

25-5-90.44

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

Re: The REQUEST OF ARCO ALASKA,) Area Injection Order No. 4A
INC., to modify Area Injection)
Order 4 to include the Point) Eastern Operating Area Prudhoe
McIntyre, Stump Island and West) Bay Unit and Pt. McIntyre Field
Beach oil pools for the purpose of)
conducting enhanced recovery and)
disposal of Class II fluids.)

August 12, 1993

IT APPEARING THAT:

1. Arco Alaska, Inc. (ARCO) by correspondence dated April 5, 1993 made application to the Alaska Oil and Gas Conservation Commission (hereinafter Commission) to modify Area Injection Order No. 4 (AIO #4) to permit the underground injection of fluids for enhanced oil recovery and disposal of Class II fluids in support of production and development of the Pt. McIntyre, Stump Island and West Beach oil accumulations.
2. Notice of an opportunity for public hearing was published in the Anchorage Daily News on April 9, 1993.
3. A request for extension of the public protest period was filed on April 22, 1993 by Copeland, Landye, Bennett and Wolf on behalf of George and Larry Ahmaogak.
4. By letter dated April 27, 1993, the Commission extended the public protest period to 4:00 PM, May 3, 1993.
5. By letter dated April 27, 1993, the Department of Natural Resources requested that any decision to modify Area Injection Order No. 4 to accommodate a proposed Pt. McIntyre participating area in the Prudhoe Bay Unit be deferred until after approval of a participating area by the state.
6. No other protest or request for a public hearing was filed.

FINDINGS:

1. Commission regulations, 20 AAC 25.460, provides authority to issue an order governing underground injection operations on an area basis for all wells within the same field, facility site, reservoir, project or similar area.

2. AIO #4, issued July 11, 1986, authorizes area injection for a "project area" described as the Eastern Operating Area of the Prudhoe Bay Unit. The project area encompasses approximately the eastern half of the Prudhoe Bay oil pool and all of the Lisburne oil pool.
3. AIO #4 establishes the vertical limits of injection for enhanced recovery operations in both the Prudhoe Bay and Lisburne oil pools and for disposal into Cretaceous and Tertiary strata. The vertical limits of injection and confining strata may be defined in the ARCO Prudhoe Bay State No. 1 and ARCO Sag River State No. 1 wells.
4. ARCO is operator of the eastern half of the Prudhoe Bay oil pool and the Lisburne oil pool.
5. The Commission issued Conservation Order No. 311 classifying the West Beach oil pool in the Prudhoe Bay field. The West Beach oil pool is composed of the Kuparuk River formation, and is defined as strata common to and which correlate with the interval between 14,548' and 14,781' measured depth in the West Beach No. 4 well.
6. The West Beach oil pool underlies the AIO #4 project area.
7. The mineral interest owners of the West Beach oil pool have designated ARCO as operator of the pool.
8. Development and depletion plans for the West Beach oil pool are uncertain at this time. Depending on the size of the pool, the operator proposes three possible depletion strategies: solution gas drive, processed gas injection, and/or waterflood. No actual proposal has been submitted to the Commission for enhanced oil recovery operations in the pool.
9. The Commission issued Conservation Order No. 317 classifying the Pt. McIntyre oil pool and the Stump Island oil pool in the Pt. McIntyre oil field. The Pt. McIntyre oil pool is composed of the Kuparuk River and Kalubik formations, and is defined as strata common to and which correlate with the interval between 9,908' and 10,665' measured depth in the Pt. McIntyre No. 11 well. The Stump Island oil pool is composed of the Seabee formation, and is defined as strata common to and which correlate with the 8,759' to 8,930' measured depth interval in the Pt. McIntyre No. 3 well.
10. A portion of the Pt. McIntyre oil field underlies the AIO #4 project area.
11. The mineral interest owners of the Pt. McIntyre oil field have designated ARCO operator of both the Pt. McIntyre and Stump Island oil pools.

12. Production from the Pt. McIntyre, Stump Island and West Beach oil pools will be commingled with production from other pools and processed at the Lisburne Production Center (LPC).
13. Disposal injection in the Pt. McIntyre oil field will occur within the Colville Group/Sagvanirktok formation which correlates with the 1,900' to 6,750' measured depth interval in the Sag River State No. 1 well. This interval is underlain by an Upper Cretaceous marine, predominately shale sequence approximately 1,600' to 2,000' thick. The interval is overlain by Tertiary shale and mudstones beds 10 to 50 feet thick which act as vertical permeability barriers and approximately 1,800' of permafrost which isolates the disposal interval from surface waters.
14. No injection wells currently exist in the Pt. McIntyre oil field. ARCO's application includes proposed locations and mechanical configurations for currently planned injectors, and the locations of all existing and abandoned wells within the field.
15. None of the existing or proposed injection wells in the Pt. McIntyre oil field are within one-quarter mile of the affected area as defined under Conservation Order No. 317.
16. All operators and surface owners within a one-quarter mile of all proposed injection wells in the Pt. McIntyre oil field have been duly notified of the proposed injection project.
17. Fracture gradients are estimated to range from approximately .55 to .65 psi/ft for receiving formations and from .80 to .90 psi/ft for confining formations in the Pt. McIntyre oil field.
18. Formation water salinity is estimated to range from approximately 12,000 ppm to more than 20,000 ppm for all aquifers in the Pt. McIntyre oil field.
19. Laboratory testing indicates proposed enhanced recovery fluids are compatible with receiving formations. Some increase in the concentration of hydrogen sulfide gas in the Pt. McIntyre oil pool may be expected from the introduction of commingled gas and produced water streams from the LPC.
20. Initial enhanced recovery plans for the Pt. McIntyre oil pool calls for 16 water injection wells and two gas injection wells. Initial waterflood pattern will be an inverted 9-spot utilizing produced water.
21. Enhanced recovery plans for the Stump Island oil pool will be evaluated on a well-by-well basis in conjunction with Pt. McIntyre oil pool development. No actual proposal has been submitted to the Commission for enhanced oil recovery operations in the Stump Island oil pool.

22. Maximum injection rates for enhanced recovery operations in the Pt. McIntyre oil pool are currently estimated to be about 500 MMSCF/D gas and 250 MBPD water.
23. Incremental hydrocarbon recovery of approximately 160 MMSTB is expected from the Pt. McIntyre waterflood and gas injection project.
24. To accommodate Pt. McIntyre, Stump Island and West Beach production, additional produced water disposal wells will be drilled at or near the LPC. The maximum combined disposal rate of produced water from the LPC will increase to about 240 MBPD. To accommodate disposal of exempt Class II wastes, a cuttings disposal well may be drilled at Pt. McIntyre Drill Site P2 (DS-P2); this well would have an estimated maximum disposal rate of about 2,000 BPD.
25. Estimated maximum and average injection pressures (psig) for Pt. McIntyre gas injection are 5000 psi and 4300 psi; for Pt. McIntyre water injection, 2850 psi and 2450 psi; and for Pt. McIntyre DS-P2 disposal, 1000psi and 500 psi.
26. The operator proposes to monitor tubing-casing annulus pressures of all injection wells at least weekly to ensure there is no leakage and that casing pressure remains less than 70% of minimum yield strength of the casing.
27. All existing wells drilled within the Pt McIntyre oil field have been constructed in accordance with 20 AAC 25.030. All wells abandoned in the Pt. McIntyre oil field have been abandoned in accordance with 20 AAC 25.105.

CONCLUSIONS:

1. An order permitting the underground injection of Class II fluids on an area basis, rather than for each injection well individually, provides for efficiencies in the administration and surveillance of underground fluid injection operations.
2. The area authorized for injection operations under an area injection order has no inherent relationship to, nor affect on, the area of participation formed by the mineral interest owners and approved by the state for pool development.
3. Authorizing the underground injection of fluids on an area basis into the West Beach and Stump Island oil pools will be appropriate when injection operations are actually proposed.
4. Area Injection Order No. 4 may be reissued to include the Pt. McIntyre oil field on the basis of common production facilities and a single operator.
5. Reissuing Area Injection Order No. 4 to include the Pt. McIntyre oil field area is appropriate for authorizing injection of fluids for enhanced recovery operations in the Pt. McIntyre oil pool.

6. Reissuing Area Injection Order No. 4 to include the Pt. McIntyre oil field area is appropriate for authorizing injection of Class II fluids for disposal operations in support of development and production of the Pt. McIntyre oil pool.
7. Injection operations in the Eastern Operating Area of the Prudhoe Bay Unit and the Pt. McIntyre oil field will be conducted in permeable strata which can reasonably be expected to accept injected fluids at pressures less than the fracture pressure of the confining strata.
8. Injection of Class II fluids for purposes of enhanced oil recovery and disposal operations in the Eastern Operating Area of the Prudhoe Bay Unit and the Pt. McIntyre oil field will occur in a manner that will prevent movement of fluids into sources of fresh water and will improve ultimate recovery.
9. Authorizing the injection of fluids on an area basis for the Eastern Operating Area of the Prudhoe Bay Unit and the Pt. McIntyre oil field will not cause waste nor jeopardize correlative rights.
10. No underground sources of drinking water (USDWs) are known to exist in the Eastern Operating Area of the Prudhoe Bay Unit and the Pt. McIntyre oil field.

NOW, THEREFORE, IT IS ORDERED THAT Area Injection Order #4 is repealed and reissued as Area Injection Order No. 4A with the following rules to govern Class II injection operations in the affected area described below:

UMIAT MERIDIAN

T12N	R14E	Sections 22, 23, 24, 25, 26, 35, and 36.
T12N	R15E	Sections 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, and 36.
T12N	R16E	Sections 28, 29, 30, 31, 32, 33, and Section 34: W 1/2 NW 1/4, SW 1/4, SW 1/4 SE 1/4
T11N	R14E	Sections 1, 2, 9, 10, 11, 12, 13, 14, 15, 16, 21, 22, 23, 24, 25, 26, 27, 28, 33, 34, 35, and 36.
T11N	R15E	Entire Township.
T11N	R16E	Section 2: SW 1/4 NW 1/4, SW 1/4, S 1/2 SE 1/4, Sections 3, 4, 5, 6, 7, 8, 9, 10, 11,

		Section 12: NW 1/4, S 1/2 NE 1/4, SE 1/4, SW 1/4 Sections 13, 14, 15, 16, 17, 18, 19, 20, 21, 28, 29, 30, 31, 32, and 33.
T10N	R14E	Sections 1, 2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 16, 21, 22, 23, 24, 25, 26, 27, 28, and 36.
T10N	R15E	Entire Township.
T10N	R16E =	Sections 4, 5, 6, 7, 8, 9, 16, 17, 18, 19, 20, 29, 30, and 31.
T12N	R15E	Section 18
T12N	R14E	Sections 3, 4, 9, 10, 13, 14, 15, 16, Section 17: NE 1/4, N 1/2 SE 1/4, E 1/2 E 1/2 NW 1/4, E 1/2 NE 1/4 SW 1/4, Section 21: N 1/2 NE 1/4,

Those Lands in Block 605 lying northerly of the north boundary of Section 3, T12N, R14E, UM, AK. (Identical with line 4-5 on Block 605) and lying easterly of the west boundary of Sections 2 and 11, T12N, R14E, UM, AK (Identical with line 5-6 on Block 605) and lying northerly of the south boundary of Section 11 and 12, T12N, R14E, UM, AK, and lying northerly of the south boundary of Section 7, T12N, R15E, UM, AK (Identical with line 6-7 on Block 605), within the offshore three-mile arc lines listed as State Area on the "Supplemental Official O.C.S. Block Diagram," approved 12/9/79, containing 1457.32 hectares.

Rule 1 Authorized Injection Strata for Enhanced Recovery

Within the affected area, Class II fluids may be injected for purposes of pressure maintenance and enhanced recovery into strata defined as those which correlate with and are common to the formations found in ARCO Prudhoe Bay State No. 1 well between the measured depths of 8,110 - 8,680 feet for the Prudhoe oil pool and between the measured depths of 8,790 - 10,440 feet for the Lisburne oil pool and in the Pt. McIntyre No. 11 well between the measured depths of 9,908 - 10,665 feet for the Pt. McIntyre oil pool.

Rule 2 Authorized Injection Strata for Disposal

Within the affected area, Class II waste fluids may be disposed by injection into ~~strata~~ strata defined as those which correlate with and are common to the strata found in ARCO Sag River State Well No. 1 between the measured depths of 1,900 - 6,750 feet.

Rule 3 Fluid Injection Wells

The injection of fluids must be conducted: 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.

Rule 4 Monitoring the Tubing-Casing Annulus Pressure Variations

The tubing-casing annulus pressure of each injection well must be checked at least weekly 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 the 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, following well workovers affecting mechanical integrity, 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 at least a 30 minute period with decline less than or equal to 10% of test pressure. The Commission must be notified at least 24 hours in advance to enable a representative to witness pressure tests.

Rule 7 Well Integrity Failure

Whenever operating pressure observations 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 to continue injection and submit a plan of corrective action on Form 10-403 for Commission approval.

Rule 8 Plugging and Abandonment of 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 Action

Upon proper application, the Commission may administratively waive the requirements of any rule stated above or administratively amend this order as long as the change does not promote waste nor jeopardize correlative rights, is based on sound engineering principles and will not result in an increased risk of fluid movement into a USDW.

DONE at Anchorage, Alaska and dated August 12, 1993.





David W. Johnston, Chairman
Alaska Oil and Gas Conservation Commission



Russell A. Douglass, Commissioner
Alaska Oil and Gas Conservation Commission



Tuckerman Babcock, Commissioner
Alaska Oil and Gas Conservation Commission

AS 31.05.080 provides that within 20 days after receipt of written notice of entry of an order, a person affected by it may file with the Commission an application for rehearing. The Commission shall grant or refuse the application in whole or in part within 10 days. 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 can refuse an application by not acting 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).