THE SHELL PETROLEUM DEVELOPMENT COMPANY OF NIGERIA LIMITED
JOINT INVESTIGATION REPORT FOR INCIDENT NO: 639568

A. GENERAL INFORMATION:

1. Spill incident Number: 639568

2. Name of Location: 24"/28" BOMU - BONNY PIPELINE AT BODO-WEST

3. Name of nearest community: BODO-CITY

4. State: RIVERS LGA: GOKANA

5. Type of Production facility/Installation: PIPELINE Asset owner /District: UIG/P/NESP

B. INCIDENT INFORMATION:

6. Details of incident

   a. Date of incident
   b. Date/Period of investigation,
   c. Description of spill point environment

   □ Firmed soil [Y] [N] [X]
   □ Loose soil [Y] [N]
   □ Previously excavated area [Y] [N] [X]
   □ Under water [Y] [N]
   □ Swampy [Y] [N]
   □ Exposed pipe surface [Y] [N]

   d. Description of leak point (tick as applicable);

   □ Drilled hole, [Y] [N]
   □ Hack saw cut, [Y] [N]
   □ Explosive tear, [Y] [N]
   □ Complete rupture [Y] [N]
   □ Inward dent, [Y] [N]
   □ Well head tampering [Y] [N]
   □ Failed Weld-on illegal hot tap valve, [Y] [N]
   □ Missing pipeline (flowline) [Y] [N]
   □ Crude oil theft (illegal bunkering) point, [Y] [N]
   □ Third party tampering with Clamp Bolt/Nut, [Y] [N]
   □ Third party tampering with valve setting, [Y] [N]
   □ Third party tampering with flange Nuts/bolts, [Y] [N]
   □ Corrosion, [Y] [N]

   Type: 

   □ Saver-pit over flow, [Y] [N]
   □ Surge vessel overflow, [Y] [N]
   □ Outward dent [Y] [N]
   □ Others (specify). 

   e. Spill point coordinates (MINNA MID-BEEL) - FOR NINE (9) ILLEGAL BUNKERING POINTS.

   Northing: (m)  Easting: (m)
   POINT 1: 66053.5 532807.4
   POINT 2: 65463.9 532726.3
   POINT 3: 65424.0 532723.1
   POINT 4: 65420.8 532722.8
   POINT 5: 64702.3 532629.4
   POINT 6: 64911.2 532511.2
   POINT 7: 64683.8 532666.3
   POINT 8: 63461.6 532503.9
   POINT 9: 63464.6 532503.9

   NOTE: POINTS 1 TO 6 ARE ON THE 28" PIPELINE

   WHILE POINTS 7 TO 9 ARE ON THE 24" PIPELINE.
C. RISK/DAMAGE ASSESSMENT

7. Type of environment of spill site:
   ☑ Swamp
   ☐ Land
   ☐ Water

Type of environment of which oil has spread:

   ☑ Swamp
   ☐ Land
   ☐ Water

8. Distance from the nearest sensitive habitat
   ☑ Farmlands
   ☑ Fish Farm/Pond
   ☐ Others (specify):

9. Containment measures put in place:
   ☑ Booms
   ☑ Trench
   ☑ Dyke
   ☑ Others:

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

11. 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

A. Structures / Properties

<table>
<thead>
<tr>
<th>S/N</th>
<th>Type of Structures</th>
<th>Description</th>
<th>Size</th>
<th>Number</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NONE WITHIN AREA OF IMPACT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Page 2 of 7
B. Crops/Economic Trees

<table>
<thead>
<tr>
<th>S/N</th>
<th>Types of crops</th>
<th>Young</th>
<th>Medium</th>
<th>Matured</th>
<th>Quantity</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NONE WITHIN AREA OF IMPACT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

C. Fish/Nets/Ponds

<table>
<thead>
<tr>
<th>S/N</th>
<th>Fish/Nets/Ponds</th>
<th>Description</th>
<th>Quantity/Size</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NONE WITHIN AREA OF IMPACT</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>S/N</th>
<th>Others</th>
<th>Description</th>
<th>Quantity/Size</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NONE WITHIN AREA OF IMPACT</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

E. GRAPHIC DESCRIPTION OF LEAK POINT (Details should be contained in leak repair report)

Section of 24" and 28" Bomu-Bonny Pipelines at Bodo-West showing locations of nine (9) Illegal Bunkering Connections (five leaking; four non-leaking) all installed at 12 o'clock positions.
<table>
<thead>
<tr>
<th>S/N</th>
<th>Northing (m)</th>
<th>Easting (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>66040.2</td>
<td>532802.7</td>
</tr>
<tr>
<td>66</td>
<td>66051.8</td>
<td>532793.0</td>
</tr>
<tr>
<td>67</td>
<td>66060.7</td>
<td>532791.3</td>
</tr>
<tr>
<td>68</td>
<td>66066.0</td>
<td>532812.0</td>
</tr>
<tr>
<td>69</td>
<td>66049.5</td>
<td>532823.1</td>
</tr>
<tr>
<td>1</td>
<td>65430.1</td>
<td>532704.6</td>
</tr>
<tr>
<td>2</td>
<td>65439.4</td>
<td>532664.6</td>
</tr>
<tr>
<td>3</td>
<td>65494.9</td>
<td>532534.1</td>
</tr>
<tr>
<td>4</td>
<td>65507.6</td>
<td>532542.1</td>
</tr>
<tr>
<td>5</td>
<td>65509.4</td>
<td>532538.2</td>
</tr>
<tr>
<td>32</td>
<td>65497.7</td>
<td>532714.0</td>
</tr>
<tr>
<td>31</td>
<td>65485.4</td>
<td>532714.0</td>
</tr>
<tr>
<td>30</td>
<td>65470.1</td>
<td>532710.9</td>
</tr>
<tr>
<td>29</td>
<td>65457.8</td>
<td>532710.9</td>
</tr>
<tr>
<td>21</td>
<td>65445.5</td>
<td>532704.7</td>
</tr>
<tr>
<td>99</td>
<td>64696.1</td>
<td>532638.6</td>
</tr>
<tr>
<td>100</td>
<td>64696.2</td>
<td>532617.1</td>
</tr>
<tr>
<td>104</td>
<td>64714.6</td>
<td>532638.7</td>
</tr>
<tr>
<td>79</td>
<td>64683.8</td>
<td>532669.4</td>
</tr>
<tr>
<td>83</td>
<td>64677.6</td>
<td>532672.5</td>
</tr>
<tr>
<td>86</td>
<td>64677.7</td>
<td>532660.2</td>
</tr>
</tbody>
</table>
G. INCIDENT INFORMATION:

17  Impacted Area Details  FOR NINE ILLEGAL BUNKERING POINTS
a. Total calculated area of impact  0.8653 Ha
   - Impact within SPDC R.O.W  0.6381 Ha
   - Impact outside R.O.W  0.2272 Ha

18  Volume of oil recovered before completion of JIV (V_{rec}):
    Recovered oil V_{rec}:  NIL  barrels

19. Computation of the residual volume on site
a. Computation of the volume of pooled free phase oil (on land or confined water body).
   i. Area (m²) occupied by pool of free phase oil  0.1229
   ii. Average Depth (m) of pool of free phase oil  0.003
   iii. Volume of pooled of free phase oil, V_{pool}:  134.52 barrels

b. Computation of volume of infiltrated oil in the soil (V-3).
   i. Area (m²) covered by the oil:  1.361
   ii. Average Depth (m) below ground surface of infiltration of oil:  0.008
   iii. Soil type: CLAY
   iv. \( \rho_e \) (effective porosity of the soil):  8%
   v. Volume of infiltrated oil, V_{in}:  5.48 barrels

20. Computation of volume of oil on open water based on standard coloration.

<table>
<thead>
<tr>
<th>Thickness (mm)</th>
<th>Percentage coverage</th>
<th>Volume (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barely Visible</td>
<td>0.00004</td>
<td></td>
</tr>
<tr>
<td>Silvery</td>
<td>0.00008</td>
<td></td>
</tr>
<tr>
<td>Slight Colour</td>
<td>0.00015</td>
<td></td>
</tr>
<tr>
<td>Bright Colour</td>
<td>0.0003</td>
<td></td>
</tr>
<tr>
<td>Dull</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>Dark</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>Black Oil</td>
<td>0.1 (60%)</td>
<td>0.007</td>
</tr>
<tr>
<td>Emulsion (30% Oil)</td>
<td>1 (40%)</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Percent Total 100%  Total Volume 0.50 bbl

NOTE: THE TOTAL AREA OF IMPACT ON OPEN WATER IS APPROXIMATELY 163 M².

21. Calculation of evaporated volume:

i. Oil type: **Bonny Medium**

ii. E-Factor: **15%**

iii.

<table>
<thead>
<tr>
<th>Oil Type</th>
<th>Bonny Light</th>
<th>Bonny Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E-Factor</td>
<td>E-Factor</td>
</tr>
<tr>
<td>Period Since Oil Spill</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1 day</td>
<td>10%</td>
<td>5%</td>
</tr>
<tr>
<td>1-7 days</td>
<td>25%</td>
<td>15%</td>
</tr>
<tr>
<td>&gt;7 days</td>
<td>40%</td>
<td>25%</td>
</tr>
</tbody>
</table>

9. Gross Total Estimated Spilled Volume

\[
V_{\text{rat}}(\text{bbls}) = V_{\text{vap}}(\text{bbls}) + V_{\text{wat}}(\text{bbls}) + V_{\text{inf}}(\text{bbls}) + V_{\text{pool}}(\text{bbls}) + V_{\text{net}}(\text{bbls}) = 24.79 + 0.50 + 5.48 + 134.52 + 0 = 165.29
\]

\[
V_{\text{rat}}(\text{bbls}) = 165.29 \text{ BARRELS}
\]

10. Net Total Estimated Spilled Volume

\[
V_{\text{rat}}(\text{bbls}) = V_{\text{vap}}(\text{bbls}) + 0.6\times V_{\text{wat}}(\text{bbls}) + V_{\text{inf}}(\text{bbls}) + V_{\text{pool}}(\text{bbls}) = 24.79 + (0.6 \times 0.5) + 5.48 + 134.52 + 0 = 165.09
\]

\[
V_{\text{rat}}(\text{bbls}) = 165.09 \text{ BARRELS}
\]

Conversion of m³ to barrel is Total volume VT (m³) x 6.29

*Emulsification factor for spill on water to consider is 60% of volume of oil.

This report was filled and signed on the **05/04/2011** at incident site by joint investigation representative 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]: [✓]

Tick as applicable