

STATE OF ALASKA
ALASKA OIL AND GAS CONSERVATION COMMISSION
3001 Porcupine Drive
Anchorage Alaska 99501-3192

Re: **THE REQUEST OF ARCO**) Area Injection Order No. 2A
ALASKA, INC for approval of a pilot) ARCO Alaska, Inc
waterflood project within the Tabasco) Kuparuk River Unit
accumulation in the Kuparuk River) Kuparuk River Field
Unit.) Tabasco Pilot Waterflood Project

June 4, 1998

IT APPEARING THAT:

1. ARCO Alaska, Inc. ("AAI") submitted an application on February 26, 1998, for approval of a proposed pilot waterflood project within the Tabasco accumulation in the Kuparuk River Unit. AAI submitted additional information about the project by letter dated March 11, 1998, e-mail messages dated March 30 and April 3, 1998, and correspondence dated May 11, 1998.
2. Notice of opportunity for public hearing was published in the Anchorage Daily News on March 12, 1998.
3. The Commission did not receive protest or a request for a public hearing.

FINDINGS:

1. The proposed Tabasco pilot waterflood project will be conducted in the Kuparuk River Unit ("KRU") in sections 2 and 11, T11N, R8E, UM.
2. The Commission has issued the following Area Injection Order ("AIO") and associated Administrative Approvals ("AA") for the KRU: AIO 2 (June 6, 1986), AA 2.1 and 2.2 (October 27, 1986), AA 2.3 (July 7, 1988), AA 2.4 (December 20, 1988), AA 2.5 (December 27, 1991) and AA 2.6 (January 27, 1994). The AAs modify or add to AIO 2.
3. The AIO and AAs govern Class II underground injection projects within the KRU.
4. The hearing records and administrative files for the above listed AIO and AAs remain valid for the Kuparuk River Field.
5. AAI is the operator of the KRU. There are no other operators within a one-quarter mile radius of the proposed Tabasco pilot waterflood project.
6. The State of Alaska is the only surface owner within a one-quarter mile radius of the proposed Tabasco pilot waterflood project.

7. AAI originally tested the Tabasco accumulation in well 2T-TAB-01 during 1995. The well has subsequently been renamed 2T-201.
8. The proposed pilot waterflood project will retest 2T-201; drill, core and test well 2T-202; produce 2T-202 for approximately 6 months; and inject water into 2T-201 to balance withdrawals from 2T-202.
9. The purpose of the pilot waterflood project is to further understand the displacement of high viscosity crude oil with low viscosity water in the Tabasco reservoir.
10. The pilot waterflood project is proposed for an undefined pool informally named Tabasco. The reservoir is encountered in well 2T-201 between 3352' MD and 3599' MD, which correlates with an equivalent interval in the ARCO West Sak No. 1 well between the depth of 4591' MD and 5324' MD.
11. The Tabasco interval is composed primarily of conglomeratic sandstone with variable amounts of mudstone and shale.
12. The Tabasco interval is an informal name given to a hydrocarbon bearing, coarse-grained clastic member of the Schrader Bluff Formation, which is part of the late Cretaceous Colville Group and is locally present in the western portion of the KRU.
13. Based upon well log data, approximately 315 feet of interbedded claystone, shale and mudstone of the late Cretaceous Colville Group overlie the Tabasco sands and constitute the upper confining layer for the Tabasco injection zone. The lower confining layer is a similar sequence of interbedded claystone, shale and mudstone with an approximate thickness of 650 feet.
14. Well 2T-201 has been completed with 16" conductor casing, 9 5/8" 40# L-80 surface casing and 7" 26# L-80 production casing. Prior to injection, the mechanical integrity of the well must be tested in accordance with 20 AAC 25.412(c).
15. Injection water will be supplied by the KRU Central Production Facility 2 ("CPF 2"). The proposed injection water is composed of produced water from the Kuparuk oil pool and treated seawater from the Beaufort Sea. Small amounts of emulsion breaker, scale and corrosion inhibitor and other products used in the production process may be present in CPF 2 water. There is no known incompatibility of this water with the Tabasco sands.
16. Expected injection rate is 1100 barrels of water per day to balance withdrawals, but could be higher depending on the productivity of well 2T-202.
17. Injection water salinity will be greater than 14,700 ppm NaCl.
18. AAI estimates the surface injection pressure in well 2T-201 will be 500 psig average and 1000 psig maximum.

19. AAI estimates the fracture gradient of the Tabasco sands at 0.65 psi/ft or less, based on test results in the Kuparuk and West Sak formations, and the fracture gradient in the confining mudstone intervals surrounding the Tabasco sands at 0.738 psi/ft.
20. AAI performed a model study of fracture tendency that indicated little potential for vertical fracture growth at injection rates significantly greater than the anticipated operating rate. AAI intends to operate the waterflood project to maintain the original reservoir pressure gradient of about 0.5 psig/ft.
21. AAI using two different log analysis techniques estimates water salinity in the Tabasco sands between 7500 and 9500 ppm NaCl.
22. All aquifers in the KRU have been exempted by the U.S. Environmental Protection Agency under 40 CFR 147.102 for purposes of Class II underground injection.
23. The Tabasco accumulation in well 2T-201 contains oil with a viscosity of 250 cp., 16.8° API gravity and 169 SCF/STBO solution gas.
24. Formation permeability estimated from transient data is 3000 millidarcies in the vicinity of 2T-201.
25. Preliminary modeling studies indicate that primary production will recover approximately 5% of original oil in place. Waterflood support could add an additional 15% to 25% recovery.
26. All fluid produced during the pilot waterflood project will be measured using the Drill Site 2T test separator and will be commingled with Kuparuk crude oil.
27. Allocation of Tabasco production will be based on two or more well tests per month.
28. Allocation of injected water will be based on continuous metering at well 2T-201.

CONCLUSIONS:

1. The requirements of 20 AAC 25.402 have been met for the Tabasco pilot waterflood project.
2. Area Injection Order 2 must be revised to accommodate the Tabasco pilot waterflood project.
3. Consolidating AIO 2 and Administrative Approvals 2.1, 2.2, 2.3, 2.4, 2.5 and 2.6 will improve the administrative function of the Commission and the application of those rules and orders. Amending Rule 2 and Rule 4 to reflect current regulatory provisions under 20 AAC 25 concerning disposal is appropriate.
4. All aquifer in the KRU, including those in the Tabasco pilot waterflood project, are exempt aquifers.

5. Fluid injection at proposed rates and pressures will not initiate fractures into the confining zones.
6. Confining lithology, well construction and proposed operating conditions will confine injected fluids to appropriate receiving zones.
7. Proposed injection fluids can be reasonably expected to be compatible with Tabasco formation waters
8. Well 2T-201 is constructed in accordance 20 AAC 25, but mechanical integrity must be demonstrated before injection may occur.
9. The Tabasco pilot waterflood project is necessary to collect reservoir performance data and determine an optimum reservoir management plan in order to increase ultimate hydrocarbon recovery.
10. The consolidation of AIO 2 and all corresponding administrative approvals and approval of the Tabasco pilot waterflood project will not cause waste, jeopardize correlative rights, or impair ultimate recovery.

NOW, THEREFORE, IT IS ORDERED that Area Injection Order #2 and Administrative Approvals 2.1, 2.2, 2.3, 2.4, 2.5 and 2.6 are revoked and reissued as Area Injection Order #2A with the following rules to govern Class II injection operations in the affected area described below. The administrative record for AIO #2 and its corresponding administrative approvals are made part of the record for this order:

UMIAT MERIDIAN

T13N	R8E	Section 1, 2, 3, 10, 11, 12, 13, 14, 15, 23, 24, 25, 26, 27, 33, 34, 35, 36.
T13N	R9E	Section 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 16, 17, 18, 19, 20, 21, 22, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36.
T12N	R8E	Entire Township.
T12N	R9E	Entire Township.
T12N	R10E	Section 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36.
T12N	R11E	Section 5, 6, 7, 8, 31.
T11N	R7E	Section 24, 25, 26, 34, 35, 36.
T11N	R8E	Entire Township.
T11N	R9E	Entire Township.

T11N	R10E	Entire Township.
T11N	R11E	Section 5, 6, 7, 8, 16, 17, 18, 19, 20, 21, 22, 27, 28, 29, 30, 31, 32, 33.
T10N	R7E	Section 1, 2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 16, 21, 22, 23, 24, 25, 26, 27, 28, 33, 34, 35, 36.
T10N	R8E	Entire Township.
T10N	R9E	Entire Township.
T10N	R10E	Entire Township.
T10N	R11E	Section 5, 6, 7, 8, 17, 18, 19, 20, 29, 30, 31, 32.
T9N	R9E	Section 3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24.
T9N	R10E	Section 1, 2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 16, 21, 22, 23, 24, 27, 28, 33, 34.
T9N	R11E	Section 5, 6, 7, 8, 17, 18, 19, 20.

Rule 1 Authorized Injection Strata for Enhanced Recovery

Within the affected area, non-hazardous fluids may be injected for purposes of pressure maintenance and enhanced oil recovery into strata defined as those strata which correlate with the strata found in the ARCO West Sak River State Well No. 1 between the measured depths of 3145 feet and 3640 feet; 3744 feet and 4040 feet; 4591 feet and 5324 feet; and 6474 feet and 6880 feet.

Rule 2 Authorized Injection Strata for Disposal

Within the affected area, Class II oil field fluids may be injected in conformance with 20 AAC 25 for the purpose of fluid disposal into strata defined as those strata which correlate with the strata found in ARCO West Sak River State Well No. 1 between the measured depths of 3390 feet and 3640 feet; and with the strata found in ARCO/BP Ugnu Well No. 1 between the measured depths of 8370 feet and 8800 feet; within tract ADL 25648 (Sections 3, 4, 9, and 10, T11N, R10E, UM) into the zone which correlates with the strata found in ARCO West Sak River State Well No. 1 between the measured depths of 3145 feet and 3390 feet; and within portions of tracts ADL 355023, ADL 355024, and ADL 373301 (Sections 3, 4, 5, 8, 9 and 10, T13N, R9E) into the non-hydrocarbon bearing portions of the zone which correlates with the strata found in ARCO Oliktok Point Well No. 2 between the measured depths of 2937 feet and 3544 feet.

Rule 3 Fluid Injection Wells

The underground injection of fluids must be: 1) through a new well that has been permitted for drilling as a service well for injection in conformance with 20 AAC 25.005; 2) through an existing well that has been approved for conversion to a service well for injection in conformance with 20 AAC 25.280; or 3) through a well that existed as a service well for injection purposes on the date of this order. The pumping away of drilling muds, rock cuttings and other-waste as provided for in 20 AAC 25.080 into an exploratory or stratigraphic test well, or into the annuli of any well approved in accordance with 20 AAC 25.005, is an operation incidental to the drilling of the well, and is not considered a disposal operation subject to regulation as an injection well (Class II or otherwise) under authority of the UIC program.

Rule 4 Monitoring the Tubing/Casing Annulus Pressures.

The tubing/casing annulus pressure of each injection well must be checked weekly, as a routine duty, to ensure there is no leakage and that it does not exceed a pressure that will subject the casing to a hoop stress greater than 70% of the casing's minimum yield strength.

Rule 5 Reporting of Tubing/Casing Annulus Pressure Variations.

Tubing/casing annulus pressure variations between consecutive observations need not be reported to the Commission.

Rule 6 Demonstration of Tubing/Casing Annulus Mechanical Integrity

A schedule must be developed and coordinated with the Commission, which ensures that the tubing/casing annulus for each injection well is pressure tested prior to initiating injection and at least once every four years thereafter. A test surface pressure of 1500 psi or 0.25 psi/ft multiplied by the vertical depth of the packer, whichever is greater, but not to exceed a hoop stress greater than 70% of the casing's minimum yield strength, must be held for 30 minutes with no more than a 10 percent decline. Alternative EPA methods may also be used with Commission approval, including but not limited to timed-run radioactive tracer survey (RTS), oxygen activation logs, temperature logs and noise logs. Wells with tubing-to-casing communication must be surveyed or logged every other year and wells which demonstrate mechanical integrity every fourth year. The Commission must be notified at least 24 hours in advance to enable a representative to witness pressure tests or the application of alternative methods.

Rule 7 Well Integrity Failure

Whenever operating pressure observances or pressure tests indicate pressure communication or leakage of any casing, tubing or packer, the operator must notify the Commission on the first working day following the observation, obtain Commission approval of a plan for corrective action, and when an USDW is not endangered, obtain Commission approval to continue injection.

Rule 8 Plugging and Abandonment of Fluid Injection Wells

An injection well located within the affected area must not be plugged or abandoned unless approved by the Commission in accordance with 20 AAC 25.105.

Rule 9 Administrative Relief

Upon request, the Commission may administratively amend any rule stated above as long as the operator demonstrates to the Commission's satisfaction that sound engineering practices are maintained and the amendment will not result in an increased risk of fluid movement into an underground source of drinking water.

DONE at Anchorage, Alaska and dated June 4, 1998.

David W. Johnston, Chairman

Robert N. Christenson, Commissioner

Camillé Oechsli, Commissioner

AS 31.05.080 provides that within 20 days after receipt of written notice of the entry of an order, a person affected by it may file with the Commission an application for rehearing. A request for rehearing must be received by 4:30 PM on the 23rd day following the date of the order, or next working day if a holiday or weekend, to be timely filed. The Commission shall grant or refuse the application in whole or in part within 10 days. The Commission can refuse an application by not acting on it within the 10-day period. An affected person has 30 days from the date the Commission refuses the application or mails (or otherwise distributes) an order upon rehearing, both being the final order of the Commission, to appeal the decision to Superior Court. Where a request for rehearing is denied by nonaction of the Commission, the 30-day period for appeal to Superior Court runs from the date on which the request is deemed denied (i.e., 10th day after the application for rehearing was filed).