



Conventional Natural Gas Resource Potential, Alaska North Slope

(statement presented at Federal Energy Regulatory Commission technical conference on regulations governing the conduct of open seasons for Alaska natural gas transportation projects, Anchorage, Alaska, December 3, 2004)

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**U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY**

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Good afternoon. My name is David Houseknecht and I represent the U.S. Geological Survey (USGS), a bureau of the Department of the Interior. The USGS conducts earth-science research and provides objective, non-advocacy scientific information in support of Federal Government decision making. As part of this mission, the USGS assesses energy resources of the U.S. and the World. The focus of domestic assessments is onshore and State offshore areas, with an emphasis on Federal lands. USGS assessments are complemented by Minerals Management Service (MMS) assessments of Federal offshore areas. USGS petroleum assessments concentrate on undiscovered resources and reserve growth, resources that may be added to proved reserves in the future. USGS assessments are reported in terms of probabilities to communicate the uncertainty associated with estimating undiscovered resources, especially in frontier areas.

I appear before you today, at the request of the Alaska State Legislature, to summarize recent USGS estimates of conventional natural gas resources of northern Alaska. Although gas resource potential also exists in central and southern Alaska, resource estimates for northern Alaska are substantially larger. Therefore, my statement will be limited to northern Alaska gas resources.

The northern Alaska petroleum province extends nearly 700 miles from the Canadian border westward to the maritime Russian border and from the Brooks Range northward for 60 to 370 miles to the edge of the continental shelf. Fewer than 500 exploration wells have been drilled in this huge province, mostly onshore and in adjacent shallow waters of the central Arctic coast, and all of these exploration wells have been focused on oil objectives. Areas thought to be gas prone have barely been explored. This historical emphasis on oil exploration has resulted, nevertheless, in the discovery of significant gas resources (Figure 1). In the main oil-producing area along the central Arctic coast, nearly 35 trillion cubic feet (TCF) of associated natural gas reserves occur in oil fields. Most of these gas reserves occur in the gas cap of the Prudhoe Bay oil field, as summarized in Table 1. Nonassociated natural gas accumulations commonly have been encountered in exploration wells drilled in the Brooks Range foothills and some offshore locations, but these accumulations seldom have been delineated in the absence of a market for natural gas (see Table 2 and Figure 1). Therefore, the sizes of the known nonassociated gas accumulations are poorly constrained.

Exploration drilling and geologic evidence indicate that the northern Alaska coastal plain is an oil-prone region in which most gas resources are likely to be associated with oil accumulations whereas the Brooks Range foothills area is a gas-prone region in which most gas resources are likely to occur as nonassociated gas accumulations (Figure 1). Figure 1 is a satellite image in which the coastal plain, where the underlying strata are nearly flat-lying, appears dotted with numerous lakes whereas the foothills, where the underlying strata are folded and faulted, appears a more uniform red color. (The satellite image is a false-color, infrared image in which vegetation appears red and water appears black.)

During the past few years, the USGS has released the results of petroleum resource assessments of the National Petroleum Reserve in Alaska (NPRA) and of the 1002 area

of the Arctic National Wildlife Refuge (ANWR); these results (Table 3) and supporting scientific documentation have been published and are available online at: <http://energy.usgs.gov/>. A similar USGS petroleum resource assessment of the non-Federal lands between NPRA and ANWR is nearing completion, with results due for release early in 2005.

These recent USGS petroleum resource assessments suggest that significant resources of undiscovered natural gas exist in northern Alaska. NPRA and adjacent State waters are estimated to contain 40 (95% probability) to 85 (5% probability) trillion cubic feet (tcf) of technically recoverable, nonassociated gas with a mean value of 61.4 TCF (Bird and Houseknecht, 2002). Most of these nonassociated gas resources are likely to occur in the Brooks Range foothills. In addition, NPRA is estimated to contain 11.7 TCF (mean estimate) of associated gas (Schuenemeyer, 2003) in oil accumulations located mostly beneath the coastal plain. Moreover, data from new wells drilled in the Jurassic "Alpine play" in northeastern NPRA and released since completion of the USGS assessment indicate that the associated gas estimate may be conservative. Alpine field, a 500 MMBO (million barrels of oil recoverable) field located on the Colville River delta just east of NPRA, produces 40° API gravity oil and was characterized at the time of discovery by no gas cap and a GOR (gas-oil ratio, standard cubic feet of gas per barrel of oil) less than 1000. Over a distance of 20 miles westward from Alpine field, announced tests from new NPRA wells increase to 60° API gravity and a GOR of nearly 17,000. These limited data suggest that this play in NPRA may contain more condensate and gas than anticipated on the basis of data from Alpine field.

The ANWR 1002 area and adjacent State waters are estimated to contain 0 to 11 (95% and 5% probabilities) TCF of technically recoverable, nonassociated gas with a mean value of 3.8 TCF (Bird and Houseknecht, 2001), and most of these nonassociated gas resources are likely to occur in the Brooks Range foothills. In addition, the mean estimate for technically recoverable associated gas in the ANWR 1002 area is 4.8 TCF (Schuenemeyer, 1999), and most of these associated gas resources are estimated to occur beneath the coastal plain.

The ongoing assessment of non-Federal lands located between NPRA and ANWR will be released early in 2005, and no results can be reported at this time. However, the continuity of geology from NPRA eastward into the similar-sized non-Federal lands suggests that estimates for nonassociated natural gas resources may be on the same order of magnitude as those for NPRA.

In conclusion, an estimate of total natural gas resource potential of northern Alaska can be obtained by summing known gas reserves in oil and gas fields (35 TCF), mean estimates of undiscovered nonassociated (61 TCF) and associated (12 TCF) gas resources in NPRA, and mean estimates of undiscovered nonassociated (4 TCF) and associated (5 TCF) gas resources in the 1002 area of ANWR; this yields a total of 117 TCF. When estimates of undiscovered gas resources for non-Federal lands are released in 2005, that total will increase by a non-trivial amount. Thus, the conventional natural gas resource potential of onshore and State offshore areas totals well over 100 TCF. The inclusion of

the MMS mean estimate (96 TCF) for undiscovered gas resources in the Beaufort and Chukchi planning areas of the Federal offshore extends that total above 200 TCF.

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Figure 1

False-color infrared satellite image of northern Alaska showing locations of known gas accumulations and exploration wells that have encountered various indications of natural gas. Coastal plain area thought to contain potential for mostly *associated* natural gas resources is outlined with green dashed line and foothills area thought to contain potential for mostly *nonassociated* natural gas resources is outlined with yellow dashed line.

Table 1

Summary of known gas reserves, Alaska North Slope.

Table 2

Other known gas accumulations of the Alaska North Slope whose sizes are poorly constrained or unknown.

Table 3

Summary of USGS estimates of undiscovered, conventional natural gas resources in NPRA and the ANWR 1002 area, including associated Native lands and State offshore areas.

Alaska North Slope Conventional Natural Gas Potential

Note: Recent NPRA discoveries contain more gas than expected

Associated Natural Gas Potential in Coastal Plain

Nonassociated Natural Gas Potential in Brooks Range Foothills

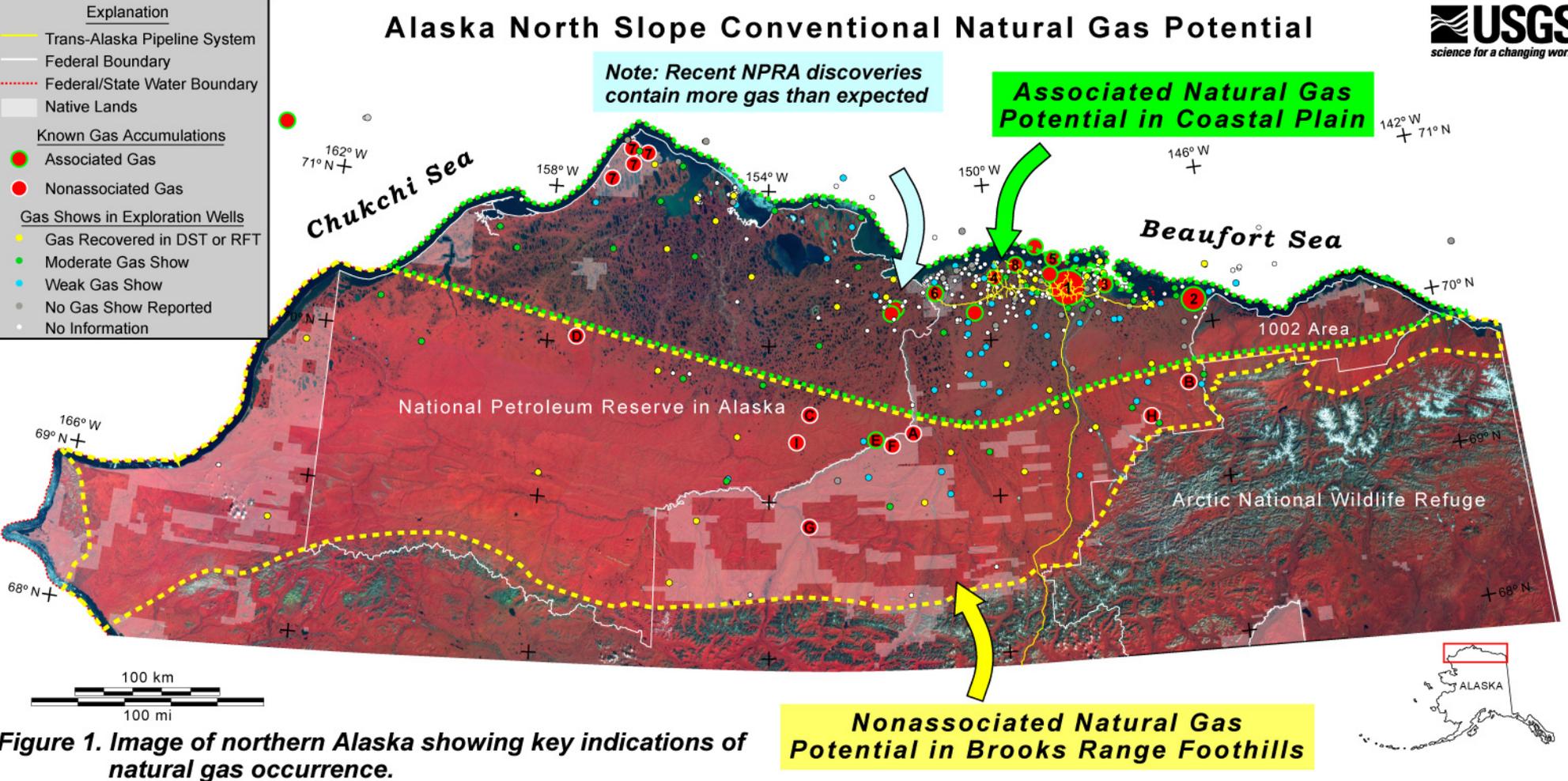


Figure 1. Image of northern Alaska showing key indications of natural gas occurrence.

Table 1. Known Reserves Unit & Gas Reserves (BCF)

1. Prudhoe Bay	23,879
2. Pt. Thomson	8,000
3. Duck Island	843
4. Kuparuk River	611
5. Northstar	450
6. Colville River	60
7. Barrow-Walakpa	34
8. Milne Point	14
TOTAL	33,879

Data from AK-DOG Annual 2003 Rpt.

Table 2. Other Known Accumulations - Possible Gas Reserves (BCF)

A. Gubik	600
B. Kavik	250
C. Square Lake	58
D. Meade	20
E. Umiat	5
F. East Umiat	4
G. East Kurupa	?
H. Kemik	?
I. Wolf Creek	?

Data from Thomas et al., 1996 (DOE)
 Sherwood & Craig, 2001 (MMS)
 Bird, pers. comm., 2004 (USGS)

Table 3. USGS Estimates of Undiscovered, Conventional Natural Gas Resources beneath Federal Lands and Related Areas, Alaska North Slope

	Technically Recoverable Gas (TCF)	
	NPRA	ANWR 1002 area
Nonassociated Gas		
F95	40.3	0
F05	85.3	10.9
Mean	61.4	3.8
Associated Gas		
Mean	11.7	4.8

USGS assessment of State and Native lands between NPRA and ANWR will be released early in 2005.