

SPE 109882

## Mad Dog Slot W1 Tubing Deformation Failure Analysis

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This paper was prepared for presentation at the 2007 SPE Annual Technical Conference and Exhibition held in Anaheim, California, U.S.A., 11–14 November 2007.

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### Abstract

On 20Apr05, while bringing Mad Dog Slot W1 back on production after a brief shut-in, pressure developed on the A annulus and persisted despite repeated bleeds. Diagnostic pressure tests and logs eliminated a number of possible sources of the annulus pressure, eventually leading to the conclusion that the 9-7/8 in. production tieback had been breached. Further investigative logs led to the observation of ovalization of the production tubing.

This study summarizes the efforts of the team assigned to investigate the causes of the production tubing and casing deformation. The outcome of the analysis suggests a subtle failure mode, ultimately related to attempts at annular pressure build-up mitigation. The subtlety emphasizes the importance of (a) design considerations in uncemented annuli opposite salt, (b) the importance of creating a complete cement sheath and (c) the inherent difficulties in converting an appraisal well into a producing well.

The study concludes with a brief review of the changes implemented in the replacement well intended to eliminate a repeat of the identified failure mechanism(s).

### Introduction

On 20Apr05, while bringing Mad Dog Slot W1 back on production after a brief shut-in, pressure developed on the A annulus and persisted despite repeated bleeds. Diagnostic pressure tests and logs eliminated a number of possible sources of the annulus pressure, eventually leading to the conclusion that the 9-7/8 in. production tieback had been breached. Further investigative logs led to the observation of ovalization of the production tubing.

As part of BP's response to this incident, two teams were formed – a Recovery Team charged with building a plan for re-entering and attempting to salvage the well and an Analysis Team. The Analysis Team was charged with gathering and interpreting all diagnostic data relating to the loss of primary

pressure containment barrier(s) at Slot W1, and with determining the probable cause(s) of the failure on Slot W1. This manuscript summarizes the findings of the Analysis Team.

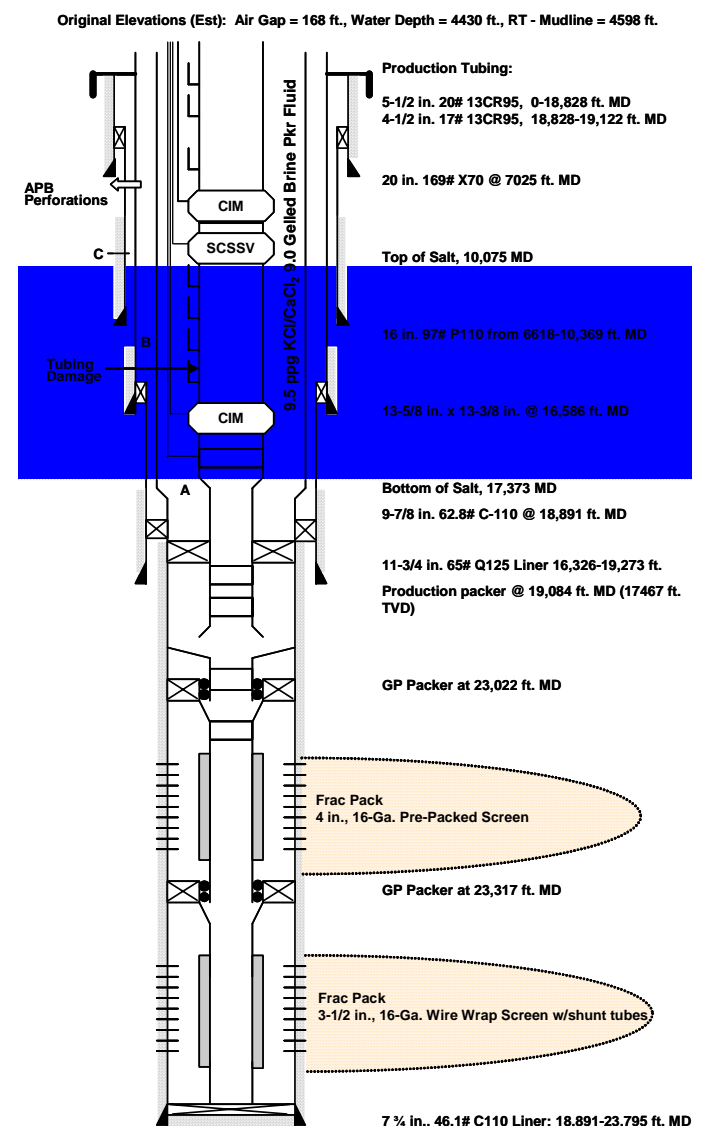


Fig. 1 – Schematic of Mad Dog Slot W1 Wellbore

**Terminology.** Fig. 1 is an overview schematic of Well W1, illustrating various well components to be addressed in the