

FINDINGS AND DECISION

of the Director, Division of Oil and Gas

APPROVING THE  
TUVAAQ UNIT APPLICATION

Under Delegation of Authority from the  
Commissioner, Department of Natural Resources, State of Alaska

August 20, 2004

## TABLE OF CONTENTS

I.	INTRODUCTION AND BACKGROUND .....	1
II.	APPLICATION FOR THE FORMATION OF THE TUVAAQ UNIT.....	1
III.	DISCUSSION OF DECISION CRITERIA.....	2
	1. Environmental Costs and Benefits of Unitized Exploration or Development.....	2
	2. Geological and Engineering Characteristics of the Reservoir .....	3
	3. Prior Exploration Activities in the Unit Area .....	6
	4. Plans for Exploration and Development of the Proposed Unit Area .....	8
	5. The Economic Costs and Benefits to the State .....	9
	6. Amendments to the Standard Unit Agreement .....	9
IV.	FINDINGS .....	10
	1. Promote the Conservation of All Natural Resources .....	10
	2. Promote the Prevention of Economic and Physical Waste .....	10
	3. Provide for the Protection of All Parties in Interest, Including the State .....	11
V.	DECISION .....	12
	Attachment 1: The Tuvaq Unit Agreement	
	Attachment 2: Exhibit A, Description of the Tuvaq Unit	
	Attachment 3: Exhibit B, Map of the Tuvaq Unit Area	
	Attachment 4: Exhibit G, Unit Plan of Exploration	
	Attachment 5: Changes to the Model Form	

## I. INTRODUCTION AND BACKGROUND

The proposed Tuvaq Unit (TU) is located in near shore waters of the Beaufort Sea, between the recently formed Oooguruk and Nikaitchuq Units. Armstrong Alaska, Inc. (Armstrong) filed the application with the Division of Oil and Gas (Division) on January 29, 2004. As of July 1, 2004, Armstrong is the sole owner of the leases and the proposed TU Operator (Operator).

The proposed unit area encompasses approximately 14,561.19 acres within seven State of Alaska (State) oil and gas leases. The TU will be administered by the State under the terms of the Tuvaq Unit Agreement (Agreement). The Agreement conforms and modifies all State oil and gas leases within the unit area so that the unit operator can explore and develop on a unit-wide basis instead of on a lease-by-lease basis.

The Department of Natural Resources (DNR) issued all of the State oil and gas leases following Beaufort Sea Sale 86, which was held on November 18, 1997. The leases, ADL 388571, ADL 388572, ADL 388573, ADL 388574, ADL 388575, ADL 388577 and ADL 388578, were issued on State lease form DOG 9609(REV 6/97). With an effective date of January 1, 1998, the seven-year primary term of these leases expires on December 31, 2004. All eight of the leases in the proposed unit area retain a 16.66667% royalty to the State.

## II. APPLICATION FOR THE FORMATION OF THE TUVAAQ UNIT

Armstrong submitted a complete application to form the TU and paid the \$5,000.00 unit application filing fee. Armstrong's application included: a proposed TU Agreement; Exhibit A to the agreement, legally describing the proposed unit area, its leases, and ownership interests; Exhibit B to the agreement, a map of the proposed unit; and Exhibit G to the agreement, the proposed Initial Plan of Exploration. In addition, Armstrong submitted a TU Operating Agreement; technical data supporting the application; and evidence that they had invited all proper parties to join the application.

The Division determined that Armstrong's application was complete and published a unit notice in the "*Anchorage Daily News*" and in the "*Arctic Sounder*" on Thursday, June 10, 2004. DNR also posted notices on the State's online public notice web page. The Division provided copies of the public notices to the North Slope Borough Mayor and Assembly, the Arctic Slope Regional Corporation, the cities of Barrow and Nuiqsut, the Kuukpik Corporation, and other interested parties in compliance with 11 AAC 83.311. The Division also provided public notices to the Alaska Department of Environmental Conservation, the Alaska Department of Fish and Game, and to post offices, libraries, and radio stations in the area. The notice invited interested parties and members of the public to submit comments by July 12, 2004. The Division did not receive any comments.

The TU Agreement requires that Armstrong, the Unit Operator, file unit plans that describe the activities for the proposed unit area. The Operator must consider how it can best explore and develop the resources underlying the entire unit area, without regard to internal lease boundaries. Armstrong proposed a five-year Unit Plan of Exploration (Initial POE) as a required under 11

AAC 83.341. Armstrong plans to drill three wells during the Initial POE. The first well will be drilled during the 2004-2005 winter drilling season. Based on the results from the initial test, geologic studies, engineering studies and seismic reprocessing, which are planned for 2006, a second exploration well may be drilled in the 2006-2007 winter drilling season or earlier. The second well is planned to test the Cretaceous Kuparuk sand interval, Jurassic Nuiqsut sand continuity, and limits of the Triassic Sag/Eileen/Ivishak accumulations within the TU. A third exploration well would be drilled during the 2008-2009 winter drilling season or earlier and test the Triassic Sag/Eileen/Ivishak intervals on the eastern side of the TU. Currently, Armstrong has applied for permits to drill up to 5 wells in the 2004-2005 winter drilling season.

### III. DISCUSSION OF DECISION CRITERIA

AS 38.05.180(p) gives DNR the authority to form an oil and gas unit. The Commissioner of DNR (Commissioner) reviews unit applications under AS 38.05.180(p) and 11 AAC 83.301 – 11 AAC 83.395. By memorandum dated September 30, 1999, the Commissioner approved a revision of Department Order 003, and delegated this authority to the Division Director (Director).

The Director will approve the Application upon finding that it will: 1) promote the conservation of all natural resources; 2) promote the prevention of economic and physical waste; and 3) provide for the protection of all parties of interest, including the State in accordance with 11 AAC 83.303(a). Subsection .303(b) sets out six factors that the Director will consider in evaluating the Application. A discussion of the subsection .303(b) criteria, as they apply to the Application, is set out directly below, followed by the Director's findings relevant to the subsection .303(a) finding and the Director's conditional approval of the Application.

#### 1. The Environmental Costs and Benefits of Unitized Exploration or Development

Alaska statutes require the DNR to give public notice and issue a written finding before disposal of the state's oil and gas resources AS 38.05.035(e); AS 38.05.945; 11 AAC 82.415. In preparing a written decision before an oil and gas lease sale, the commissioner may impose additional conditions or limitations beyond those imposed by law. AS 38.05.035(e). The DNR develops lease stipulations through the lease sale process to mitigate the potential environmental, social and cultural impacts from oil and gas activity.

The leases that are proposed to be included in the TU contain many stipulations designed to protect the environment and address any outstanding concerns regarding impacts to the area's fish and wildlife species and to habitat and subsistence activities. They address the protection of primary waterfowl areas, site restoration, construction of pipelines, seasonal restrictions on operations, public access to, or use of the leased lands, and avoidance of seismic hazards. Including these leases in the TU will not result in additional restrictions or limitations on access to surface lands or to public and navigable waters. All lease operations are subject to a coastal zone consistency determination, and must comply with the terms of both the State and North Slope Borough coastal zone management plans.

Ongoing mitigation measures such as seasonal restrictions on specific activities in certain areas can reduce the impact on bird, fish, and mammal populations. With these mitigation measures, the anticipated exploration and development related activity is not likely to significantly impact bird, fish, and mammal populations. Area residents use the unit area for subsistence hunting and fishing. Oil and gas activity may impact some wildlife habitat, and some subsistence activity. The environmental impact will depend on the level of development activity, the effectiveness of mitigation measures and the availability of alternative habitat and subsistence resources. In any case, the anticipated activity under the new TU will impact habitat and subsistence activity less than if the lessees developed the resources on an individual lease basis. Unitized exploration, development and production will minimize surface impact.

Furthermore, state unitization regulations require the commissioner to approve a Plan of Operations before the unit operator performs any field operations. 11 AAC 83.346. Any Plan of Operations must describe the operating procedures designed to prevent or minimize adverse effects on natural resources. The unit operator must guarantee full payment for all damage sustained to the surface estate before beginning operations. The Plan of Operations must include plans for rehabilitation of the unit area. When the operator proposes to further explore and develop the unit area and submits a Unit Plan of Operations, the Division will ensure that it complies with the lease stipulations and lessee advisories developed for the most recent North Slope areawide lease sale.

The approval of the TU has no environmental impact itself. The commissioner's approval of the unit is an administrative action, which by itself does not convey any authority to conduct operations within the unit. Unitization does not waive or reduce the effectiveness of the mitigating measures that condition the lessee's right to conduct operations on these leases. The Division's approval of the POE is only one step in the process of obtaining permission to drill wells and develop the known reservoirs within the unit area.

The Unit Operator must still obtain approval of a Unit Plan of Operations and obtain various permits from state agencies before initiating activities. Armstrong plans to explore the area through ice roads and pads, which will leave no trace after they melt. All planned exploration wells will be plugged and abandoned before the ice breaks up.

## 2. The Geological and Engineering Characteristics of the Reservoir

Armstrong submitted a strong technical application that justified the size and shape of the unit that included geological, geophysical, and engineering data. Armstrong integrated and interpreted several 3-D seismic surveys over the proposed unit area, tied it to the surrounding well control, incorporated pressure data, and calculated oil gradients from adjacent well control to identify several viable exploration targets that include the Jurassic Nuiqsut and Sag River, Eileen, and Ivishak sandstones.

There is a significant amount of well data south of the proposed TU that provides information to justify the TU Area. The Milne Point Unit (MPU) field lies several miles to the southeast of the proposed unit and produces oil from the Schrader Bluff, Kuparuk, and Sag River Formations. The Kuparuk River Unit lies south of the proposed unit and produces out of the Kuparuk River

Formation. A dozen or so exploration wells lie to the south and west of the proposed Tuvaq Unit and have tested hydrocarbons in both the Kuparuk Formation and Jurassic sands. Armstrong has identified potential Jurassic reserves by tying the 3-D seismic coverage over the proposed Tuvaq Unit with the Thetis Island 1, Kalubik 1, and recently drilled Ivik 1, Natchiq 1, Oooguruk 1 and Nikaitchuq 1 and 2 wells. Armstrong believes that the quality and thickness of the Sag River sandstone should increase to the north/northwest from the Milne Point area into the Tuvaq Unit area. Oil stained Brookian sandstones have been encountered in the Thetis Island 1 and Kalubik 1 wells southwest of the proposed Tuvaq Unit.

### Brookian Sandstone Potential

Brookian sandstones were deposited during latest Cretaceous and Paleocene time in available accommodation spaces as the Colville Trough was filled with sediment in response to thrust loading from the Brooks Range, a large north vergent fold and thrust belt to the south. A Brookian sandstone at 5,050' - 5,250' in the Kalubik 1 well tested oil (API gravity not measured) at the rate of 10 BOPD. Brookian sands were also tested in the Thetis Island. 1 well at depths of 5,576' - 5,578' (md) and 5,631' - 5,633' (md) that produced mud filtrate with a trace of oil.

### Kuparuk River Formation: Stratigraphy and Depositional and Tectonic History

The Kuparuk River Formation of Early Cretaceous age (120 – 145 million years old) has a unique and complex depositional history. The Kuparuk River formation is informally subdivided into four members designated by letters A (oldest) through D (youngest). Each member is further subdivided into sub-members designated by numbers, such as A-1 and C-4 (with one being the oldest sub-member). The lower A and B sandstone members were derived from a sub-aerially exposed northern provenance that foundered during Late Jurassic - Early Cretaceous time. The Kuparuk A sandstone sub-members are predictable, continuous, coarsening-upward marine offshore bars-to-shoreface sequences that were deposited over large contiguous areas. Following the deposition of shallow marine Kuparuk B sediments, the area became tectonically active due to regional rifting and extension tectonics that resulted in regional tilting and the formation of localized high source areas that were subsequently eroded by the Lower Cretaceous Unconformity (LCU), a major regional scouring event. The LCU progressively truncates the B sediments, where deposited, and A sandstone members in a predictable manner. As the northern source terrain subsided, localized uplifted blocks along the Prudhoe Bay structural high became the primary source of the Upper Kuparuk C and D sediments. The Kuparuk C and D members are deposited on top of the eroded irregular topography created by the LCU and represent the first sediments derived from the local structural highs. Sediment eroded from the highs was deposited as the C and D members and was preserved in grabens and other low-lying areas on the eroded LCU surface. The most productive C sandstone areas tend to be associated with thicker sand intervals deposited in paleo-topographic depressions on down-thrown fault blocks. Kuparuk C sandstone is absent by erosion or non-deposition on paleo-topographic highs. In the northern MPU and northeastern part of the Kuparuk River Unit (around 3R, 3Q, and 3O pads) the primary oil production comes from the lower A sandstone members. Locally, the LCU has completely eroded all of the B sandstone members and upper A sandstone members and has progressively eroded or truncated

the A3, A2, and A1 Kuparuk sandstone members in a northwest direction. The LCU is generally coincident with the top of the reservoir sand in the northeastern Kuparuk River Unit and MPU areas. To the west in the northwestern Kuparuk River Unit (around 3M and 3H pads) more Kuparuk C sandstone is preserved locally, primarily in paleo-topographic lows and grabens, and a significant amount of Kuparuk production is from the Kuparuk C interval along with A sandstones. Southwest of the TU, in the Kalubik wells and in the Colville Delta wells, some Kuparuk C sandstone is preserved. It is quite possible that the Tuvaq area could contain pods of Kuparuk C sandstone that have been preserved on the down-side of the northwest trending, down to the northeast faults in the area.

### Jurassic Sandstone Potential

The Colville Delta area, southwest of the proposed TU, contains three oil-bearing Jurassic sands. From oldest to youngest the three sandstones are the Nechelik, Nuiqsut, and Alpine sandstones. All three sandstones appear to have the same general depositional setting and lithologic characteristics. The sands are very fine to fine-grained quartz arenites that contain up to 15% glauconite. These shallow marine sands were deposited from a northern source area that foundered in the early Cretaceous during the opening of the Canada Basin. The regional setting of the Colville Delta and Alpine area is interpreted from seismic and regional well control as a broad, very low gradient marine shelf on a south-facing passive margin. The shelf was likely a muddy one with limited accommodation space and relatively low rates of sedimentation. The three successive upper Jurassic sand intervals were deposited as progradational and aggradational coarsening upward units over a period of approximately 20 million years.

A number of factors contributed to the preservation of these three Jurassic sandstone packages: eustatic and tectonic sea level changes; local topography created by normal faulting resulting from pre-breakup rift-related extensional tectonics; and the localized point-source contributions of localized rivers, incised valleys, and eroded highs sculpted by localized erosion during lowstands of sea level. The Alpine interval records the last significant sandstone pulse of Jurassic sedimentation in the vicinity of the Alpine field. The Alpine sandstone from the Bergschrund 1 well (discovery well for the Alpine field) initially produced at a rate of 2,380 BOPD of 39 API gravity oil. The Alpine interval is not present in the northern Colville Delta area where it was apparently eroded by the LCU. The underlying Nuiqsut sandstone appears to have extended into and thickens in the Colville Delta area. The overall Jurassic section appears to thicken to the east-northeast of the Colville Delta area based on the East Harrison Bay 1 and Oliktok Pt. 1 wells.

The Jurassic Nuiqsut sandstone oil prospects in the proposed Tuvaq unit are dependent on the interplay of faulting, especially the northwest trending, down to the northeast fault that separates the Thetis Island 1 well from the Tuvaq area and the northeast trending Nuiqsut truncation edge that occurs in the northern part of the Tuvaq area, and the preservation of good quality Jurassic sandstones on the downside of the major fault referred to above. These factors suggest the fluids in the potential Jurassic reservoir in the Tuvaq area are separated from the accumulation at Thetis Island. The key to unlocking the reserves within the Jurassic sands is producing the low API gravity oil without damaging the formation with drilling fluids.

## Sag River and Sadlerochit Potential

Armstrong has integrated various 3-D seismic surveys over the Colville Delta, Prudhoe, northern Milne Point and northern Kuparuk field, and Oooguruk, Tuvaq, and Nikaitchuq areas to define a prospective exploration trend in the Sag River, Eileen, and Ivishak sandstones.

Armstrong has collected and analyzed Sag River pressure and oil property data for the Nikaitchuq 1 and 2, and Milne Point wells F-33, F-33a, and C-1. The Tuvaq Unit contains two Sag River structural prospects. Each prospect exhibits independent four-way structural closure. Armstrong's evaluation of fault juxtaposition, pressure, petrophysical, and seismic data indicate geologic spill points between -8200' and -8300' subsea. Geochemical analyses of oils collected from the Nikaitchuq and Milne Point wells predict that Sag River oil should be in the range of 36-38° API oil. Reservoir modeling predicts production rates up to 2500 BOPD with horizontal wells.

In conclusion, Armstrong has submitted adequate geological, geophysical, and engineering data to the division to properly evaluate and justify the formation of the Tuvaq Unit.

### 3. Prior Exploration Activities in the Unit Area

Several key exploration wells lie within several miles of the proposed Tuvaq Unit area. The first major exploration activity in the area in the early 1970's targeted the Ivishak sandstone following the discovery of the prolific Ivishak sandstone in Prudhoe Bay State 1 in 1967.

The first exploration wells in the Oliktok Point area were Simpson Lagoon 32-14 and 32-14A, drilled by Chevron in 1969 as Sadlerochit exploration wells. The Simpson Lagoon 32-14 well was drilled to a total measured depth of 10,483 feet and bottomed in the Lisburne formation. The Ivishak, Echooka, and Lisburne formations were drill stem tested and were wet. The Kuparuk formation exhibited mud log shows. Two cores were taken in the Kuparuk formation, but the interval was not tested. A production test was run in the Kuparuk A intervals in the Simpson Lagoon 32-14A well and the sands produced oil at a rate around 629 BOPD of 22.5 degree API and 185 MCFG/D. The Shublik formation was also production tested in this well and was not oil productive. Two DST's were taken in the Sadlerochit formation. One test yielded water; mud and minor high gravity oil along with gas at a rate around 466 MCFPD. The other DST recovered gassy mud; gassy, muddy water; and a slight trace of foamy oil.

The Hamilton Brothers Milne Pt. 18-1 was one of the early wells drilled on the Milne Point Structure in 1970 in search of Ivishak and Lisburne objectives. This well encountered about 50' of tight oil-saturated sandstone that was not tested and a section of Kuparuk Sandstone that tested at a rate of 875 BOPD. This discovery encouraged companies to explore for Kuparuk reserves in the Milne Point area. In the early 1980's the Sag River was cored in the Conoco Milne Pt. Unit C-1 well and contained bleeding oil and gas. The Sag River Formation was also cored in the MPU L-1 well and contained no visible porosity or staining and the Sag River appeared tight on wireline logs.



The Unocal East Harrison Bay State 1 well lies near the northwest corner of the Kuparuk River Unit, approximately 3.5 miles south of the proposed TU. The well was drilled in February 1977 to a measured depth of 9,809 feet, bottoming in argillite basement. The East Harrison Bay State 1 well logs appear to contain about 15 feet of oil-bearing Kuparuk sandstone that appears cemented in the upper half. The Jurassic section looks silty on logs. The Sag River and Ivishak formations exhibited log porosity and permeability and had minor hydrocarbon shows on the mudlog. The Ivishak tested wet.

ARCO drilled the Oliktok Point #1 well in 1982 as an Ivishak and Lisburne exploration well to a total measured total depth of 10,620' into Argillite basement. Twenty-three cores were cut in the well, varying from depths of 3012' to 10028'. No tests were conducted. Good mud log shows were encountered within the Kuparuk, Shublik, and Sadlerochit formations. The Oliktok Point #2 and #2A wells were drilled as Kuparuk exploration wells in 1984 to measured total depths of 8280' and 9750', respectively, into the Kingak formation. All three Oliktok Point wells appear oil bearing in the Kuparuk formation on resistivity logs.

The BP Mukluk well drilled to the northwest of the proposed unit in 1984 contained about 50' of good quality Kuparuk sandstone. The Sag River sandstone was absent due to erosion by the LCU. The Tenneco Phoenix well, drilled in 1986, encountered around 90' of good reservoir quality Sag River sandstone immediately below the LCU. The porous and permeable Sag River sand quality demonstrates that good quality reservoir potential exists to the northwest of the proposed TU.

In the early 1990's about a dozen wells were drilled to the west-southwest of the proposed TU in the Colville Delta area with Jurassic sandstones and Kuparuk C sandstones as targets. The ARCO Kalubik 1 well, spud on 3/5/1992, was completed on 5/1/1992 to a total depth of 8273' in the Ivishak formation. The well encountered a 35' section of porous Kuparuk C sandstone that tested at a rate of 1220 BOPD of 25.5° API gravity oil with a GOR of 450 and 0% water cut. Two other intervals were tested in the well. An upper Cretaceous sandstone (5,050-5,250' md) recovered 4.5 BO and 146 BW in a 12.5-hour test from which an average oil rate of 10 BOPD was calculated. The Jurassic Nuiqsut sandstone at 6,385-6,445' md was also tested and recovered 280 BO (with a measured API gravity of 23° and a GOR of 232 scf/stb) and no formation water. The well also encountered approximately 160' of productive Nuiqsut and Nechelik sandstone that tested at a rate of 336 BOPD. With nitrogen lift the Jurassic sandstones produced at an average rate of 660 BOPD of 19.7° API oil.

The Exxon Thetis Island 1 well was spud on 3/6/1993 and completed on 4/28/1993 to a total depth of 8460' in the Ivishak formation. A combined drill stem test was conducted in a Kuparuk C sandstone and in the Jurassic Nuiqsut sandstone. The well tested at an initial flow rate of 64 BWPD and 43 BOPD of 24.8 ° API oil. After acid stimulation, the well flowed at an average rate of 154 BOPD. Exxon also tested a sandstone within the Seabee formation at 5,576-5,633' (md) that produced mud filtrate with a trace of oil. In addition, the well penetrated an 80' section of wet Sag River sandstone with calculated log porosities in the range of 16 to 24%.

In the late 1990's BP drilled several dedicated Sag River wells including MPU C-23, K-33, E-13A, F-33, F-33A, and F-73A. AOGCC production data indicate that several Milne Point wells have produced oil out of the Sag River sandstone with an average API oil gravity of 37°. MPU C-23 produced 378,012 barrels of oil between 1996 and 1998 and 2001. MPU F-33 produced 314,276 barrels of oil between September 1996 and May 1995 and was subsequently plugged and abandoned. MPU K-33 has produced approximately 520,819 barrels of oil since 1997. MPU F-33A produced approximately 384,444 barrels of oil since April of 2001.

The ARCO Kalubik 3 well, drilled in February 1998, lies to the south-southwest of the TU. The well bottomed in the Jurassic at a measured depth of 7,000 feet. The well encountered a 40-foot (md) thick interval of Kuparuk C sandstone that appears on electric logs as oil-bearing, but siderite cemented in the upper 10 feet of the interval. On well logs the Jurassic interval appears silty with a 12-foot silty sand developed around 6,565' measured depth (md). The well was plugged and abandoned on 3/6/1998.

Pioneer and Armstrong drilled three exploration wells in 2003 in the Oooguruk Unit to the southwest of the proposed TU. The Pioneer Ivik 1, drilled approximately 3 miles south of the Thetis Island 1 well, encountered reservoir quality oil-stained sands with mudlog shows within the Brookian and Jurassic intervals. The Brookian sands tested wet in a formation test. The Nuiqsut sands (approximately 60' thick) tested at a rate of 1300 BOPD after fracture stimulation. The Oooguruk well, drilled approximately 1 ½ miles to the north of the Ivik well, contained 45' of Nuiqsut sandstone pay that was not production tested, but did produce hydrocarbons in a formation test. The Oooguruk well also penetrated 10 feet of porous, oil-bearing Kuparuk sandstone.

During the first quarter of 2004, Kerr-McGee/Armstrong drilled two exploration wells in the adjacent Nikaitchuq Unit, the Nikaitchuq 1 and 2 wells to the east of the proposed Tuvaq Unit. On 4/19/04 Kerr-McGee announced that the Nikaitchuq 1 well (drilled to a total measured depth of 9307') produced 38 °API oil from the Sag River Formation at a rate of 960 BOPD. A porous and permeable Sadlerochit section based on log data from the well with strong hydrocarbon shows tested wet. The Nikaitchuq 2 well, drilled 9,000' southwest of the first well to a total measured depth of 9507', successfully extended the known limits of the Sag River accumulation down dip. The Jurassic Nuiqsut Interval encountered in the Nikaitchuq 2 well was predominantly comprised of silt and shale.

#### 4. Plans for Exploration and Development of the Proposed Unit Area

The unit operator must provide plans for exploration or development that justify including the proposed acreage in the unit area. 11 AAC 83.306(1). A Unit Plan of Exploration must include a description of proposed exploration activities, including the bottom-hole locations and depths of proposed wells, and the estimated date drilling will commence. 11 AAC 83.341(a).

The Initial POE, attached to this Decision as Attachment 4, sets out a timely sequence of exploration activities that will facilitate the ultimate development and production of the reservoir, if oil and gas are discovered in commercial quantities. Furthermore, completion of the proposed exploration activities as scheduled during the five-year initial term will satisfy the

performance standards and diligence requirements that the State and the WIOs agreed to as a condition for approval of the Agreement. The Division and the WIOs have agreed that a failure to timely perform the various components set out in the Initial POE would constitute a default under the Agreement.

The Initial POE protects the interests of the public and the State by committing the Operator to drill wells and reprocess seismic data within the unit area. The Initial POE, with the agreed-to terms and conditions, ensures that the lease extensions resulting from unitization under 11 AAC 83.336 continue only so long as the applicants proceed diligently with exploration and development of the unit area. Therefore, the plans for exploration of the proposed unit area justify approval of the Application under the section .303(b)(4) criteria.

#### 5. The Economic Costs and Benefits to the State

Approval of the TU could result in both short-term and long-term economic benefits to the State. The additional assessment of the hydrocarbon potential of the leases will create jobs and in-state economic activity in the short-term and if the exploration activity is successful, the State will enjoy royalty and tax revenues as well as employment opportunities over the long-term.

The primary term of the leases is due to expire on December 31, 2004, but it is in the best interest of the State to form the unit to facilitate the exploration efforts.

The leases in the proposed TU are not written on the State's current lease form (DOG 200204). Effective the date of this decision, the WIOs agreed to permanently amend the terms of the leases to conform with the provisions in DOG 200204 and to delete the last sentence in paragraph 15(d) of all the lease forms. Specifically:

- Delete the last sentence of paragraph 36(b) of the Old Leases and insert "The 'actual and reasonable costs of transportation' for marine transportation are as defined in 11 AAC 83.229(a), (b)(2), and (c) – (l)."
- Delete the last sentence of paragraph 15(d) of all eight leases. That sentence reads "If any portion of this lease is included in a participating area formed under a unit agreement, the entire leased area will remain committed to the unit and this lease will not be severed."

Any additional administrative burdens associated with the formation of the new unit are far outweighed by the additional royalty and tax benefits derived from any production that may occur if the exploration and development activity is successful.

#### 6. Amendments to the Standard Unit Agreement

Armstrong submitted a unit agreement based on the State Only Model Form, dated June 2002 (Model Form) with the same modifications that were negotiated in the Nikaitchuq Unit Agreement.

During the negotiations of the Nikaitchuq, the Royalty Accounting Section of the Division proposed ten modifications to the Model Form for clarity reasons and the Units Section of the

Division proposed two changes to allow severing of leases upon unit contraction. Armstrong included these changes in the Agreement and the modifications are listed in Attachment 5 to this decision.

The Agreement defines the relationship between the unit operator, the working interest owners (WIOs), and the royalty owners. It describes the rights and responsibilities, in addition to those imposed by state law and the leases, of the unit operator, working interest owners, and royalty owners for exploration and development of the unit area. DNR may approve the Agreement if the available data suggest that the unit area covers all or part of one or more oil or gas reservoirs, or all or part of one or more potential hydrocarbon accumulations that should be developed under an approved unit plan, and the Application meets the other statutory and regulatory criteria.

These modifications to the Standard Unit Agreement are in the best interest of the State and under the .303.(b)(6) criteria, support approval of the Application.

#### IV. FINDINGS

The Application meets the criteria in 11 AAC 83.303(a) as discussed below.

##### 1. Promote the Conservation of All Natural Resources

The unitization of oil and gas reservoirs is a well-accepted means of hydrocarbon conservation. Without unitization, the unregulated development of reservoirs tends to be a race for possession by competitive operators. The results can be: (1) overly dense drilling, especially along property lines; (2) rapid dissipation of reservoir pressure; and (3) irregular advance of displacing fluids. These all contribute to the loss of ultimate recovery or economic waste. The proliferation of surface activity, duplication of production, gathering, and processing facilities, and haste to get oil to the surface also increases the likelihood of environmental damage (such as spills and other surface impacts). Requiring lessees to comply with conservation orders and field rules issued by the AOGCC would mitigate some of these impacts without an agreement to unitize operations. Unitization, however, provides a practical and efficient method for maximizing oil and gas recovery, and minimizes negative impacts on other resources.

The formation of the TU will promote the conservation of both surface and subsurface resources through the unitized (rather than lease-by-lease) development. Unitization allows the unit operator to explore the area as if it were one lease. The formation of the unit will allow this area to be comprehensively and efficiently explored and developed. Adoption of an Operating Agreement and Plan of Development governing that production will help avoid unnecessary duplication of development efforts on and beneath the surface.

Exploring and developing the leases under a unified Plan of Exploration and Plan of Development will reduce the incremental environmental impact of the additional production.

##### 2. Promote the Prevention of Economic and Physical Waste

Traditionally, under unitized operations, the assignment of undivided equity interests in the oil and gas reservoirs to each lease largely has resolved the tension between lessees to compete for their share of production. Economic and physical waste, however, could still occur without a well-designed and coordinated development plan and an equitable cost sharing formula. Consequently, unitization must equitably divide costs and production, and plan to maximize physical and economic recovery from any reservoir.

An equitable allocation of hydrocarbon shares among the WIOs discourages hasty or unnecessary surface development. Similarly, an equitable cost sharing agreement promotes efficient development of reservoirs and common surface facilities and encompasses rational operating strategies. Such an agreement further allows the WIOs to decide well spacing requirements, scheduling, reinjection and reservoir management strategies, and the proper common, joint use surface facilities. Unitization prevents economic and physical waste by eliminating redundant expenditures for a given level of production, and avoiding loss of ultimate recovery by adopting a unified reservoir management plan.

Unitized operations greatly improve development of reservoirs beneath leases that may have variable productivity. Marginally economic reserves, which otherwise would not be produced on a lease-by-lease basis, often can be produced through unitized operations as a stand-alone project or in combination with more productive leases. Facility consolidation saves capital and promotes better reservoir management by all WIOs. Pressure maintenance and secondary recovery procedures are much more predictable and attainable through joint, unitized efforts than would otherwise be possible. In combination, these factors allow less profitable areas of a reservoir to be developed and produced in the interest of all parties, including the state.

The lessees in the proposed unit leases have signed the Unit Agreement and the Unit Operating Agreement. By combining the efforts of multiple leases into a single effort, infrastructure can be shared, which eliminates the need to construct stand-alone facilities to process the volume of recoverable hydrocarbons that may be discovered on each individual lease, thus preventing economic and physical waste. Given the overall North Slope economics, stand-alone facilities on each individual lease would most likely be uneconomic.

### 3. Provide for the Protection of All Parties in Interest, Including the State

The proposed unit seeks to protect the economic interests of all WIOs of the reservoirs in the unit, as well as the royalty owner. Combining interests and operating under the terms of the Unit Agreement and the Unit Operating Agreement assures each individual working interest owner an equitable allocation of costs and revenues commensurate with the value of their leases.

Because hydrocarbon recovery will more likely be maximized, the state's economic interest is promoted. Diligent development and exploration under a single approved unit plan without the complications of competing leasehold interests is certainly in the state's interest. It promotes efficient evaluation and development of the state's resources, yet minimizes impacts to the area's cultural, biological, and environmental resources.

The lease form and the conditions of this decision provide, in part, that the state's royalty share will be free and clear of all lease expenses. Operating under the terms and conditions of the lease and Unit Agreement also provides for accurate reporting and record keeping, royalty settlement, in kind taking, and emergency storage of oil, all of which will further the state's interest. Finally, the inclusion of the lands in the unit promotes the state's interest in the evaluation and development of those lands sooner rather than later.

## V. DECISION

- 1) For the reasons discussed above, I hereby approve the TU Application subject to the conditions specified herein. The five-year term of the Agreement and the Initial POE become effective as of 12:01 a.m. on the day following approval by the Director.
- 2) The unitized development and operation of the leases will reduce the amount of land and fish and wildlife habitat that would otherwise be disrupted by individual lease development. Reducing environmental impacts and minimizing interference with subsistence activity is in the public interest. The formation of the new unit will not diminish access to public and navigable waters beyond those limitations imposed by law or already contained in the oil and gas leases.
- 3) The available well data and Initial POE justify formation of the new unit. Under regulations governing formation and operation of oil and gas units (11 AAC 83.301 – 11 AAC 83.395) and the terms and conditions under which these lands were leased from the State of Alaska, the leases listed in Attachment 1, and shown on Attachment 2 are included in the TU.
- 4) The WIOs waive the extension provisions of 11 AAC 83.140 and Article 15.2 of the Agreement and the notice and hearing provisions of 11 AAC 83.374 applicable to default and termination of the TU.
- 5) By October 1, 2004, the Operator shall submit updated Exhibits A and B to the Agreement that reflect the ownership on the Agreement effective date.
- 6) In accordance with Article 8.1.1 of the Agreement and 11 AAC 83.341, an annual status report is due on each anniversary of the effective date of the TU. The annual status report must describe the status of projects undertaken and the work completed during that year of the Initial POE, as well as any proposed changes to the plan.
- 7) The unit operator must submit a Second Plan of Exploration to the Commissioner at least 60 days before the Initial POE expires. Alternatively, the unit operator shall request approval of the first Plan of Development, if appropriate, at least 90 days before the Initial POE expires. 11 AAC 83.341(b) and .343(c).
- 8) Failure to drill the first well by June 1, 2005 will result in the automatic termination of the TU effective June 1, 2005.
- 9) Failure to drill a second well or obtain approval of a revised POE by June 1, 2007, will result in the automatic termination of the TU effective June 1, 2007.
- 10) Failure to drill a third well or obtain approval of a revised POE by June 1, 2009 will result in the automatic termination of the TU effective June 1, 2009.

- 11) If the TU terminates for failure to fulfill any of the commitments in the Initial POE, the WIOs shall automatically surrender all leases within the Unit whose primary terms have expired, effective the day the unit terminates.

A person affected by this decision may appeal it, in accordance with 11 AAC 02. Any appeal must be received within 20 calendar days after the date of "issuance" of this decision, as defined in 11 AAC 02.040(c) and (d) and may be mailed or delivered to Thomas E. Irwin, Commissioner, Department of Natural Resources, 550 W. 7th Avenue, Suite 1400, Anchorage, Alaska 99501; faxed to 1-907-269-8918, or sent by electronic mail to [dnr\\_appeals@dnr.state.ak.us](mailto:dnr_appeals@dnr.state.ak.us). This decision takes effect immediately. An eligible person must first appeal this decision in accordance with 11 AAC 02 before appealing this decision to Superior Court. A copy of 11 AAC 02 may be obtained from any regional information office of the Department of Natural Resources.

Signed on 8/20/2004

Mark D. Myers, Director  
Division of Oil and Gas

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Date

- Attachments:
1. The Tuvaq Unit Agreement
  2. Exhibit A, Tract Description and Ownership Schedule
  3. Exhibit B, Map of the Tuvaq Unit Boundary and Exploration Blocks
  4. Exhibit G, Plan of Exploration
  5. Amendments to the State Only Model Form, dated June 2002

Attachment 2: Exhibit A, Tract Description and Ownership Schedule

EXHIBIT "A"								
Attached to and made a part of that certain								
TUVAQA UNIT AGREEMENT								
UNIT TRACT #	LESSOR LEASE #	WORKING INTEREST OWNERS	WORKING INTEREST	LEASE EFFECTIVE DATE	DESCRIPTION	ACREAGE	ROYALTY BURDEN	ORRI BURDEN
1	State of Alaska ADL 388571	Armstrong Alaska, Inc.	100.00%	1/1/1998	T14N R8E, UMIAT MERIDIAN SEC 1: PROTRACTED, ALL TIDE AND SUBMERGED LANDS (640.00) SEC 2: PROTRACTED, ALL TIDE AND SUBMERGED LANDS WITHIN THE COMPUTED TERRITORIAL SEA, LISTED AS "STATE ACREAGE" ON ALASKA'S SEAWARD BOUNDARY DIAGRAM APPRD BY THE STATE ON APRIL 15, 1996 (539.63) SEC 11: PROTRACTED, ALL TIDE AND SUBMERGED LANDS (640.00) SEC 12: PROTRACTED, ALL TIDE AND SUBMERGED LANDS (640.00) T16N R8E, UMIAT MERIDIAN SEC 35: PROTRACTED, ALL TIDE AND SUBMERGED LANDS WITHIN THE COMPUTED TERRITORIAL SEA, LISTED AS "STATE ACREAGE" ON ALASKA'S SEAWARD BOUNDARY DIAGRAM APPRD BY THE STATE ON APRIL 15, 1996 (24.00) SEC 36: PROTRACTED, ALL TIDE AND SUBMERGED LANDS WITHIN THE COMPUTED TERRITORIAL SEA, LISTED AS "STATE ACREAGE" ON ALASKA'S SEAWARD BOUNDARY DIAGRAM APPRD BY THE STATE ON APRIL 15, 1996 (282.73)	2,766.36	16.667%	4.25% ConocoPhillips Alaska, Inc.

\\E:\del-hap\project\haskell\Tuvaaq Unit\Unit Agreement\Exhibit A to Tuvaaq Unit.a



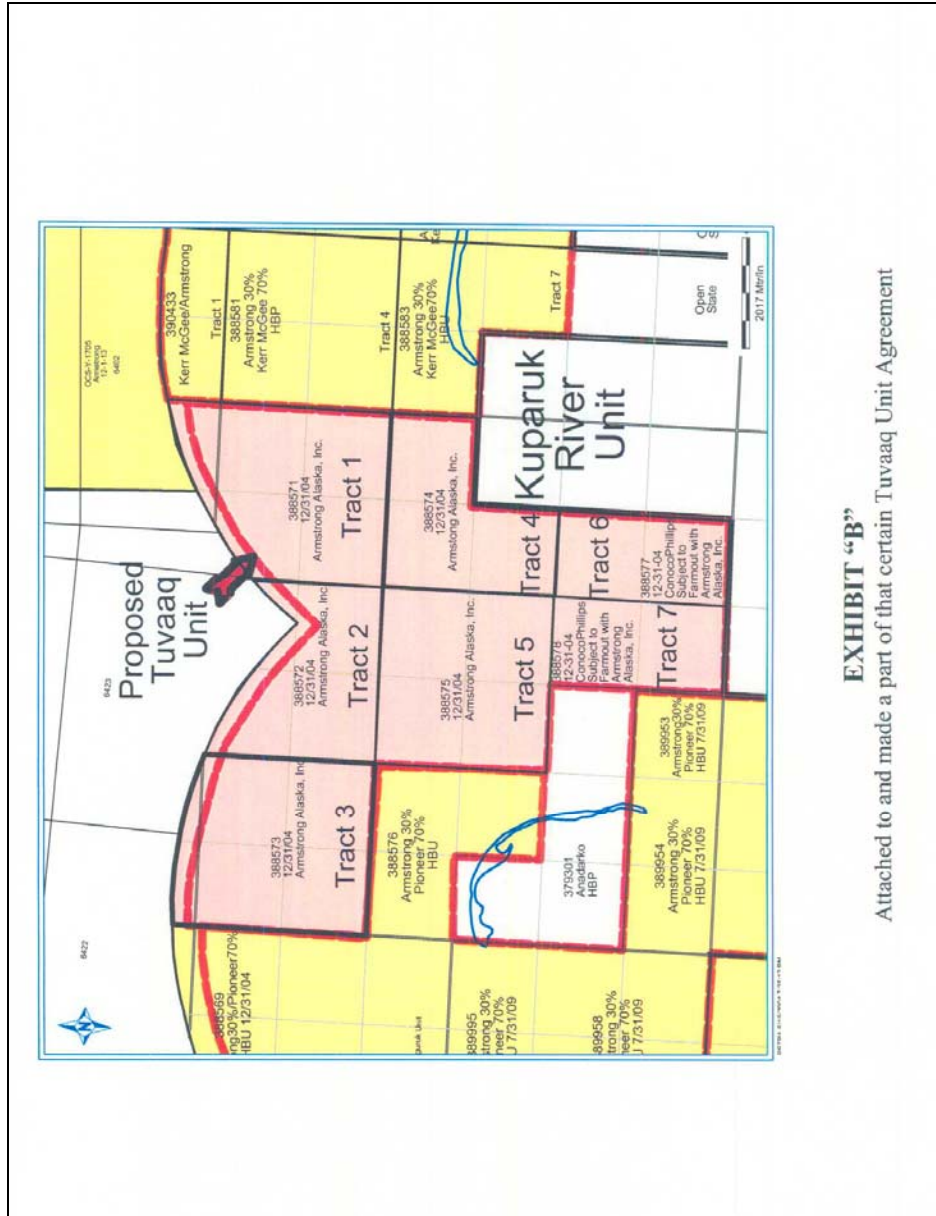
UNIT TRACT #	LESSOR LEASE #	WORKING INTEREST OWNERS	WORKING INTEREST	LEASE EFFECTIVE DATE	DESCRIPTION	ACREAGE	ROYALTY BURDEN	ORRI BURDEN
2	State of Alaska ADL 388572	Armstrong Alaska, Inc.	100.00%	1/1/1998	<b>T14N R8E, UMIAT MERIDIAN</b> SEC 3: PROTRACTED, ALL TIDE AND SUBMERGED LANDS WITHIN THE COMPUTED TERRITORIAL SEA, LISTED AS "STATE ACREAGE" ON ALASKA'S SEAWARD BOUNDARY DIAGRAM APPRD BY THE STATE ON APRIL 15, 1996 (170.91) SEC 4: PROTRACTED, ALL TIDE AND SUBMERGED LANDS WITHIN THE COMPUTED TERRITORIAL SEA, LISTED AS "STATE ACREAGE" ON ALASKA'S SEAWARD BOUNDARY DIAGRAM APPRD BY THE STATE ON APRIL 15, 1996 (516.41) SEC 9: PROTRACTED, ALL TIDE AND SUBMERGED LANDS (640.00) SEC 10: PROTRACTED, ALL TIDE AND SUBMERGED LANDS (640.00) <b>T15N R8E, UMIAT MERIDIAN</b> SEC 33: PROTRACTED, ALL TIDE AND SUBMERGED LANDS WITHIN THE COMPUTED TERRITORIAL SEA, LISTED AS "STATE ACREAGE" ON ALASKA'S SEAWARD BOUNDARY DIAGRAM APPRD BY THE STATE ON APRIL 15, 1996 (.92)	1,968.24	16.667%	4.25% ConocoPhillips Alaska, Inc.

UNIT TRACT #	LESSOR LEASE #	WORKING INTEREST OWNERS	WORKING INTEREST	LEASE EFFECTIVE DATE	DESCRIPTION	ACREAGE	ROYALTY BURDEN	ORRI BURDEN
3	State of Alaska ADL 388573	Armstrong Alaska, Inc.	100.00%	1/1/1998	T14N R8E, UMIAT MERIDIAN SEC 5: PROTRACTED, ALL TIDE AND SUBMERGED LANDS (640.00) SEC 6: PROTRACTED, ALL TIDE AND SUBMERGED LANDS (609.00) SEC 7: PROTRACTED, ALL TIDE AND SUBMERGED LANDS (611.00) SEC 8: PROTRACTED, ALL TIDE AND SUBMERGED LANDS (640.00) T16N R8E, UMIAT MERIDIAN SEC 31: PROTRACTED, ALL TIDE AND SUBMERGED LANDS WITHIN THE COMPUTED TERRITORIAL SEA, LISTED AS "STATE ACREAGE" ON ALASKA'S SEAWARD BOUNDARY DIAGRAM, APPR'D BY THE STATE ON APRIL 15, 1996 (177.20) SEC 32: PROTRACTED, ALL TIDE AND SUBMERGED LANDS WITHIN THE COMPUTED TERRITORIAL SEA, LISTED AS "STATE ACREAGE" ON ALASKA'S SEAWARD BOUNDARY DIAGRAM, APPR'D BY THE STATE ON APRIL 15, 1996 (109.39)	2,786.59	16.667%	4.25% ConocoPhillips Alaska, Inc.
4	State of Alaska ADL 388574	Armstrong Alaska, Inc.	100.00%	1/1/1998	T14N R8E, UMIAT MERIDIAN SEC 13: PROTRACTED, ALL TIDE AND SUBMERGED LANDS (640.00) SEC 14: PROTRACTED, ALL TIDE AND SUBMERGED LANDS (640.00) SEC 23: PROTRACTED, ALL TIDE AND SUBMERGED LANDS (640.00)	1,920.00	16.667%	4.25% ConocoPhillips Alaska, Inc.
5	State of Alaska ADL 388575	Armstrong Alaska, Inc.	100.00%	1/1/1998	T14N R8E, UMIAT MERIDIAN SEC 15: PROTRACTED, ALL TIDE AND SUBMERGED LANDS (640.00) SEC 16: PROTRACTED, ALL TIDE AND SUBMERGED LANDS (640.00) SEC 21: PROTRACTED, ALL TIDE AND SUBMERGED LANDS (640.00) SEC 22: PROTRACTED, ALL TIDE AND SUBMERGED LANDS (640.00)	2,560.00	16.667%	4.25% ConocoPhillips Alaska, Inc.
6	State of Alaska ADL 388577	ConocoPhillips Alaska, Inc.	100.00%	1/1/1998	T14N R8E, UMIAT MERIDIAN SEC 26: PROTRACTED, ALL TIDE AND SUBMERGED LANDS (640.00) SEC 35: PROTRACTED, ALL TIDE AND SUBMERGED LANDS (640.00)	1,280.00	16.667%	4.25% ConocoPhillips Alaska, Inc.
7	State of Alaska ADL 388578	ConocoPhillips Alaska, Inc.	100.00%	1/1/1998	T14N R8E, UMIAT MERIDIAN SEC 27: PROTRACTED, ALL TIDE AND SUBMERGED LANDS (640.00) SEC 34: PROTRACTED, ALL TIDE AND SUBMERGED LANDS (640.00)	1,280.00	16.667%	4.25% ConocoPhillips Alaska, Inc.

Armstrong Alaska, Inc.  
700 17th Street, Suite 1  
Denver, CO 80202

State of Alaska  
Department of Natural Resources  
Division of Oil and Gas  
550 West 7th Avenue, Suite 800  
Anchorage, Alaska 99502-3560

Tracts 1-7 are burdened by overriding Royalties held by:  
ConocoPhillips Alaska, Inc.  
700 "G" Street  
Anchorage, Alaska 99501



### EXHIBIT "B"

Attached to and made a part of that certain Tuvaag Unit Agreement

**Exhibit "G"**

**RECEIVED**  
MAY 18 2004

**Attached to and made a part of that certain Tuvaag Unit Agreement**

DIVISION OF  
OIL AND GAS

**INITIAL PLAN OF EXPLORATION**

**SPY ISLAND, ALASKA**

Outlined below is the initial Plan of Exploration for the proposed Tuvaag Unit. The proposed Unit will encompass 14,561.19 acres of State land within the shallow waters of Harrison Bay, Alaska. The Unit is immediately northeast of the Oooguruk Unit, north of the Kuparuk River Unit and southwest of the Nikaitchuq Unit. The Plan of Exploration is a 5 year forecast of planned unit exploration activities. Prospective intervals to be tested by this exploration program may include but are not limited to the Cretaceous Kuparuk Sandstones, the Jurassic Nuiqsut Sandstone, the Triassic Sag River Sandstone, the Triassic Eileen Sandstone and Triassic Ivishak Sandstone.

**Historical Drilling Summary**

Initial exploration of the area began in 1969 with the drilling of the Chevron Simpson Lagoon 32-14. The well was drilled to a total depth of 10017 ft TVD (10483' MD) in the Lisburne formation. The well encountered pay in the Cretaceous Kuparuk "A" sandstones. Additional intervals penetrated included porous and permeable sandstones in the Triassic Ivishak which were water bearing and tight carbonates within in the Lisburne.

Unocal drilled the next significant deep test well in 1977, East Harrison Bay #1, to a total depth of 9809 ft in basement Argillites. Zones of interest in the well were thin oil saturated sands in the Kuparuk "A", porous (15-20 %) and permeable (1-4 md) sands in the Triassic Sag River with minor shows and porous (12-16%) and permeable (10-200 md) sands in the Triassic Ivishak sandstone which had minor oil shows that tested wet.

Arco drilled the next deep test, the Oliktok Point #1, which reached a total depth of 10353' TVD (10620 MD) in basement Argillites. The well encountered hydrocarbon saturated sands within the Cretaceous Kuparuk "A". The well also encountered medium to coarse grained porous sands bleeding oil in the Triassic Eileen and medium to coarse grained oil stained sands within the upper Triassic Ivishak. The Lisburne carbonates were tight with no shows of hydrocarbon.

The next significant deeper exploration drilling along trend began in 1992, which highlighted the Cretaceous and Jurassic exploration trend potential for this area. The Arco Kalubik #1 was drilled in 1992 to a total depth of 8273' within the Triassic Ivishak sandstone. The well penetrated an 85 ft thick section of wet Sag River sandstone with porosities ranging from 15% to 22 %. Additionally, 35' of porous Kuparuk "C" sands was tested productive, at a rate of 1220 bopd (25.5° API gty. oil). The well also encountered approximately 160' of productive Jurassic Nuiqsut and Nechelik sandstone, which tested on nitrogen lift at an average rate of 660 BOPD (19.7° API gty. oil)..

The following year, Exxon drilled the Thetis Island #1 to a total depth of 8460' in the Ivishak sands. The well penetrated an 80 ft thick section of Sag River sandstone with porosities ranging from 16% to 24% with minor shows of hydrocarbon. No cores or tests were taken from this

water-saturated interval. However, it is noteworthy that there was well-developed and porous sandstone in the Sag River "A" (basal) and Sag River "B" intervals. An additional 45' of pay was encountered within the Nuiqsut interval. Testing of this interval yielded rates as high as 650 BOPD, with an average rate over the duration of the test of 120 BOPD. Both the Thetis Island #1 and Kalubik #1 encountered prospective sandstones with significant hydrocarbon shows in the Cretaceous Brookian section.

The next significant phase of exploration was undertaken in 2003, when Pioneer/Armstrong drilled 3 wildcat wells directly to the southwest of the Tuvaq Unit, within the Oooguruk Unit. The Ivik #1 penetrated reservoir-quality sands within the Brookian and Jurassic intervals. The Brookian sands had impressive mud log hydrocarbon shows, but yielded water on formation test. The well also penetrated 60'+ of Nuiqsut sandstone pay and had an initial potential rate of 1300 BOPD after fracture stimulation. The Oooguruk #1, an offset well to the Ivik, encountered 45'+ sandstone pay in the Nuiqsut. This zone was never production tested, but yielded hydrocarbons on wireline formation test. The well also encountered 10 ft of porous Kuparuk "C" sandstone which was also proved productive by wireline formation test.

The last deeper phase of exploration in the area occurred in 2004 when Kerr McGee/Armstrong drilled the Nikaitchuq #1 and Nikaitchuq #2 wells. Both wells were drilled to the Triassic Ivishak sandstones. The Nikaitchuq #1 was drilled to a total depth of 9307' and encountered productive Triassic Sag River sandstone. The well was reported tested at a stabilized rate of 960 bopd of light 38° API gty. oil. The well also encountered porous and permeable Eileen/Ivishak sands with significant hydrocarbon mud log shows which tested wet on wireline formation test. The Nikaitchuq #2 well was drilled to a total depth of 9507' which successfully extended the known limits of the Sag River accumulation. The Jurassic Nuiqsut interval penetrated was distal and shale in the well.

#### **Supporting Engineering data**

Sag River pressure and oil property data has been collected, analyzed and supplied for key offset wells (Nikaitchuq 1, Nikaitchuq 2, F-33, F33a, C-1, Milne Point Unit wells). This data serves as the basis for deliverability and recovery estimates for the Sag River interval. The Tuvaq East and West structures are 4-way independent structural closures on the Triassic reservoir intervals and we have evaluated fault juxtaposition, pressure, petrophysical and seismic data to provide a best estimate of possible oil/water contact levels for the Tuvaq structures. This analysis identified possible geologic spill points for the Tuvaq East and West structures of approximately -8200' subsea for the Western Tuvaq closure and -8300' subsea for the Eastern Tuvaq closure. Both closures are located on a broader structural horst block in between the Milne and Thetis structural horst trends. Sag River accumulation limits could extend to the broader tilted "trap door" closure because of more favorable cross fault juxtaposition possibilities. The range of Sag River oil mobility parameters is derived from oil produced from MPU and Nikaitchuq offset wells. The range of produced oil gravity is 36-38° API, with oil viscosity in the range of 0.26-0.30 centipoise. Engineering modeling work on the Sag River sand suggests the well could produce at rates as high as 2500 bopd if drilled and completed laterally.

The Jurassic hydrocarbon trap is assumed to be controlled by the west bounding Thetis down to the northeast fault. To date, no wet Jurassic wells have been drilled on this sand trend. As a consequence, the range of potential accumulation limits for the Nuiqsut sand objective has a large amount of uncertainty associated with it. Given the magnitude of the potential Thetis trapping fault and migration pathway alternatives, the Jurassic Nuiqsut sand interval if present, could

contain higher gravity oils associated with migration of mature sweet Shublik sourced hydrocarbons from the Dinkum Graben to the northeast.

Other prospective intervals targeted in the Cretaceous Kuparuk have been characterized by strong oil shows in offsetting wells. Pressures collected from the Kuparuk "C" interval by wireline formation test in the Oooguruk #1 well define a separate hydrocarbon accumulation than the Kuparuk Field. Geologic data from the Oooguruk Unit drilling program suggests that this sand is stratigraphically separated from the Kuparuk Field accumulation and more similar to the structural hydrocarbon levels observed in the Mukluk and Phoenix Cretaceous Kuparuk intervals. The data suggests a possible oil-water contact on the north flank of the Colville high in the Kuparuk interval of -7050 subset. Gravities and production rates are expected to be similar to other Kuparuk accumulations on the Colville High.

#### **Tuvaag Unit Objectives**

##### **Triassic Sag River/Eileen/Ivishak Sandstones**

Two prospective structurally independent 4-way closures for these Triassic sand intervals have been identified by a high quality Western ocean bottom cable 3-D "patch" seismic survey acquired and processed in 2000. Armstrong was one of the first companies to integrate this data with other recently acquired 3-D data in the area. This data when taken in regional context with last years drilling in the Nikaitchuq Unit, exploration drilling along the Colville High, development drilling at Prudhoe Bay and exploitation drilling along the Milne Structure establishes an overall prospective trend for Ivishak Sand and a trend of improving Sag River/Eileen Sand quality and thickness to the north/northwest over the West Milne structures and within our proposed Tuvaag Exploration Unit. Additionally, given that the Sag River to Ivishak isopach thicknesses for the area vary by only tens of feet, the Included Sag River structure map serves as the basis for trap identification on the Triassic Eileen/Ivishak intervals as well. (Attached: Tuvaag Prospect structural cross section montage, Sag River depth Structure Map, strike oriented arbitrary seismic sections and a dip oriented arbitrary seismic section)

##### **Jurassic Nuiqsut Sandstone**

Delineation by previous exploration drilling of the southwest/northeast regional Jurassic sand trend highlights the potential for Nuiqsut sand development over the West Milne Horst block and within the proposed Tuvaag Unit. The Jurassic event mapped has been tied to 3-D seismic and carried from the Thetis Island #1, Ivik #1, Oooguruk #1 and Kalubik #1 wells. Based on cross fault juxtaposition issues the Jurassic is expected to have separate hydrocarbon system than previous penetrations to the southwest. The hydrocarbon limits should be controlled by the stratigraphic sand limits within the Tuvaag unit area and as a consequence structural elevation should have no impact on hydrocarbon limits. The Jurassic is a secondary interval of prospective interest within our proposed Tuvaag Exploration Unit. (Attached: previously referenced Tuvaag structural cross section montage, strike oriented arbitrary seismic sections and dip oriented arbitrary seismic section and a Jurassic Trend Montage containing the regional sand trend, a datumed seismic section on the base of the HRZ interval and an additional dip oriented seismic section over the prospective Jurassic structure trend)

##### **Cretaceous Kuparuk Sandstone**

Sand presence, good reservoir quality and hydrocarbons tests within the Kuparuk interval in the Oooguruk and Kalubik wells directly to the southwest highlight this as our third prospective interval within the proposed Tuvaag Exploration Unit. Pressures collected by wireline formation test in the Oooguruk #1 well define a separate hydrocarbon accumulation than the Kuparuk Field. Geologic data from the Oooguruk Unit drilling program suggests that this sand is stratigraphically

separated from the Kuparuk Field accumulation and more similar to the structural hydrocarbon levels observed in the Mukluk and Phoenix Cretaceous Kuparuk intervals. The data suggests a possible oil-water contact on the north flank of the Colville high in the Kuparuk interval of -7050 subsea. If this proves to be the case, any water level within the Cretaceous sand interval will be significantly below the structural level of the Kuparuk "C" sand limits within the proposed Tuvaq Unit area (Attached: previously referenced Tuvaq Prospect geologic cross section montage, strike/dip arbitrary seismic sections and a Kuparuk "C" isopach/seismic montage)

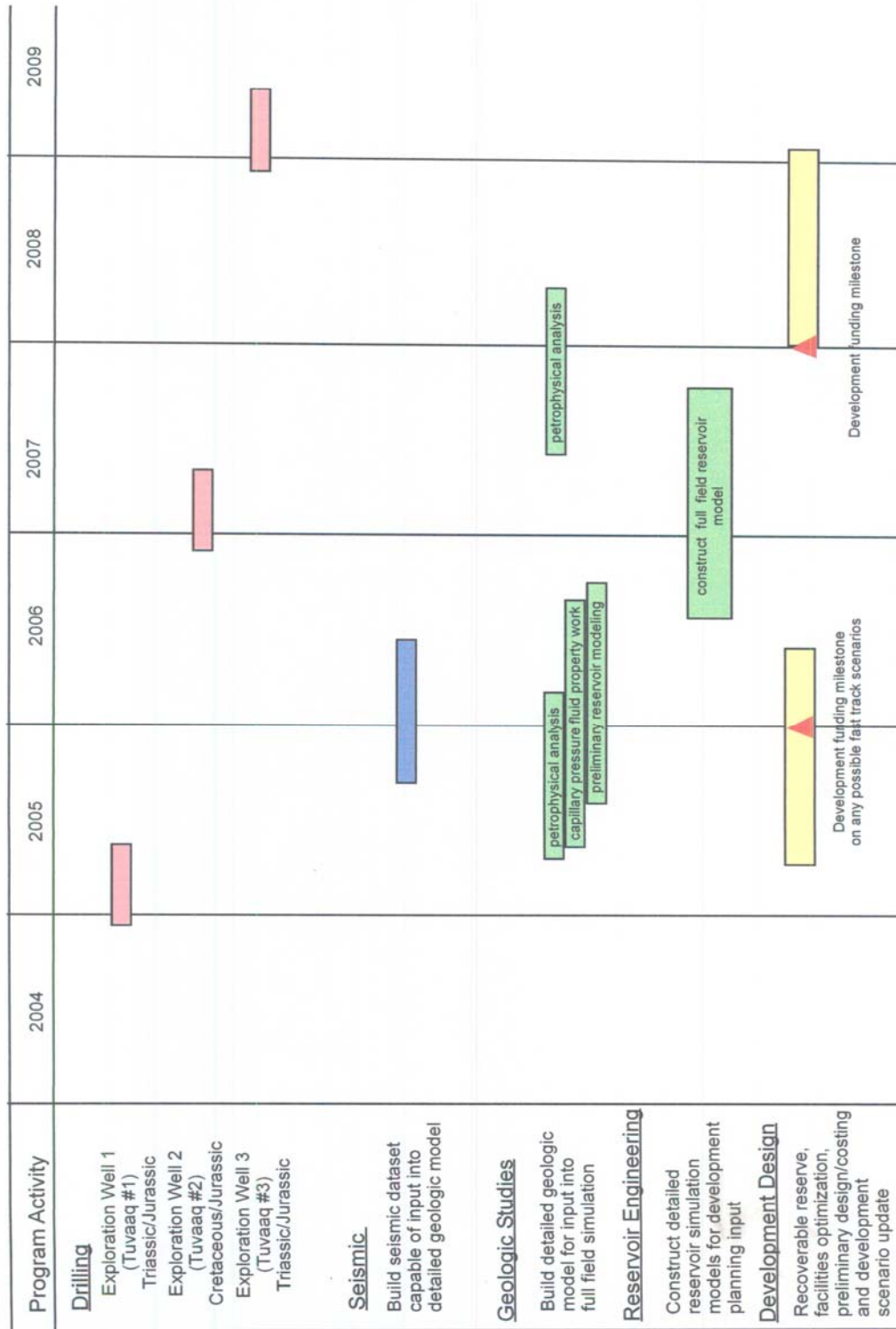
#### **Drilling Program**

Currently, three wells are planned for the proposed Tuvaq Unit. The first well will be drilled during the 2005 Winter Drilling Season. Based on the results from this initial test, geologic studies, engineering studies and seismic reprocessing are planned in 2006 leading to a second Exploration Well for the 2007 Winter Drilling Season, or earlier. The proposed second well will test the prospectivity of the Cretaceous Kuparuk sand interval, Jurassic Nuiqsut sand continuity and limits and limits of the Triassic Sag/Eileen/Ivishak accumulations within the Tuvaq Unit. The third Exploration Well will be drilled during the 2009 Winter Drilling Season or earlier, and will test the prospectivity of the Triassic Sag/Eileen/Ivishak intervals on the eastern structure. The planned locations for each of these Exploration Wells are depicted upon the CONFIDENTIAL displays submitted to the Department in support of the Tuvaq Exploration Unit application. The intended bottom-hole locations and depths are set forth below. Armstrong reserves the right to modify the location and/or order in which these wells are to be drilled based on operational considerations. Following drilling of the first well, the location and drilling depth of subsequent wells may be adjusted pursuant to the results of the prior wells.

<b>Well (Well name)</b>	<b>Surface/Bottomhole Location</b>	<b>Total Depth true vertical</b>
1 <sup>st</sup> Exploration Well (Tuvaq #1)	SHL 330' FNL x 2500' FEL, Sec 25, T14N, R8E BHL 2500' FSL x 2000' FEL, Sec 15, T14N, R8E	9150 ft
2 <sup>nd</sup> Exploration Well (Tuvaq #2)	SHL 1900' FNL x 2000' FEL, Sec 19, T14N, R8E BHL 330' FSL x 1000' FEL, Sec 8, T14N, R8E	9600 ft
3 <sup>rd</sup> Exploration Well (Tuvaq #3)	SHL 330' FNL x 2500' FEL, Sec 25, T14N, R8E BHL 2390' FSL x 1280' FWL, Sec 11, T14N, R8E	9600 ft



Nikaichuq Exploration Unit  
Proposed Plan of Exploration



4. Attachment 5: Amendments to the State Only Model Form, dated June 2002

*NOTE: Text that is underlined indicates where text has been added and text that has the strikethrough font indicates where text has been deleted.*

## ARTICLE 9: PARTICIPATING AREAS

### 9.1 Amend the last sentence to read:

The Unit Operator shall notify the Commissioner before the ~~of~~ commencement of Sustained Unit Production ~~within 10 days after commencement~~ from each Participating Area.

### 9.8.1 Amend the first sentence to read:

If the Commissioner consents to the transfer of Unitized Substances between Participating Areas without immediate payment of royalties, the Unit Operator shall provide monthly reports to the State of the transferred Unitized Substance volumes in both the originating and receiving Participating Areas as specified in 11 AAC 04.

## ARTICLE 11: ALLOCATION OF PRODUCTION

### 11.1 Amend the fourth sentence to read:

The Commissioner will give the Unit Operator and Working Interest Owners reasonable notice and an opportunity to be heard before revising the Unit Operator's proposal.

## ARTICLE 12: LEASES, RENTALS AND ROYALTY PAYMENTS

### 12.1 Amend article to read:

The Working Interest Owners shall pay rentals and royalty payments due under the Leases. Payments to the State must be made in accordance with the applicable State regulations, 11 AAC 04 and 11 AAC 83.110. ~~Those payments must be made to any depository designated by the State with at least sixty days notice to the Unit Operator and the Working Interest Owners.~~

### 12.4 Amend third sentence to read:

These excluded expenses also include the costs of gathering and preparing the Unitized Substances for transportation off the Unit Area and ~~gathering and~~ transportation costs incurred within the Unit Area. ~~incurred before the Unitized Substances are delivered to a common carrier pipeline.~~

### 12.5 Amend article to read:

Notwithstanding any contrary Lease term or provision in 11 AAC 83.228—11 AAC 83.229, all royalty deductions for transportation, including marine, truck, and pipeline transportation, from the Unit Area to the point of sale are limited to the actual and reasonable costs incurred by the Working Interest Owners. These transportation costs must be determined by taking into account all tax benefits applicable to the transportation.

#### 12.6 Amend article to read:

The Unit Operator shall give the Commissioner notice of the anticipated date for commencement of production at least six months before the commencement of Sustained Unit Production from a Participating Area. The Commissioner may take Unitized Substances in-kind in accordance with the following: ~~Within ninety days of receipt of that notice, The Commissioner will give the Working Interest Owners Unit Operator 90 days written notice of its the State's initial elections to take Unitized Substances in-kind all, none, a specified percentage, or a specified quantity of its royalties in any Unitized Substances produced from the Participating Area. After taking has actually commenced, the Commissioner will, in his or her discretion, may increase or decrease (including ceasing to take royalty Unitized Substances in-kind) the amount of royalty Unitized Substances the State takes taken in-kind by not more than 10 percent, upon 30 days written notice to the Unit Operator; and greater than 10 percent, upon 90 days written notice to the Unit Operator. The Commissioner shall give written notice to the Working Interest Owners ninety days before the first day of the month in which an increase or decrease is to be effective.~~

#### 12.6.3 Amend article to read:

Royalty Interest Unitized Substances delivered in kind shall be delivered in good and merchantable condition and be of pipeline quality. Those substances shall be free and clear of all lease expenses, Unit Expenses, and Participating Area Expenses, and free of any lien for these excluded Expenses. These excluded expenses include, but are not limited to, expenses for separating, cleaning, dehydration, saltwater removal, processing, compression, pumping, manufacturing, and the costs of gathering and preparing the Unitized Substances for transportation off the Unit Area and transportation costs within the Unit Area. If a Working Interest Owner processes the Unitized Substances to separate, extract or remove liquids from a Working Interest Owner's share of natural gas Unitized Substances, the State ~~will, in its discretion,~~ may require that a Working Interest Owner also process the State's share of natural gas Unitized Substances being taken in kind in the same manner without cost to the State. Under these circumstances, the State, or its buyer, shall only pay any tariffed transportation costs and shrinkage of the volume of gas resulting from processing.

#### 12.8 Replace article to read:

The Unit Operator shall maintain records, and shall keep and have in its possession books and records including expense records, of all exploration, development, production, and disposition of all Unitized Substances and Outside Substances. Each Working Interest Owner shall maintain records of the disposition of its portion of the Unitized Substances and Outside Substances including sales prices, volumes, and purchasers. The Unit Operator and the Working Interest Owners shall permit the Commissioner ~~or its agents~~ to examine those books and records at all reasonable times. Upon request by the Commissioner, the Unit Operator and the Working Interest Owners shall make the books and records available to the Commissioner at the Commissioner's office designated by the Commissioner. They may provide these books and records in a mutually agreeable electronic format. These books and records of exploration, development, production, and disposition must employ methods and techniques that will ensure

the most accurate figures reasonably available. The Unit Operator and the Working Interest Owners shall use and consistently apply generally accepted accounting procedures.

*12.10 Amend second sentence to read:*

The State ~~will, in its discretion,~~ may audit the net profit share reports or payments due for any Lease within ten years of the ~~date~~ year of production of Unitized Substances in Paying Quantities.

*13.2 Amend Article to read:*

Ten years after Sustained Unit Production begins, the Unit Area must be contracted to include only those lands then included in an approved Participating Area, lands included in an Approved Unit Plan of Exploration or Development, and lands that facilitate production including the immediately adjacent lands necessary for secondary or tertiary recovery, pressure maintenance, reinjection, or cycling operations. The Commissioner ~~will, in the Commissioner's discretion~~may, after considering the provisions of 11 AAC 83.303, delay contraction of the Unit Area if the circumstances of a particular unit warrant. If a portion of a Lease contracts out of the unit, that portion will be severed and treated as a separate and distinct lease, which may be maintained thereafter only in accordance with the terms and conditions of the original lease. The Working Interest Owners waive the provisions of 11 AAC 83.356(b), which protect the Lease from severance when a portion of a lease is contracted out of the Unit Area. If any portion of a Lease is included in the Participating Area, the portion of the Lease outside the Participating Area will neither be severed nor will it continue to be subject to the terms and conditions of the unit. The portion of the Lease outside the Participating Area will continue in full force and effect so long as production is allocated to the unitized portion of the Lease and the lessee satisfies the remaining terms and conditions of the Lease.

*13.3 Amend Article to read:*

Not sooner than 10 years after the effective date of this Agreement, the Commissioner ~~will, in the Commissioner's discretion,~~ may contract the Unit Area to include only that land covered by an Approved Unit Plan, or that area underlain by one or more oil or gas reservoirs or one or more potential hydrocarbon accumulations and lands that facilitate production. If a portion of a Lease contracts out of the Unit Area, that portion will be severed and treated as a separate and distinct lease, which may be maintained thereafter only in accordance with the terms and conditions of the original lease. The Working Interest Owners waive the provisions of 11 AAC 83.356(e), which protect the Lease from severance when a portion of a Lease is contracted out of the Unit Area. Before any contraction of the Unit Area under this Article 13.3, the Commissioner will give the Unit Operator, the Working Interest Owners, and the ~~royalty~~ Royalty Interest owners Owners of the Leases or portions of Leases being excluded reasonable notice and an opportunity to be heard.