Demolition of Redundant Oil Pipelines

Introduction

Replacement of the old pipelines which exceed its life time by a new one is one of the methods used to avoid excess leaks, Shutdowns, high maintenance cost, Safety Hazards & Environmental impacts. In that case the Demolition of the redundant oil pipeline becomes important for the following reasons:

- Avoid uncontrolled oil and gas leaks
- Avoid uncontrolled Soil Contamination
- Use of the old pipeline route for any future extension.
- Economical benefits through the use of the scrape materials as well as the inline oil.

The aim of this paper is to introduce the guide lines for safe, economical & practical techniques to implement such job, which have been proven through a successful demolition of 50 Km of crude oil pipelines with various diameters starting from 16” to 48” through the following three main activities.

1- Survey and data collection of the pipeline to be demolished is the main parameters to settle the proper work method statement, all the data related to the line starting from the pipeline profile, P&ID, Tie Ins, Pipeline inspection records, pipe wall thickness through the pipeline soundings e.g drain pits, headers, occupation & other adjacent or intersecting lines.

2- De-oiling and cleaning activities is the critical pass of the demolition job, a de-oiling plan has to be prepared according to the previous collected data where the isolation points, de-oiling point, vent points, used pumps, receiving line and the de-oiling method has to be clearly identified, de-oiling activity can be carried out either by gravity bulk de-oiling and then removing of the residual oil by pigging which is suitable some cases where direct pigging de-oiling is more suitable for other cases.

The pigging process proves its capability of effective and economical de-oiling and cleaning method where the pipelines profile normally shows a numerous low points along the route as shown in Fig No.1 in which the oil accumulates and spills during the cutting process causing an excessive soil contamination with addition to uncontrolled delay and cost impact.
Photo No. 1 shows the oil leak and soil contamination produced during the cutting of pipeline which has been gravity de-oiled without carrying the pigging process to remove the residual oil.
Photo No.2 shows the presence of oil and sludge found in one of the pipe segments.
Photo No. 3 Shows the trench of pigged pipeline clear from any oil spill or contamination

Photo No. 4 and 5 shows one of the pipes removed from the pigged pipeline where its completely free from oil.
It has been noticed in our project that Pigging of the pipelines prior to cutting and transportation save approximately 40% of overall cutting cost and time.

In most of the cases it's more feasible to convert the unpiggable pipeline into piggable pipeline which can be done through some or all of the following steps as per the pipeline condition:

- Installation of temporarily Pig Launcher and Receiver.
- Use of suitable pig for 1.5D Elbows.
- Use of Long nose Pig or extra long Pig to path through the unbarred Tee.
- Remove any obstacle can create a reduction in the line internal diameter or use a suitable Pig which can accommodate the reduction of internal Diameter.

The Pig designer and manufacture is a partner for choosing the suitable pig for the assigned application therefore the full line data shall be shared to reach a succeeded pigging process.

Where the de-oiling and pigging process for a life pipeline is a high risky job a proper job safety analyses shall be prepared and followed which shall include but not limited to the following precautions.
• At no circumstances the oxygen content at any point in the line upstream or down stream the pig shall exceed 5%, Nitrogen gas is suitable for purging the line prior to pigging and running the pig.
• In case of removing the residual oil by pigging the receiver shall be connected to a reservoir partially filled with water for hydrocarbon gas dumping and spark elimination, the vent shall be directed to a safe area.
• Continuous pigging with controlled speed reduces the probability of pig damage.

3- Excavation, Cutting and Transportation Controls approximately 70% for the most of the demolition job Cost and Time. 

**Mechanical Excavation** can be used to save cost and time under high safety precautions. Filling the line by Nitrogen with positive pressure eliminates any fire probability can be produced due to hitting the line during the excavation process.

**Choosing the suitable cold cutting method** directly affects the cutting cost and time.

The following table compare between the manual cold cutting method and the air driven travel cutters through the practical experience.

---

**Practical Comparison between the fixed frame Manual Cutters and air Driven Travel Cutters**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Item of Comparison</th>
<th>Fixed frame Manual Cold Cutting</th>
<th>Travel Cold Cutting Machines</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Diameter Size Range</td>
<td>Up to 36&quot;</td>
<td>Up To 52&quot;</td>
</tr>
<tr>
<td>2</td>
<td>Flexibility in size range for one machine</td>
<td>Limited to 3 consequence sizes</td>
<td>Full range</td>
</tr>
<tr>
<td>3</td>
<td>Initial Cost / Machine</td>
<td>Relatively Low</td>
<td>Relatively High</td>
</tr>
<tr>
<td>4</td>
<td>Depreciation Rate</td>
<td>Relatively Low</td>
<td>Relatively High</td>
</tr>
<tr>
<td>5</td>
<td>Cutters Cost</td>
<td>Relatively Low</td>
<td>Extremely High</td>
</tr>
<tr>
<td>6</td>
<td>Required Equipments</td>
<td>Non</td>
<td>Air Compressor</td>
</tr>
<tr>
<td>7</td>
<td>Required Manpower</td>
<td>2 Skilled labors and 2 Helpers</td>
<td>1 Highly Skilled Technician and 2 helpers</td>
</tr>
<tr>
<td>8</td>
<td>Weight and Moving from cutting point to another</td>
<td>Relatively light weight shifted Manual</td>
<td>Relatively Heavy weight (100 KG)</td>
</tr>
<tr>
<td>9</td>
<td>Productivity for 34&quot; line Size per day</td>
<td>6 to 7 cutting point</td>
<td>4 to 5 Cutting Point</td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------</td>
<td>---------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>10</td>
<td>Accommodate pipe unsoundness &amp; Cutting Quality</td>
<td>Relatively low, May produce partial cut points</td>
<td>Relatively High, Full Cut</td>
</tr>
<tr>
<td>11</td>
<td>Maintenance</td>
<td>High Reliability required Minimum maintenance</td>
<td>Required More maintenance</td>
</tr>
<tr>
<td>12</td>
<td>Recommendation</td>
<td>More Suitable for same size or consequences sizes with mass production and thickness up to 10 mm</td>
<td>More Suitable for varias sizes and high thickness</td>
</tr>
</tbody>
</table>

**Using of gas cutting method** reduce the demolition job time and cost, the pigged line can be cut into 24 mt segments, the segment to be removed from the trench then left enough time for ventilation (minimum 24 Hr), visual checking shall be carried out to be sure that the pipe segments is free from any sludge or oil residuals.

Gas test shall be carried out to be sure that the full pipe segments is free from any flammable gases, then the gas cutting can be used as shown in photo No.6 & 7.

![Photo No. 6](image-url)
Conclusion:

It has been found that accommodation of the high productivity construction techniques in the demolition activity through a detailed study for the pipeline data and proper safety risk analyses extremely affect the demolition job safety, Time and Cost.

Each Pipeline to be demolished has to be treated as a special case due to the variance of the pipelines Conditions and circumstances.