THE SHELL PETROLEUM DEVELOPMENT COMPANY OF NIGERIA LIMITED
JOINT INVESTIGATION REPORT FOR INCIDENT NO: 633111

A. GENERAL INFORMATION:

1. Spill incident Number: 633111

2. Name of Location 24" BOMU - BONNY PIPELINE AT K-DERE

3. Name of nearest community K-DERE

4. State RIVERS LGA GOKANA

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

B. INCIDENT INFORMATION:

6. Details of incident
   a. Date of incident 10TH MARCH, 2011
   b. Date/Period of investigation, 11TH MARCH, 2011
   c. Description of spill point environment
      - [Y] Firmed soil [N]
      - [Y] Loose soil [N]
      - [Y] Previously excavated area [N]
      - [Y] Under water [N]
      - [Y] Swampy [N]
      - [Y] Exposed pipe surface [N]
   d. Description of leak point (tick as applicable);
      - [Y] Drilled hole [N]
      - [Y] Hack saw cut, [N]
      - [Y] Explosive tear, [N]
      - [Y] Complete Rupture [N]
      - [Y] Inward dent, [N]
      - [Y] Well head tampering, [N]
      - [Y] Failed Weld-on illegal hot tap valve, [N]
      - [Y] Missing pipeline (flowline), [N]
      - [Y] Crude oil theft (illegal bunkering) point, [N]
      - [Y] Third party tampering with Clamp Bolt/Nut, [N]
      - [Y] Third party tampering with valve setting, [N]
      - [Y] Third party tampering with flange Nuts/bolts, [N]
      - [Y] Corrosion, [N]
      - [Y] Saver-pit over flow, [N]
      - [Y] Surge vessel overflow, [N]
      - [Y] Outward dent [N]
      - [Y] Others (specify). [N]
   e. Spill point coordinates (MINNA MID-BELT)
      Northing: 72908.858m
      Easting: 534899.851m

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C. RISK/DAMAGE ASSESSMENT

7. Type of environment of spill site:
   - [ ] Land
   - [ ] Swamp
   - [ ] water

   Type of environment of which oil has spread:
   - [ ] Land
   - [ ] Swamp
   - [ ] water

8. 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).

9. Containment measures put in place;
   - [ ] Booms [Y][N]
   - [ ] Trench [Y][N]
   - [ ] Dyke [Y][N]
   - [ ] 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>

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### 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><strong>NONE WITHIN AREA OF IMPACT</strong></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><strong>NONE WITHIN AREA OF IMPACT</strong></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><strong>NONE WITHIN AREA OF IMPACT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

**Plan Section of 24" Bomu-Bonny Pipeline at K-Dere Showing Position of Hack Saw Cut.**

![Pipeline Diagram]

75MM HACKSAW CUT AT 12 O' CILOCK POSITION ON PIPELINE
<table>
<thead>
<tr>
<th>S/N</th>
<th>Northing (M)</th>
<th>Easting (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>72730.564</td>
<td>534979.672</td>
</tr>
<tr>
<td>17</td>
<td>72752.238</td>
<td>534852.506</td>
</tr>
<tr>
<td>21</td>
<td>72737.949</td>
<td>534961.718</td>
</tr>
<tr>
<td>23</td>
<td>72739.811</td>
<td>534961.196</td>
</tr>
<tr>
<td>30</td>
<td>72770.886</td>
<td>534936.300</td>
</tr>
<tr>
<td>33</td>
<td>72752.114</td>
<td>534971.971</td>
</tr>
<tr>
<td>38</td>
<td>72767.547</td>
<td>534908.850</td>
</tr>
<tr>
<td>45</td>
<td>72819.770</td>
<td>534905.859</td>
</tr>
<tr>
<td>49</td>
<td>72832.251</td>
<td>534902.012</td>
</tr>
<tr>
<td>66</td>
<td>72962.779</td>
<td>534902.852</td>
</tr>
<tr>
<td>70</td>
<td>72902.674</td>
<td>534912.168</td>
</tr>
<tr>
<td>77</td>
<td>72908.848</td>
<td>534906.015</td>
</tr>
<tr>
<td>75</td>
<td>72908.858</td>
<td>534899.851</td>
</tr>
<tr>
<td>81</td>
<td>72897.660</td>
<td>534890.589</td>
</tr>
<tr>
<td>82</td>
<td>72896.588</td>
<td>534890.583</td>
</tr>
</tbody>
</table>
G. INCIDENT INFORMATION:

17 Impacted Area Details
   a. Total calculated area of impact:
      - Impact within SPDC R.O.W: \(53.4 \text{ m}^2\) (0.05 Ha)
      - Impact outside R.O.W: \(39.3 \text{ m}^2\) (0.04 Ha)
      - Impact outside R.O.W: \(14.1 \text{ m}^2\) (0.01 Ha)

18 Volume of oil recovered before completion of JIV \(V_{\text{rec}}\):
   Recovered oil \(V_{\text{rec}}\): 5 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 \(m^2\) occupied by pool of free phase oil: 231
      ii. Average Depth \(m\) of pool of free phase oil: 0.078
      iii. Volume of pooled of free phase oil, \(V_{\text{pool}}\): 113.3 barrels

   b. Computation of volume of infiltrated oil in the soil \(V_{\text{in}}\).
      i. Area \(m^2\) covered by the oil: 303
      ii. Average Depth \(m\) below ground surface of infiltration of oil: 0.03
      iii. Soil type: CLAY
      iv. \(p_e\) (effective porosity of the soil): 8%
      v. Volume of infiltrated oil, \(V_{\text{in}}\): 4.6 barrels

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

<table>
<thead>
<tr>
<th>Thickness</th>
<th>Percentage coverage</th>
<th>Volume (m3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barely Visible</td>
<td>0.00004</td>
<td>NOT</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>APPLICABLE</td>
</tr>
<tr>
<td>Dark</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>Black oil</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Emulsion (30% Oil)</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Percent Total 100% Total Volume NIL bbl

21. Calculation of evaporated volume:

i. Oil type: **Bonny Medium**

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

iii. Volume of evaporated oil, $V_{ev} = 21.7$ barrels

<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</td>
<td>10%</td>
<td>5%</td>
</tr>
<tr>
<td>Spill</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1 day</td>
<td>25%</td>
<td>15%</td>
</tr>
<tr>
<td>1-7 days</td>
<td>40%</td>
<td>25%</td>
</tr>
</tbody>
</table>

9. Gross Total Estimated Spilled Volume $V_{tot}(bbls) = V_{vap}(bbls) + V_{wat}(bbls) + V_{inf}(bbls) + V_{pool}(bbls) + V_{rec}(bbls) = 21.7 + 0 + 4.6 + 113.3 + 5 = 144.6$

$V_{tot}(bbls) = 144.6$ BARRELS

10. Net Total Estimated Spilled Volume $V_{est}(bbls) = V_{vap}(bbls) + 0.6*V_{wat}(bbls) + V_{inf}(bbls) + V_{pool} + V_{rec}(bbls) = 21.7 + 0 + 4.6 + 113.3 + 5 = 144.6$

$V_{est}(bbls) = 144.6$ BARRELS

*Calculation of the respective estimated volume is to done using the new spill estimation software on site
*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 **11/03/2011** 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]