Solution Mining Research Institute Spring 2013 Technical Conference

Lafayette, Louisiana, USA, 22 – 23 April 2013

Selection of Methods for Casing Cuts in Gas Filled Caverns

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Abstract

Operational priorities and periodic monitoring of gas storage caverns often require that hanging casing strings be cut and dropped to the cavern floor. Hanging strings may be dropped to increase gas flow or to allow direct measurement of conditions in the ambient cavern space without the influence of one or more pipe walls. Gas storage operators are increasingly seeing the benefit of accurate down-hole pressure and temperature monitoring while the cavern is in active natural gas storage service. Also, State and/or Federal regulatory agencies require periodic sonar surveys. Both of these tests may require, or be greatly facilitated, if the de-brining string is cut or removed from the cavern. There are also times when a brine string becomes damaged and has to be cut and replaced for reasons such as a separated or leaking collar or a collapsed pipe.

The brine string is typically casing of up to 9-5/8 inch diameter pipe. The process of pulling this string to the surface, while the cavern is in gas storage service, requires a costly snubbing workover, an operation that incurs some risk – safety, environmental, and financial. Many of the same objectives may be met by cutting the casing, and a variety of methods have been successfully utilized to accomplish this in gas caverns.

There are a number of methods that have been designed to cut tubing/casing. The method chosen can vary depending upon the environmental conditions inside the pipe, type of metal (steel, stainless steel, chrome, Hastalloy). This presentation will examine some of the methods used, their advantages, disadvantages, and uses in the gas storage cavern processes. Four basic methods used to cut pipe are: explosive charges, chemical agents, plasma, and mechanical cutters.

Explosive cutting tools include jet cutters, split-shot tools, and linear explosive charge cutters, which use controlled directional charges. Chemical cutting tools use bromine trifluoride, which reacts violently when exposed to organic materials. Plasma cutting tools for this purpose are referred to as Radial Cutting Torch (RCT). Representing the latest in cutting technology, this method uses a thermite material that, when ignited, creates a super-heated plasma to cut the pipe. Mechanical cutting tools are rotating cutting blades, and abrasion cutting tools. The abrasion cutting tools use high pressure nozzles to direct a jet of abrasive fluid at the casing wall. There are two other methods which are rarely used in the storage well industry and they are collider and electrical arc methods.

Of the above methods jet cutting and split-shot cutting (both controlled directional charges), mechanical rotating cutting blades, and abrasion cutting (high pressure nozzle with abrasive fluids) are used in gas filled caverns. Of these, the wireline-deployable methods such as a jet cutter, “split-shot” cutter, and mechanical cutters are utilized the most often. Additionally, mechanical methods such as an abrasion cutting system and mechanical arm “blade” type cutter have been deployed with success. This technical paper will describe each technology, its primary application, and the associated benefits and disadvantages of each.

Key words: Caverns for Gas Storage, Gas Storage, Well Casing, Well Logging