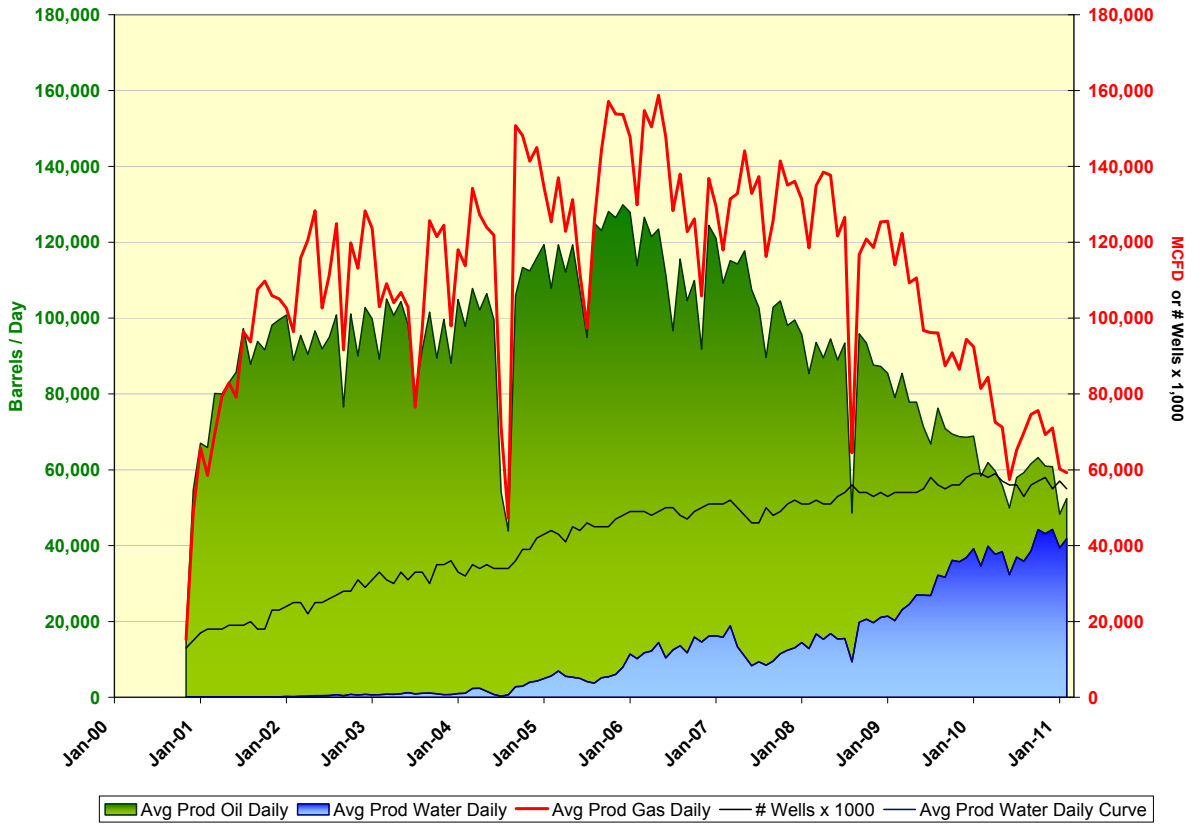
Alpine Oil Pool

Summary

Discovered in 1994[1] and declared commercial in 1996, the Alpine Oil Pool was the largest oil field discovered in the US in over a decade.[2] Development drilling began in 1998, and nine facilities modules were delivered to the North Slope via sealift during July 1999. Regular production began in November 2000. The Alpine Oil Pool has now been penetrated by more than 140 wells, most of which are horizontal production and injection wells.[3] Alpine is a model for future oil development: its facilities occupy only 97 surface acres,[4] but it produces from about 25,000 acres (39 square miles) of reservoir.[5] During 2003, development drilling at Alpine surpassed the 1 million-foot milestone,[6] and by year-end 2010 the footage drilled in about 135 development and service wells totaled over 1.8 million feet.[7]

Average Daily Production Rates



[1] Alaska Oil and Gas Conservation Commission, 1999, Conservation Order No. 443
[2] Alvord, C., B. Noel, V. Johnson, R. Handley, D. Egedahl, E. Cribbs, L. Smith, 2004, A Step Change in Drilling Efficiency: Application of New Technology in the Alpine Development Field, SPE Paper 87176
[3] Alaska Oil and Gas Conservation Commission, 2011, internal RBDMS and Geographix Databases
[4] BP, 1999, First Alaska-Built Sealift Modules Bound for Alpine, BP Press Release, July 9, 1999
[5] AOGCC, 2011, estimate of productive area from internal Geographix database
[6] AOGCC, 2003, Annual Report, p. 9.
[7] AOGCC, 2011, estimate of drilled footage from internal RBDMS database

Production has greatly exceeded expectations: originally projected to produce 80,000 barrels of oil per day ("BOPD"),[8] the Alpine Oil Pool averaged 97,485 BOPD during 2003[9] and 98,895 BOPD in 2004.[10] Facilities upgrades completed during 2004 designed to increase oil production and water handling[11] boosted average production to 117,370 BOPD during the first half of 2005.[12] A second phase of facilities upgrades completed in June 2005 increased average production to 128,180 BOPD during the last five months of 2005.[13] Production peaked at an average rate of 130,685 barrels of oil per day during November 2005, and began declining. During the last four months of 2010, daily oil production averaged 61,650 BOPD from about 57 producers.[14]

Recent drilling and development operations demonstrate that the Alpine reservoir and the overlying Nanuq-Kuparuk reservoir are in pressure communication throughout the central and southern Colville River Unit. Because they are in pressure communication, these two reservoirs must be classified as a single oil pool according to AS 31.05.170(12). Conservation Order 443B, issued March 26, 2009, expands the geographic and vertical boundaries of the Alpine Oil Pool to include both reservoirs. The pool is now defined as the accumulation of hydrocarbons common to, and correlating with, the interval between the measured depths of 6,980 feet and 7,276 feet in the Alpine No. 1 well. CO 443B also terminates the former Nanuq-Kuparuk Oil Pool.[15] All affected production and injection records have been re-assigned to the Alpine Oil Pool.

Geology

The reservoir consists of the Alpine Sands, an informal member of the Jurassic-aged (Ellesmerian) Kingak Formation. These are stratigraphically the highest sand units in the Kingak within the Colville Delta area. They are shallow marine, v. fine to fine-grained, quartz-rich sandstone layers deposited on a southerly prograding shelf, and elongated in an east-west direction. Gross thickness of the combined reservoir sandstone layers ranges up to 100'. The Alpine structure is a homocline that dips southwest at a rate of about 100' per mile. This homocline is broken by several minor, northwest-trending, down-to-the-west, normal faults that average less than 30' in vertical displacement. Porosity and permeability range approximately from 15% to 23% and 1 to 160 md, respectively. No oil-water or gas-oil contacts have been observed.[16]

Conservation Order 443B, issued March 26, 2009, expands the geographic and vertical boundaries of the Alpine Oil Pool to include both the Alpine and the former Nanuq-Kuparuk reservoir, which lies within the Early Cretaceous-aged Kuparuk River Formation. The Nanuq-Kuparuk reservoir is a thin, transgressive, shallow marine sandstone that lies atop the Lower Cretaceous Unconformity ("LCU"). It consists of fine- to medium-grained, quartz-rich sandstone that contains varying amounts of glauconite, and ranges from 5 to 15 feet thick. Net pay averages 6 feet, porosity averages 18 percent, and

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[8] ConocoPhillips, 2004, ConocoPhillips, Anadarko Approve Development of Alpine Satellites, ConocoPhillips News Release, Dec. 20, 2004
[9] Alaska Oil and Gas Conservation Commission, 2004, Production Database
[10] Alaska Oil and Gas Conservation Commission, 2005, Production Database
[11] Nelson, K., 2005, First Well Completed and Tested at Fiord, Petroleum News, Vol. 10, No. 35, August 28, 2005
[12] Alaska Oil and Gas Conservation Commission, 2005, Production Database
[13] Petroleum News, 2003, Alpine Expansion Phase I a Go, in Petroleum News, Vol. 9, No. 53, May 16, 2003
Petroleum News, 2004, Phase 2 of Alpine Capacity Expansion Under Way, in Petroleum News, Vol. 10, No. 22, March 3, 2004
[14] Alaska Oil and Gas Conservation Commission, 2011, Production Database
[15] Alaska Oil and Gas Conservation Commission, 2009, Conservation Order No. 443B
[16] Alaska Oil and Gas Conservation Commission, 1999, Conservation Order No. 443

permeability averages 100 millidarcies. The original reservoir pressure measured 3,240 psia,[17] and reservoir temperature measured about 160° F.[18]

Geochemical analysis indicates oil from the Nanuq-Kuparuk reservoir is closely related to oil from the overlying Nanuq reservoir, which lies about 700 true vertical feet shallower. Production and RFT samples indicate the crude oil gravity is 40 to 41 degrees API. Oil viscosity is estimated to be 0.5 centipoise, and the solution GOR is estimated at 990 SCF/STB. No gas or water contacts have been identified within this proposed oil pool.[19]

The Nanuq-Kuparuk reservoir is overlain by mudstone and shale assigned to the Kuparuk D interval, Kalubik Shale, HRZ, and basal Torok, in ascending order. The reservoir is underlain by silty shale assigned to the Jurassic-aged Miluveach Formation.[20]

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[17] Alaska Oil and Gas Conservation Commission, 2009, Conservation Order No. 443B
[18] Alaska Oil and Gas Conservation Commission, 1999, Conservation Order No. 443, p. 3
[19] Alaska Oil and Gas Conservation Commission, 2009, Conservation Order No. 443B
[20] Division of Oil and Gas, 2006, Colville River Unit: Applications for the Formation of the Nanuq-Kuparuk and Nanuq-Nanuq Participating Areas, Findings and Decision of the Director, Division of Oil and Gas, November 14, 2006, p.8