

in North America. Unlike most other large refiners of the period who concentrated on maximizing kerosene production yields, the Downer organization made nearly every product then possible from a barrel of crude. The Downer firm revolutionized the lubricating industry.

Devising the best distilling and chemical treatment methods and early innovations like cracking in the late 1850s, the Downer Kerosene Oil Co. became the standard of excellence in the young refining industry. In the 1860s new and radically different products like deodorized, neutral lubricating oil and mineral sperm oil enhanced the firm's reputation for technological leadership and excellence. Additionally, Downer successfully manufactured these new products on a large commercial scale and sold them with similar success to the consuming markets of North America and Europe. Downer was a larger-than-life entrepreneurial force, a legend in his own time and one of the great pioneers of the early oil industry.

**OF KENTUCKY SALT AND OIL:
A HISTORY OF EARLY PETROLEUM FINDS ALONG
THE CUMBERLAND RIVER**

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Kentucky's pre-1859 petroleum history is rich but largely unknown. This article provides accounts of early boring and explorations, particularly for brines for the manufacture of salt that instead found commercial quantities of oil. The discovery of early salt springs led directly to the drilling of two important Kentucky wells. The Beatty oil well was drilled in 1818 at the mouth of the eponymous Oil Well Branch of the Big South Fork of the Cumberland River, McCreary County. Two attempts to ship oil to market along the Big South Fork, ended in disaster and lead to creation of an overland route. Beatty abandoned the well and later founded successful salt works at other locations. In 1829, the Old American Well near Burkesville, Cumberland County, became famous as the first gusher to make news worldwide. Drilled on Little Renox Creek a tributary to the Cumberland River, oil from the well flowed unchecked into the river and was ignited. Oil from this well was widely sold for medicinal purposes and was used by Sam Keir of Pennsylvania to treat his wife's tuberculosis. The production and attention these wells attracted led directly to Kentucky's post-Civil War oil boom.

**THE HALF-CENTURY ANNIVERSARY OF PROJECT
KETCH:
A PROPOSAL TO CREATE NATURAL GAS
STORAGE IN NORTHCENTRAL PENNSYLVANIA
THROUGH NUCLEAR DETONATION**

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POSTER PRESENTATION

Most instances of natural gas history in Pennsylvania are notable for what did happen; the following is one example which is just as notable for what didn't. In this case, a U.S. President's speech in December 1953, combined with a U.S. Supreme Court decision made just six months later, might have set into motion a chain of events that led to the consideration of the underground detonation of a nuclear device in northcentral Pennsylvania for the purpose of creating a natural gas storage cavern by the end of the 1960s.

The President was Dwight D. Eisenhower, lauding an "Atoms-for-Peace" proposal in his speech to the United Nation's General Assembly. The court ruling was *Phillips Petroleum Co. v. Wisconsin*, 347 U.S. 672 (1954), decided on June 7, 1954, which determined that the Federal Power Commission (predecessor to FERC, the Federal Energy Regulatory Commission) was authorized under the Natural Gas Act of 1938 to regulate the wellhead price of natural gas sold into interstate pipelines.

The court decision resulted in natural gas being kept at artificially low prices, making it attractive to consumers and therefore increasing its demand, particularly in the post-WWII economy. But with profits effectively constrained, there was little incentive for drilling companies to explore for additional supplies; the risk of dry holes or only marginally profitable ones was a substantial one. These factors of supply and demand combined to create natural gas shortages in the 1960s, with additional anticipated ones being projected into the 1970s. These circumstances made natural gas storage a valuable commodity, particularly in meeting peak demand along the East Coast during the winter months.

One company challenged by meeting the energy needs of its customers in Pennsylvania and other states in the 1960s was Columbia Gas System Service Corporation (Columbia Gas). One of this company's subsidiaries, Manufacturer's Light & Heat Company (ML&H), was operating seven of 61 active natural gas storage pools in Pennsylvania at the end of 1960. Six of the ML&H's storage fields were located

in the southwestern Pennsylvania (Greene, Washington and Westmoreland Counties) and one was in Jefferson County.

Depleted production fields converted to gas storage ones aren't typically or conveniently located near large markets for the gas. Columbia began contemplating the artificial creation of a natural gas storage cavern through the detonation of a large underground explosive device. If such methodology was proved to be safe and both economically and technologically feasible, it could be replicated elsewhere in the U.S. where access to stored gas wouldn't need to be dependent on depleted fields.

So in early 1964, Columbia Gas began discussions with the Atomic Energy Commission's (AEC) Division of Peaceful Nuclear Explosions which had oversight of the AEC's "Plowshare" program, created in 1957 as an outgrowth of President Eisenhower's Atoms-for-Peace initiative. The program's name came from a Biblical passage referencing the "beating of swords into plowshares", and its purpose was to determine the feasibility of using nuclear weapons' knowledge and technology developed during the war for peaceful purposes, such as blasting road cuts, creating canals, quarrying, and other underground engineering projects – including the creation of a gas storage cavern.

Columbia Gas had a particular site in mind. Within three years following discovery of the Leidy Oriskany gas field in 1950, ML&H drilled at least two deep exploratory wells (API #s 37-035-90027 and 37-035-90008) at locations adjacent to the company's pipeline in Beech Creek Township, Clinton County, PA, approximately 20 miles south-southeast of the Leidy field. These wells were drilled along strike of the Hyner Dome, to depths averaging about 8000' below ground, but came up dry and were plugged. However, the lithologic data collected during the drilling of these wells probably lent itself to later use by the company in selecting its location and depth interval of interest for the proposed cavern.

A feasibility study outlining the economics of the proposal, its location and geologic setting, theorized resultant radioactivity, and the timeframe associated with the project were summarized in a July 1967 report put out jointly by Columbia Gas, the AEC, US Bureau of Mines and the Lawrence Radiation Laboratory at the University of California. The project was given the Plowshare name of Ketch.

Should the results of the feasibility study have met certain criteria, the project could have resulted in a 24 kiloton nuclear device being detonated for the purpose of creating an underground natural gas storage cavern to be owned and

operated by Columbia Gas. The cavern itself was predicted to have taken the form of a rubble-filled "chimney" having dimensions of approximately 300 feet in height and a radius of about 90 feet. This centralized void space, combined with fractures extending out for distances of up to 650 feet, was anticipated to be able to accommodate about 465,000 Mcf of natural gas.

The 1967 feasibility study described the location of the proposed project as being located along the southwestern limb of the Hyner anticline, with the proposed depth of the shot being planned for approximately 3300 feet below ground, and within the "Chemung Portage" stratigraphic groups, replaced by later workers as the Lock Haven Formation and Brallier Formation, respectively; in particular, the detonation zone corresponded with that of the Lock Haven Formation.

In a letter dated August 11, 1967 and addressed to the US Atomic Energy Commission, Pennsylvania's Governor Raymond P. Shafer granted approval to use the Sproul State Forest for Phase I of the project based on certain conditions, most important of which was that should the results of the Phase I site evaluation not demonstrate that the project would be in the best interests of the Commonwealth of Pennsylvania, the state reserved the right to refuse permission for the project to proceed any further.

As word of the feasibility study spread in newspapers across the state, letters of opposition began to be sent to public officials. In its July 5, 1968 letter to Governor Shafer, Columbia Gas wrote that the company was, ...undertaking a re-evaluation of Project Ketch and, Columbia is unconditionally withdrawing its (proposal) to conduct the project on a site in the Sproul State Forest.

Just as the wind had been left out of the sails of Project Ketch, Project Plowshare itself was soon on the wane. The program effectively ended in May 1973, following its final test in Colorado and it was no longer funded beyond the Federal Government's fiscal year ending 1975, coincident with the dissolution of the Atomic Energy Commission as a result of the Energy Reorganization Act of 1974.