

**STATE OF ALASKA**  
**ALASKA OIL AND GAS CONSERVATION COMMISSION**  
**333 West 7<sup>th</sup> Avenue, Suite 100**  
**Anchorage, Alaska 99501**

Re: THE APPLICATION OF Aurora Gas, LLC for an Aquifer Exemption Order for portions of the Nicolai Creek Unit in Township 11 North, Range 12 West, Seward Meridian, Kenai Peninsula Borough, in conformance with 20 AAC 25.440.	)	Docket Number: AEO-10-01
	)	Aquifer Exemption Order No. 12
	)	
	)	Nicolai Creek Field
	)	Nicolai Creek Unit
	)	South Undefined Gas Pool
	)	
	)	Kenai Peninsula Borough, Alaska
	)	
	)	April 16, 2010

**IT APPEARING THAT:**

1. On March 16, 2010, the Alaska Oil and Gas Conservation Commission (Commission) received the application of Aurora Gas, LLC (Aurora) for an aquifer exemption order for portions of Section 29, Township 11N, Range 12W, Seward Meridian (SM), below 2000' true vertical depth (TVD) within the Nicolai Creek Unit (NCU), Kenai Peninsula Borough, Alaska.
2. The same date, the Commission requested and received additional information from Aurora.
3. On March 22, 2010 pursuant to 20 AAC 25.540, the Commission published in the Anchorage Daily News notice of opportunity for public hearing on April 15, 2010. It was also published in Peninsula Clarion on March 24, 2010. The Commission has jurisdiction in this matter under 20 AAC 25.440.
4. Aurora's proposed underground storage of "hydrocarbons which are of pipeline quality and are gases at standard temperature and pressure" is specifically excluded from federal Underground Injection Control ("UIC") regulations.
5. The Commission has authority to issue an aquifer exemption in accordance with the standards set forth in 20 AAC 25.440.
6. No protests to the application or requests for hearing were received.
7. Because Aurora's submittals and the Commission's public records provide a sufficient basis upon which to make an informed decision, the Commission determined the request could be resolved without a hearing. The public hearing was vacated on April 12, 2010.

## **FINDINGS:**

### 1. Operator

Aurora operates the NCU and the NCU No. 2 well (NCU 2) located on the west side of Cook Inlet, approximately 1.6 miles west of Shirleyville Camp and 11.5 miles west-southwest of Tyonek.

### 2. Extent of Aquifer Exemption Area

Aurora's NCU 2 well is a gas production well proposed for conversion to gas storage injection service. Data in the record supports an aquifer exemption covering an area within Township 11N, Range 12W, SM, specifically described as:

Section 29: SE  $\frac{1}{4}$  SW  $\frac{1}{4}$  NW  $\frac{1}{4}$ ; SW  $\frac{1}{4}$  SE  $\frac{1}{4}$  NW  $\frac{1}{4}$ ; SW  $\frac{1}{4}$  NW  $\frac{1}{4}$  SW  $\frac{1}{4}$ ;  
E  $\frac{1}{2}$  NW  $\frac{1}{4}$  SW  $\frac{1}{4}$ ; W  $\frac{1}{2}$  NE  $\frac{1}{4}$  SW  $\frac{1}{4}$ ; SW  $\frac{1}{4}$  SW  $\frac{1}{4}$ ; NW  $\frac{1}{4}$  SE  $\frac{1}{4}$  SW  $\frac{1}{4}$

### 3. Geology and Groundwater Hydrology

The stratigraphic column on the western margin of the Cook Inlet includes clastic rocks of Quaternary through Tertiary age that lie unconformably on top of Mesozoic-aged basement rocks. Glacial, Pleistocene shallow sand and gravel deposits are locally 400' to 500' thick<sup>1</sup> and contain freshwater. The underlying Beluga and Tyonek Formations (in descending stratigraphic order), consist mainly of a series of reservoir and non-reservoir fluvial-derived rocks.

The Beluga Formation, approximately 1,550' thick within the affected area, is comprised of clay, siltstone, coal and sand. Individual sand beds within the Beluga Formation are generally less than 30' thick and are separated by numerous low-permeability layers, resulting in a heterogeneous sequence of rocks with very poor or no vertical connectivity or permeability.

Three uppermost Tyonek sandstone strata (in descending order, Carya 2-1.1, 2-1.2, and 2-2.1) that range in thickness from 15' to 35' are currently being drained by gas production well NCU 2. Only these three strata are proposed for use as storage reservoirs. Gas in these strata is trapped within a small, east-trending fold bounded to the west and to the east by small, north-northeast-trending faults.

The Carya 2-1.1, 2-1.2, and 2-2.1 reservoir strata are separated from the overlying Beluga Formation by more than 150' of low permeability clay, siltstone, and coal that persist laterally across the area proposed for aquifer exemption.

### 4. Formation Water Salinity

The very low water yield from NCU 2 (only 1 barrel of water was reported during the most recent year of production) precluded sampling and analysis of produced water from the proposed storage reservoirs. A produced water sample obtained during July 2007 from Beluga reservoirs in nearby well NCU 9 measured 9,820 ppm total dissolved solids (TDS). During February, 2010, a commingled Beluga and Upper Tyonek produced water sample from nearby well NCU 3 measured

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<sup>1</sup> All thicknesses presented herein are expressed as true vertical feet unless otherwise specified.

3,500 ppm chlorides, equal to approximately 7,200 ppm TDS<sup>2</sup>. Other February, 2010 produced-water analyses reported by Aurora from the Beluga in NCU 9 and Upper Tyonek in NCU 1B, measured 19,000 and 18,000 ppm chlorides (39,000 and 16,400 ppm TDS<sup>3</sup>), respectively.

Calculated TDS concentrations using well log data from the Beluga and Upper Tyonek reservoirs are not reliable for NCU 2 due to significant amounts of methane present at depths greater than 650' below sea level.

5. Suitability of NCU 2 Sediments as Drinking Water Aquifers

Under 20 AAC 25.440 (a)(1) the Commission may grant a aquifer exemption if the aquifer “is hydrocarbon producing” or “is situated at a depth or location that makes recovery of water for drinking purposes economically or technologically impractical”. The aquifer exemption requested by Aurora is supported by the following:

- a. the area has plentiful surface and groundwater available to a depth of approximately 450' below sea level;
- b. mud logs from wells drilled to date nearby NCU 2 show that hydrocarbon gas, primarily methane, frequently occur at depths greater than 650' below sea level;
- c. the proposed storage reservoirs produce, or have produced, commercial quantities of hydrocarbon gas;
- d. produced water samples suggest that the Beluga and Upper Tyonek reservoirs in the storage area have TDS concentrations between 3,000 and 10,000 ppm, or greater than 10,000 ppm; and
- e. at the March 17, 2010 public hearing for Storage Injection Order No. 8 regarding NCU 2, Aurora testified that the nearest drinking water wells are located at Shirleyville Camp, about 1.6 miles to the east, and are less than 100' below ground surface. According to the Alaska Department of Natural Resources' Water Rights Geographic Information System and Land Administration System Case Abstracts websites, the nearest registered surface water rights claim is for Markley's Spring, which lies about 2 miles east of the proposed storage project (ref. DNR Case File LAS 3400). There are no other surface or subsurface water rights claims recorded within 14 miles of the proposed storage operation.

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<sup>2</sup> The July, 2007 Beluga reservoir produced water sample from NCU 9 measured 4790 ppm chlorides and 9820 ppm TDS. Applying that same ratio (1 to 2.05) to the NCU 1B sample that measured 3500 ppm chlorides yields 7175 ppm TDS.

<sup>3</sup> Conversion from chloride concentration to TDS concentration is based on the 1 to 2.05 ratio of chlorides to TDS established in footnote 1, above.

**CONCLUSIONS:**

1. Those portions of freshwater aquifers occurring deeper than 2000' below sea level within NCU 2 wellbore and affected area do not currently serve as a source of drinking water. All known and foreseeable ground water consumption from the NCU vicinity is consistent with usable surface and ground water resources occurring above a depth of about 450' below sea level;
2. those portions of freshwater aquifers occurring deeper than 2000' below sea level within the NCU 2 wellbore and affected area contain hydrocarbon gases, TDS concentrations between 3,000 ppm and 10,000 ppm or exceeding 10,000 ppm, and are situated at locations and depths that make recovery of these waters for drinking water purposes economically impractical;
3. those portions of aquifers occurring deeper than 2000' below sea level within the affected area cannot reasonably be expected to serve as underground sources of drinking water; and
4. those portions of aquifers occurring in the NCU 2 storage injection strata within the affected area and deeper than 2000' below sea level qualify as exempt freshwater aquifers under 20 AAC 25.440(a)(1)(A), 20 AAC 25.440(a)(1)(B), and 20 AAC 25.440(a)(2).

**NOW, THEREFORE, IT IS ORDERED THAT** the aquifers or portions of aquifers occurring deeper than 2000' below sea level in the following areas within T11N, R12W, SM, are exempt as provided by 20 AAC 25.440 for the purposes of gas storage injection operations:

Section 29: SE  $\frac{1}{4}$  SW  $\frac{1}{4}$  NW  $\frac{1}{4}$ ; SW  $\frac{1}{4}$  SE  $\frac{1}{4}$  NW  $\frac{1}{4}$ ; SW  $\frac{1}{4}$  NW  $\frac{1}{4}$  SW  $\frac{1}{4}$ ;  
E  $\frac{1}{2}$  NW  $\frac{1}{4}$  SW  $\frac{1}{4}$ ; W  $\frac{1}{2}$  NE  $\frac{1}{4}$  SW  $\frac{1}{4}$ ; SW  $\frac{1}{4}$  SW  $\frac{1}{4}$ ; NW  $\frac{1}{4}$  SE  $\frac{1}{4}$  SW  $\frac{1}{4}$

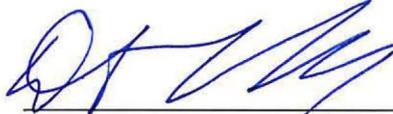
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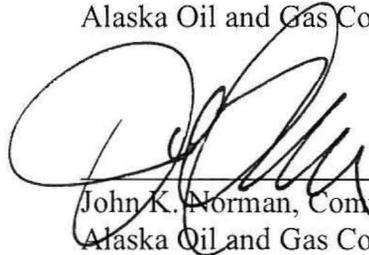
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**Note that this Order does not authorize the injection of any fluids or gas within the exemption area. Storage Injection Order No. 8 governs storage injection operations within the exemption area.**

**DONE** at Anchorage, Alaska, and dated April 16, 2010.



Daniel T. Seamount, Jr., Commissioner, Chair  
Alaska Oil and Gas Conservation Commission



John K. Norman, Commissioner  
Alaska Oil and Gas Conservation Commission



Cathy P. Foerster, Commissioner  
Alaska Oil and Gas Conservation Commission

**RECONSIDERATION AND APPEAL NOTICE**

As provided in AS 31.05.080(a), within **20** days after written notice of the entry of this order or decision, or such further time as the Commission grants for good cause shown, a person affected by it may file with the Commission an application for reconsideration of the matter determined by it. If the notice was mailed, then the period of time shall be **23** days. An application for reconsideration must set out the respect in which the order or decision is believed to be erroneous.

The Commission shall grant or refuse the application for reconsideration in whole or in part within 10 days after it is filed. Failure to act on it within 10-days is a denial of reconsideration. If the Commission denies reconsideration, upon denial, this order or decision and the denial of reconsideration are **FINAL** and may be appealed to superior court. The appeal **MUST** be filed within **33** days after the date on which the Commission mails, **OR 30** days if the Commission otherwise distributes, the order or decision denying reconsideration, **UNLESS** the denial is by inaction, in which case the appeal **MUST** be filed within **40** days after the date on which the application for reconsideration was filed.

If the Commission grants an application for reconsideration, this order or decision does not become final. Rather, the order or decision on reconsideration will be the **FINAL** order or decision of the Commission, and it may be appealed to superior court. That appeal **MUST** be filed within **33** days after the date on which the Commission mails, **OR 30** days if the Commission otherwise distributes, the order or decision on reconsideration. As provided in AS 31.05.080(b), "[t]he questions reviewed on appeal are limited to the questions presented to the Commission by the application for reconsideration."

In computing a period of time above, the date of the event or default after which the designated period begins to run is not included in the period; the last day of the period is included, unless it falls on a weekend or state holiday, in which event the period runs until 5:00 p.m. on the next day that does not fall on a weekend or state holiday.

**STATE OF ALASKA**  
**ALASKA OIL AND GAS CONSERVATION COMMISSION**  
**333 West 7<sup>th</sup> Avenue, Suite 100**  
**Anchorage, Alaska 99501**

Re: THE APPLICATION OF Aurora Gas,	)	Docket Number: AEO-10-01
LLC for an Aquifer Exemption Order for	)	Aquifer Exemption Order No. 12
portions of the Nicolai Creek Unit in	)	
Township 11 North, Range 12 West,	)	Nicolai Creek Field
Seward Meridian, Kenai Peninsula	)	Nicolai Creek Unit
Borough, in conformance with 20 AAC	)	South Undefined Gas Pool
25.440.	)	
	)	Kenai Peninsula Borough, Alaska
	)	
	)	April 16, 2010
	)	

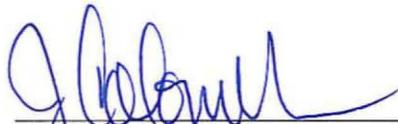
**NOTICE CLOSING DOCKET**

**BY THE COMMISSION:**

The Commission has the closed the Docket in the above captioned matter.

**ENTERED AND EFFECTIVE at Anchorage, Alaska** and this 16th day of April, 2010.

BY DIRECTION OF THE COMMISSION



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Jody J. Colombie  
Special Assistant to the Commission