



9. The depletion plan for the Badami Oil Pool entails maintaining pressure by replacing voidage. The four primary types of injection fluids will be source water, produced water, associated gas and imported miscible gas. Minor volumes of other Class II fluids that the Commission determines to be both incidental to the production of oil and gas and appropriate for use in enhanced oil recovery operations may also be injected.
10. The operator estimates that 6% to 8% of original oil in place (OOIP) in the Badami Oil Pool will be recovered with primary recovery methods, 12% to 20% OOIP with waterflood and, ultimately, 25% OOIP with a water-alternating-gas injection project.
11. The primary source of miscible fluids for the Badami EOR project will be the Endicott Oil Pool.
12. Maximum wellhead injection pressures for water and miscible gas is expected to be 3,500 psig and 5,500 psig, respectively.
13. Rock properties and fracture calculations indicate the sandstone intervals may fracture near the wellbore but the confining shales will not. Data indicate the confining shales have greater strength than the sands and expected injection pressures will not be great enough to fracture the shales.
14. Thermal effects of water injection and long-term reservoir pressure decline will tend to reduce the strength of the sand intervals lowering its fracture pressure. The impermeable, confining shales will not be affected and are expected to retain rock strength at or near their original fracture pressure.
15. The operator proposes to begin EOR operations no later than four months after first production.
16. Disposal injection for Class I wastes are authorized and governed by rules prescribed in Disposal Injection Order No. 12, AK-11001-A, issued by the U.S. Environmental Protection Agency, Region 10, and waste disposal permit No. 9631-DB004 issued by the Alaska Department of Environmental Conservation.
17. The operator is required to drill wells within the proposed project area in accordance with 20 AAC 25.030 and to abandon wells in accordance with 20 AAC 25.105.
18. The mechanical integrity of injection wells must be demonstrated as specified in 20 AAC 25.412 prior to initiating injection operations.
19. The operator is required by 20 AAC 25.402 (d) & (e) to monitor tubing-casing annulus pressures of injection wells periodically during injection operations to ensure there is no leakage and that casing pressure remains less than 70% of minimum yield strength of the casing.

#### **CONCLUSIONS:**

1. Issuing an Area Injection Order in accordance with 20 AAC 25.402 is appropriate for the project area. The AIO will not cause waste or jeopardize correlative rights.
2. The Badami reservoir is incompletely delineated at this time and further well control may cause the currently proposed development plan to be substantively modified.
3. The proposed injection operations will occur in permeable strata that reasonably can be expected to accept injected fluids at pressures less than the fracture pressure of the confining strata.

4. Enhanced recovery fluids will consist of source water, produced water, minor amounts of incidental Class II fluids; and associated and miscible gas, and are compatible with the receiving and confining zones.
5. All wells drilled within the proposed project area have been and will be constructed in accordance with 20 AAC 25.030 and abandoned in accordance with 20 AAC 25.105 or equivalent precursor regulation.
6. Well mechanical integrity must be demonstrated in accordance with 20 AAC 25.412 prior to initiation of injection operations.
7. A schedule must be developed which ensures that the mechanical integrity of each injection well is tested at least every four years after an initial test.
8. Tubing-casing annulus pressure and injection rates must be monitored at least weekly for disclosure of possible abnormalities in operational conditions.

**NOW, THEREFORE, IT IS ORDERED THAT** Area Injection Order No. 17 be issued with the following rules governing Class II enhanced oil recovery injection operations in the following affected area:

UMIAT MERIDIAN

T9N	R19E	Section 1.
T9N	R20E	Sections 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 16, 17.
T10N	R19E	Sections 24, 25 and 36.
T10N	R20E	Sections 19, 29, 30, 31, 32, 33, 34, and 35.

Rule 1 Authorized Injection Strata for Enhanced Recovery

Within the affected area, fluids may be injected for purposes of pressure maintenance and enhanced recovery into strata defined as those which correlate with and are common to those found in the Badami #1 well between the measured depths of 9,500 feet and 11,500 feet as stated in Conservation Order 402.

Rule 2 Fluid Injection Wells

The underground injection of fluids must be through a well permitted for drilling as a service well for injection in conformance with 20 AAC 25.005 or through a well approved for conversion to a service well for injection in conformance with 20 AAC 25.280.

Rule 3 Monitoring the Tubing-Casing Annulus Pressure Variations

The tubing-casing annulus pressure and injection rate 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 4 Reporting the Tubing-Casing Annulus Pressure Variations

Tubing-casing annulus pressure variations between consecutive observations need not be reported to the Commission unless accompanied by a greater than 10% increase in injection rate, indicating possible tubing and casing leaks.

Rule 5 Demonstration of Tubing-Casing Annulus Mechanical Integrity

A schedule must be developed and coordinated with the Commission that 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 minimum yield strength of the casing to be used. The test pressure must show stabilizing pressure and a decline of less than 10% within a thirty-minute period. The Commission must be notified at least twenty-four (24) hours in advance to enable a representative to witness pressure tests.

Rule 6 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 and obtain Commission approval of a plan for corrective action and Commission approval to continue injection.

Rule 7 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. Well abandonment must be done in accordance with 20 AAC 25.105.

Rule 8 Administrative Action

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 a source of freshwater.

Rule 9 Badami Oil Pool Annual Reservoir Report

An annual Badami Oil Pool surveillance report will be required by April 1 of each year subsequent to commencement of enhanced oil recovery operations. The report shall include but is not limited to the following:

- a. Progress of the enhanced recovery project and reservoir management summary including engineering and geological parameters.
- b. Voidage balance by month of produced fluids and injected fluids.
- c. Analysis of reservoir pressure surveys within the pool.
- d. Results and where appropriate, analysis of production and injection logs, tracer surveys and observation well surveys.
- e. Results of any special monitoring.

- f. Evaluation of well testing and allocation.
- g. Future development plans.
- h. Review of Annual Plan of Operations and Development.

**DONE** at Anchorage, Alaska and dated August 26, 1998

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David W. Johnston, Chairman

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Robert N. Christenson, Commissioner

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Camille 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).