

Solutions to Brownfield Problems by Using Casing Inspection Tool

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Summary

In order to diagnose and liquidate the well problems and carry out suitable measures for solutions, Cased hole and Production logging service is one of the important tools. Besides other diagnostic studies, 40-arm Casing Inspection Caliper is a very useful tool which has been used in six wells of Mehsana Asset, recently. This study has yielded positive results in detecting casing damages and helped in taking decisions for work-over jobs. On the basis of the study of the well data of these wells in conjunction with 40- Arm Casing Inspection Caliper log, successful work-over jobs were carried out in three wells and other three wells were approved for abandonment.

Introduction

Today, Mehsana Asset is the highest oil producing onshore oil field of ONGC. All the major oil producing fields viz. North Kadi, Sobhasan, Santhal, Balol and Jotana are mature fields. In Balol and Santhal fields, In-situ Combustion Technique has been implemented successfully for heavy oil recovery. This method puts extra strain on the casing due to generation of heat. Besides, there are many wells where injection of steam and water are being carried out alternately. In such operations, casing is being damaged and during work over jobs, various problems are cropped up. Cased hole and Production logging service is used to detect mechanical problems such as casing / tubing leaks, casing partition, corrosion etc which, in turn, provide guidance for work-over jobs. One of the tools which can help in detecting these problems is Multi-Arm Pipe Inspection Caliper.

The features of Multi-Arm Inspection Calipers are:

- Determination of internal size and condition of tubing and casing.
- Detection of corrosion, perforations, holes, pipe separations, splits, flats, scale build- up etc.

The tools are motor operated for opening and closing the caliper for immediate repeats with continuous surface recording facility. A full range of mechanical multi-arm pipe inspection calipers e.g. thirty, forty, sixty and eighty arms are available in the market to inspect internal condition of the pipe. In addition, these calipers come in different diameters ranging from 2-3/8" to 10-3/4". These tools give a minimum resolution of 0.5" of the pipe circumference.

A study has been recently carried out in six wells of Mehsana Asset by Logging Services, ONGC, Mehsana by using 40-Arm Casing Inspection Tool.

Method

The 40-Arm Casing Inspection Caliper having mechanical calipers gives accurate measurements of the inside diameter of casing. The tool is having outer diameter of 3.63", length 56.75" and weight 83 lbs. It covers a range of pipe sizes ranging from 4 1/2" to 7". A schematic diagram of the tool is shown on Figure-1. The measurements are made using 40-Arms which are centralized using roller-tipped centralizers above and below the measuring arms. The arms are made up of tungsten carbide and tipped for wear and tear. When released down hole, spring loaded arms press against the pipe wall. The tool can be closed and reopened under surface control for any number of log repeats. This multipass feature allows the detection of pipe defects that

are even smaller than the distance between the feeler arm tips. The tool is lowered in a well being filled with water or brine.

Case Studies

Case No.-1

WELL NO. : A

The well was completed in the year 1988 as a producer and was converted as an EOR injector in the year 2002. As the well stopped taking air since 21.12.2004, work over rig was deployed to clear the hole to resume air injection and to make the well ready for wet phase conversion with GLV / sliding sleeve and hydraulic packer.

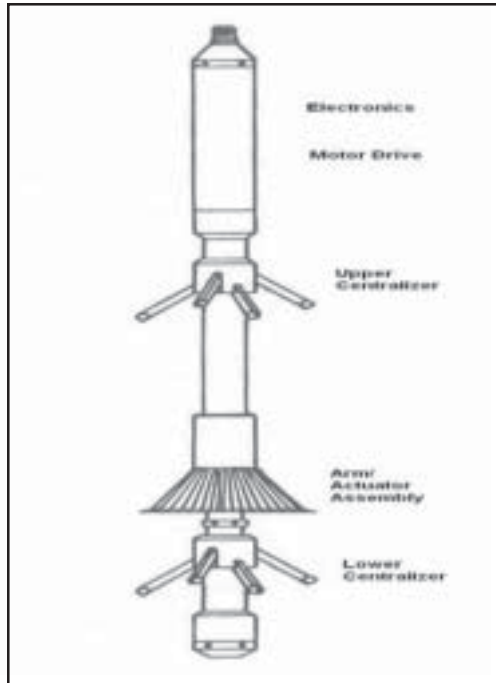


Fig. 1: Mechanical 40- Arm Casing Inspection Tool

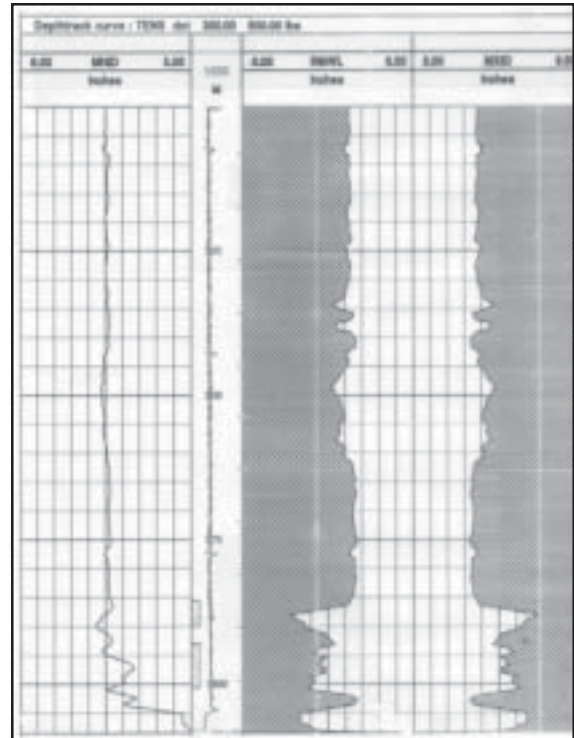


Fig 2: Casing Caliper log of Well No. A

During work-over job difficulty was faced in clearing the well to bottom. It was decided to record 40-Arm Casing Pipe Inspection Caliper to find out the integrity of the casing.

- Log was recorded in the interval 810.0-1004.0 m. (Fig No. 3).
- Casing in the interval 927.0-960.0 m was found to be of slightly different diameter than the normal diameter. Damage in the casing was not much.
- Casing in the interval 985.5-1001.0 m was found to be of larger size than the normal size of the casing indicating damaged casing. However, it was against the perforated intervals only.
- The work over job was carried out as per plan.

Case No. -2

WELL NO. : B

The well was completed in the year 1988 as a producer and was converted as an EOR injector in the year 2001. As the well was not taking air, work over rig was deployed to clear the obstruction and to resume air and water injection. During work-over job difficulty was faced in clearing the well to bottom. Corrosion and poor condition of the casing were reported by Well Services. It was decided to record 40-Arm Casing Pipe Inspection Caliper to find out the integrity of the casing.

- Log was recorded in the interval 700.0-933.0 m. (Fig No.2).
- Casing diameter in the interval 890.0-902.0 m was

found to be of smaller size than the normal casing diameter indicating badly deformed casing.

- Casing diameter in the interval 922.0-933.0 m was non uniform at different intervals indicating damaged condition of casing.
- Based on the information of Casing Inspection, realizing that the casing was beyond repairs, it was decided to abandon the well.

Case No.-3

WELL NO. : C

The well was completed in the year 1972 and was converted to water injector in the year 1995. Later, in the year 1998 the well was put back to production. The cumulative oil production as on June 2004 is 17,900T. The well was not producing oil since June 2004. Work over rig was deployed to convert this well as an Effluent Disposal well in the intervals below the existing perforations (1029.0-1037.5 m and 1040.0-1044.0 m). During work-over the well could not be cleared up to bridge plug (1046.6 m). It was decided to record 40-Arm Casing Pipe Inspection Caliper to find out the integrity of the casing.

- Log was recorded in the interval 800.0-1040.0 m. (Fig No. 4).
- Size of the casing up to 1036.5 m was found to be normal.

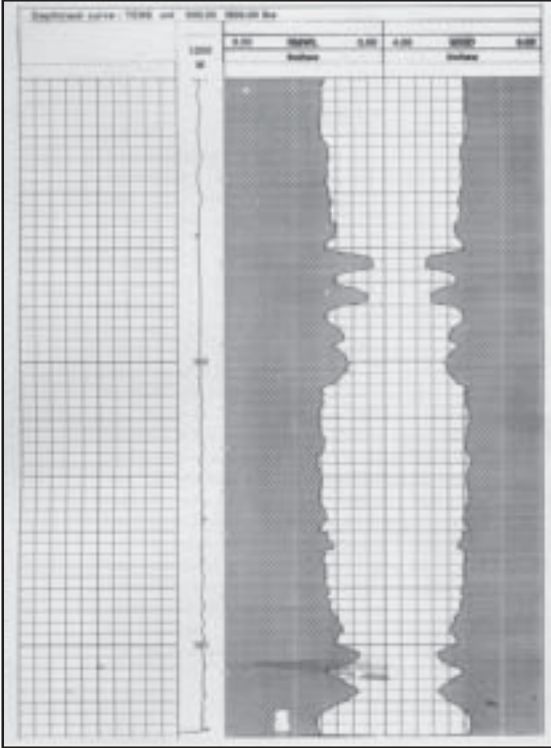


Fig 3: Casing Caliper log of Well No. B

- Diameter of the casing below 1036.5 m was found to be very large indicating absence of casing below this depth.
- The well was approved for abandonment.

**Case No.-4
WELL NO. : D**

The well was completed in the year 1995 as a producer and was converted as an injector of Santhal in-situ Phase-I in the year 1999. Air was being injected @ 35000 Nm³/d. High pressure in annulus was observed and hydraulic packer failure was suspected as the same could not be released. Hence, work over rig was deployed to recompleat the well with hydraulic packer and GLV / Sliding sleeve after replacing the corroded tubings, if any. During work-over job, 40-Arm Casing Pipe Inspection Caliper was recorded to find out the integrity of the casing.

- Log was recorded in the interval 980.0-1055.0 m (Figure-5)
- Size of the casing up to 1042.5 m was found to be normal.
- Diameter of casing against the interval 1042.5-1046.0 m was found slightly larger than the normal diameter indicating some damage in the casing. However, it was

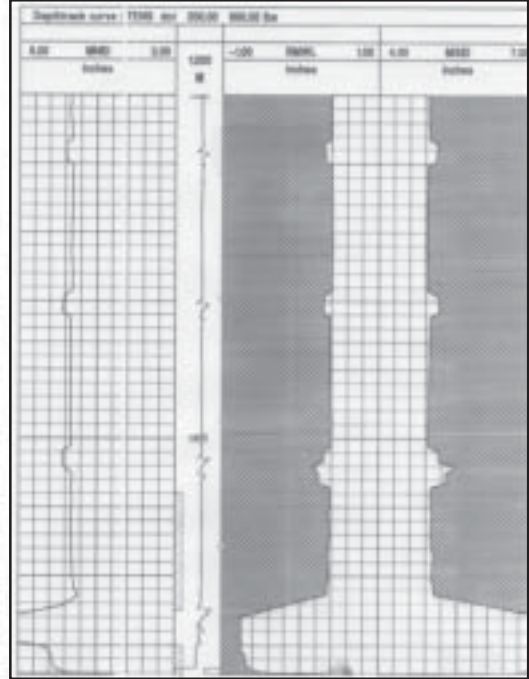


Fig 4: Casing Caliper log of Well No. C

- against the perforated interval only.
- The work over job was carried out as per plan.

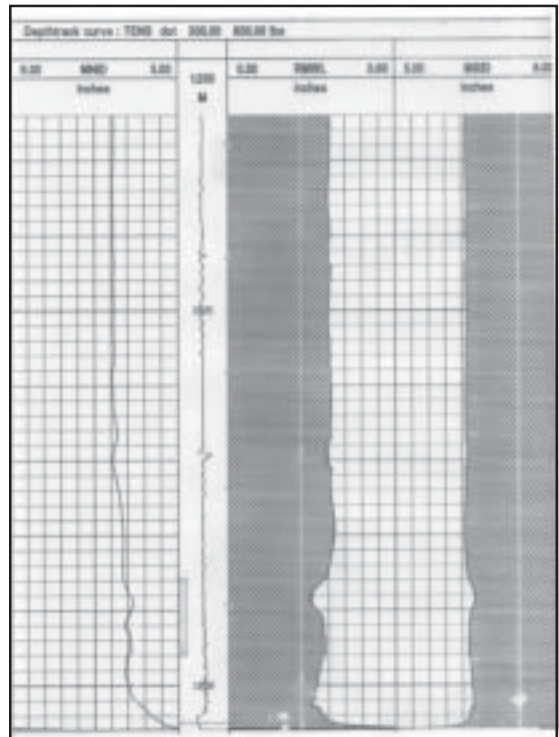


Fig 5: Casing Caliper log of Well No. D



Case No.-5 WELL NO.: E

The well was completed in the year 1988 as a producer and was converted as an injector of Balol in-situ Phase-I in the year 1998. Air was being injected @ 62000 Nm³/d. High pressure in annulus was observed and hydraulic packer failure was suspected as the same could not be released. Hence, work over rig was deployed to re-complete the well with hydraulic packer and GLV / Sliding sleeve after replacing the corroded tubings, if any. During work-over job, 40-Arm Casing Pipe Inspection Caliper was recorded to find out the integrity of the casing.

- Log was recorded in the interval 820.0-950 m (Figure-6).
- Size of the casing up to 935.0 m was found to be normal.
- Diameter of casing against the interval 935.0-946.0 m was found slightly larger than the normal diameter indicating damage in the casing. However, it was against the perforated interval only.
- As the 40-Arm Casing Caliper established that there was no major damage / corrosion to the casing, the well was completed as an air injector after work over job.

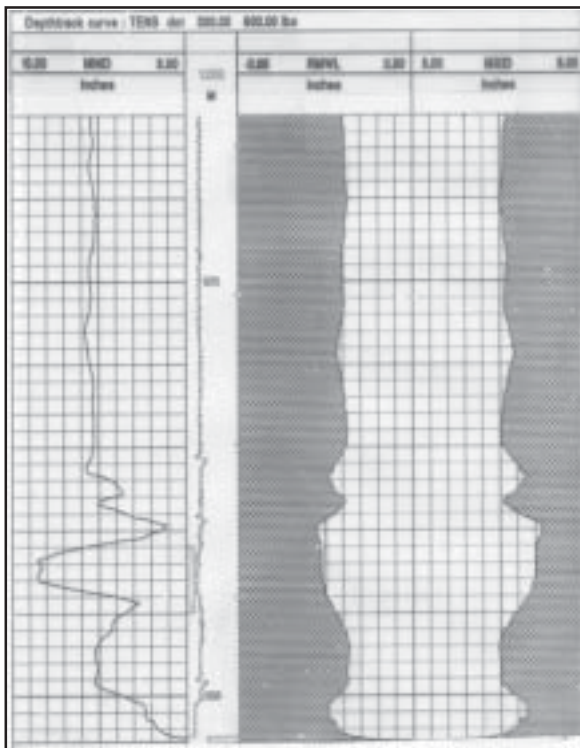


Fig 6: Casing Caliper log of Well No. E

Case No.-6 WELL NO. : F

The well was completed in the year 1985 as a producer. The well stopped producing since 04.09.2002. Hence, work over rig was deployed for water shut off job. During workoverjob, a communication between annulus (5 1/2"X2 7/8"), outer annulus (5 1/2"X9 5/8") and ground (cellar pit and surroundings) was observed. It was decided to record 40- Arm Casing Pipe Inspection Caliper to detect casing leakage.

- Log was recorded in the interval 0.0-50.0 m (Figure-7)
- Diameter of the casing in the interval 5.5-8.0 m was found to be of larger size as compared to normal diameter indicating casing damage against this interval. It was in the first casing from the surface.
- Diameter of the casing in the well was found to be variable at different intervals which may be due to casing of different sizes.
- The well was approved for abandonment.

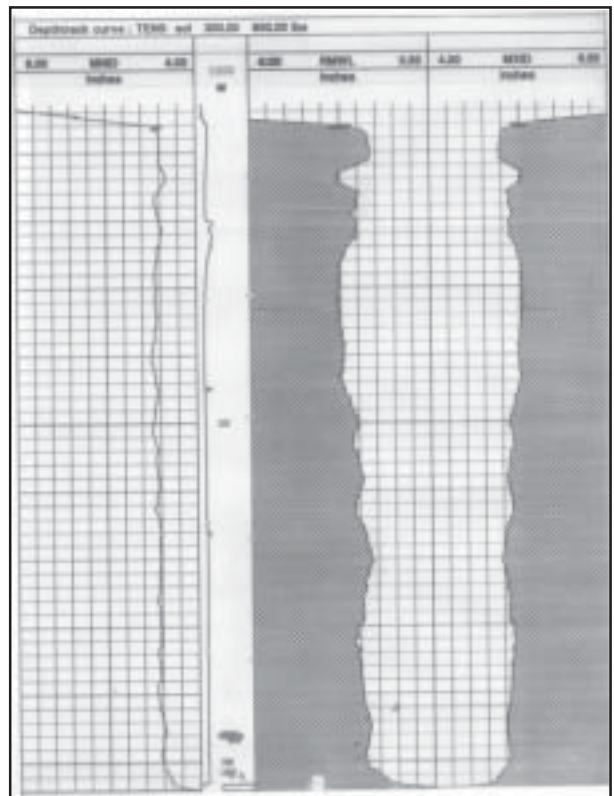


Fig 7: Casing Caliper log of Well No. F

Conclusions

As there is a risk in explorational activity so also is in the developmental aspects. It is very important to know

how long a particular casing is going to serve us in meeting the desired objective. This can only be assessed by running cased hole tools like 40-Arm Casing Caliper which is of immense use in mitigating operational risks. 40-Arm Pipe Inspection Caliper has been found to be very useful in assessing the overall condition of the pipe, whether it is to evaluate the suitability of changing a producing well to an injector, assessing the condition of casings to continue the work-over plans or determining the financial value of pipe before plugging and abandoning a well.

After analyzing the 40-Arm Pipe Inspection Caliper data along with well data, successful work-over jobs were carried out in three wells, namely, Well # A, D and E. It also helped in taking decision for the abandonment of Well # B, C and F.

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Views expressed in this paper are that of the author only and may not necessarily be of ONGC.

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