE LEAK POINT IS A 5MM DIAMETER HOLE, THUS WITH A RADIUS OF $5MM/2 = 2.5MM = 0.0025M$, AREA COMPUTED WITH THE FORMULA, $\pi R^2 = \pi \times 0.0025^2 = 0.0000196 \approx 0.00002M^2$.

T_c (SECONDS) = ESTIMATED DURATION OF LEAK AS EXPLAINED BELOW:
IT WILL TAKE AN ESTIMATED TIME OF 5 MINUTES FOR THE SURFACE SAFETY VALVE TO TRIP-OFF THE WELL (AND SHUT-IN FLOW FROM THE WELL) ONCE A DROP IN PRESSURE SIGNAL IS RECEIVED DUE TO THE LEAK (NOTE: THE CLOSER A LEAK POINT IS TO THE SURFACE SAFETY VALVE AT THE WELL, THE FASTER IT WILL TAKE TO SIGNAL A PRESSURE DROP AND SHUT-IN FLOW) ONCE WELL IS NOT FLOWING, THE SUBSEQUENT RELEASE FROM THE LEAK POINT WILL BE FROM THE FLOW LINE CONTENT, WITH AN ESTIMATE OF AN ADDITIONAL 5 MINUTES GIVEN FOR THIS POST-SHUT-IN RELEASE. THEREFORE, TOTAL LEAK DURATION IS ESTIMATED AS 10 MINUTES (= 5 + 5) = (10 x 60) = 600 SECONDS.

C_o = DISCHARGE COEFFICIENT = 0.62.

Δp_o (IN N/M^2) = DIFFERENCE IN PRESSURE = PRESSURE INTERNALLY ACROSS THE LEAK POINT [P_{in} GIVEN AS A FLOWLINE PRESSURE OF 40 BARS = $(40 \times 100,000) N/M^2$ OR PASCALS = $4,000,000 N/M^2$] - ATMOSPHERIC PRESSURE (1 BAR = $100,000 N/M^2$), THUS $\Delta p_o = (4,000,000 - 100,000) N/M^2 = 3,900,000 N/M^2$.

ρ = OIL DENSITY (IN KG/M^3) TAKEN AS $850 KG/M^3$.

f = FRACTION OF OIL; GIVEN A BSW (BASE SEDIMENT AND WATER) OF 41.3%, $f = (100 - 41.3)\% = 58.7\% = 0.587$.

THEREFORE, V_s (IN M^3) = $0.00002 \times 600 \times 0.62 \times \sqrt{\frac{2 \times 3,900,000}{850}} \times 0.587$
 $\approx 0.42 M^3$. CONVERTING TO BARRELS, $0.42 M^3 = (0.42 \times 6.29) \approx 2.63$ BARRELS
 ≈ 3 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 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

<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 checked="" 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 checked="" 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

