

THE GEOLOGICAL ASPECTS OF MINING UNDERGROUND CAVERNS FOR L. P. G. STORAGE

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Underground storage for L. P. G. (propane and butane) is used in areas where natural gas is not available. There is a big demand for this type of product in the winter but virtually none in the summer. The low value of the product plus the necessary use of vessels with a working pressure of 75 to 150 psi, made it extremely uneconomical to store summer surplus for winter sales. As a result considerable amounts were burned with resultant waste.

About 1950 there developed in the industry considerable interest in obtaining large volume storage for these products at reasonable cost. Two types of underground storage were found as a result of this study. The cheapest and most widely used underground storage for L. P. G. is cavities leached or washed out in salt beds or domes. The salt is dissolved by fresh water from the prospective cavern, and the cost varies from \$.50 to \$2.00 per barrel of capacity.

In localities where salt beds are unavailable, underground cavities are mined, at a cost of \$3.00 to \$7.00 per barrel of capacity. On the other hand, above-ground steel storage tanks cost about \$20.00 to \$30.00 per barrel of capacity. Propane and butane are less viscous than water and hence will go where water cannot. For this reason the storage rock must be impervious, massive enough to allow excavation of a cavity and structurally sound. It also must be inert so as not to react with the stored material. It takes greater pressure than one pound per foot of depth to fracture the formation.

The pressure in the cavern would need to exceed the weight of the overburden to fracture it. As pressure rarely exceeds 150 psi, a minimum depth of 200 feet is adhered to for safety.

Operating losses are negligible. The usual practice is to remove only the liquid leaving a perpetual inventory of vapor. Waste of about 1% of the capacity in the purging of the cavity and placing it in operation is usual. After the initial waste in inventory, there should be an operating loss of less than 1/2 of 1%.

Principal users of underground storage are LPG-Gas producing plants, distribution terminals, refineries, pipe line terminals, barge and ship transportation, petrochemical industry, and gas utilities. The idea for the mined type of storage was conceived and developed by the Warren Petroleum Corporation of Tulsa.

GRAVITY AND MAGNETICS FOR GEOLOGISTS AND SEISMOLOGISTS

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To a great many petroleum exploration people the words "geophysics" and "seismograph" are almost synonymous and there is a tendency to forget that other methods have their uses in petroleum exploration. While it is true that seismograph operations consume some 90 per cent of the total geophysical expenditures the other methods have a definite and useful place in the total exploration picture.

This talk reviews briefly the fundamental principles of gravity and magnetic methods and outlines the geological problems in which they are applicable.