

U.S. Geological Survey Open File Report 98-34

**The Oil and Gas Resource Potential
of the Arctic National Wildlife Refuge 1002 Area, Alaska
by
ANWR Assessment Team**

USGS Energy Team
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1999

U.S. DEPARTMENT OF THE INTERIOR
BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY
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I. INTRODUCTION

In anticipation of the need for scientific support for policy decisions and in light of the decade-old perspective of a previous assessment, the USGS has completed a reassessment of the petroleum potential of the ANWR 1002 area. This was a comprehensive study by a team of USGS scientists in collaboration on technical issues (but not the assessment) with colleagues in other agencies and universities. The study incorporated all available public

data and included new field and analytic work as well as the reevaluation of all previous work.

In keeping with the USGS responsibility for assessing the petroleum potential of all onshore and state-water areas of the U.S., the total assessment area was extended offshore to the 3-mile boundary between State and Federal jurisdiction. Thus, in addition to the Federal lands of the 1002 area, the assessment includes resources associated with adjacent State waters and Native lands. Petroleum commodities assessed include crude oil, natural gas, and natural gas liquids distributed among 10 petroleum plays. Using a methodology similar to that used in previous USGS assessments in the ANWR and the National Petroleum Reserve-Alaska, this study estimates the total quantity of in-place and technically recoverable oil, gas, and natural gas liquids. Quantities of economically recoverable oil are reported as a set of curves (incremental cost functions) which show increasing amounts of economically recoverable oil with increasing price. Natural gas is considered to be non-economic for at least two decades.

The amounts of in-place oil estimated for the 1002 area are larger than previous USGS estimates. The increase results in large part from improved resolution of reprocessed seismic data and geologic analogs provided by recent nearby oil discoveries.

This publication is a two CD-ROM set containing the ANWR Assessment Team's report and supporting data files. This set contains Portable Document Format (PDF) files, PDF viewing software for a variety of systems, a Director movie of panoramas and photos, and supporting data files in text and spreadsheet formats. *ANWRrpt* contains the interactive digital report, *The Oil and Gas Resource Potential of the Arctic National Wildlife Refuge 1002 Area, Alaska* by the ANWR Assessment Team. *ANWRdata* contains supporting data and Adobe Acrobat Reader software.

II. DISCLAIMERS

This Compact Disc-Read Only Memory (CD-ROM) publication was prepared by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed in this report, or represents that its use would not infringe privately owned rights. Reference therein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof.

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III. SYSTEM REQUIREMENTS

In addition to the system requirements discussed below, the Image Gallery software requires Apple Quicktime to operate properly. This software is usually included in

Macintosh system installations. For Windows95 or Windows NT the proper software can be obtained from Apple, Inc. or their website, www.apple.com. System requirements for Macintosh and PC systems are higher than those for viewing the “.pdf” files. Macintosh systems require 24MB of free memory and VRAM capable of displaying thousands or millions of colors for the image gallery software. PC systems require 32MB of free memory and VRAM capable of displaying thousands or millions of colors for the image gallery software.

A. Macintosh computer (Macintosh II series with 68020 or greater processor, including all Power Macintosh computers), with MacOS 7.0 or later.

- 4 MB application RAM for 680x0-based Macintosh or Power Macintosh with Virtual Memory turned on, 5227 KB for Power Macintosh with Virtual Memory turned off
- 20 MB hard disk space, plus 4.4 MB additional temporary disk space available during installation

B. Intel - x86-based personal computer (386 minimum; 486, Pentium, or Pentium Pro recommended), with Microsoft Windows 3.1, Microsoft Windows for Workgroups, Microsoft Windows 95, Microsoft Windows NT 3.51 or 4.0,

- 32 MB application RAM minimum, 64 MB recommended
- 17 MB hard disk space, plus 7 MB additional temporary disk space
- display graphic card with resolution 1024 x 768 or at least 800 x 600 available during installation.

C. Sun SPARCstation with SunOS(TM) 4.1.3 or later, or Solaris(R) 2.3, 2.4, or 2.5 operating system software and OpenWindows(TM) (version 3.0 or later), Motif(TM) window manager (1.2.3 or later), OpenLook version 3.0, or Common Desktop Environment (CDE) 1.0. (Acrobat Reader will not run under Solaris 2.0, 2.1, or 2.2.).

- 12 megabytes of available hard disk space
- a 32 MB RAM

D. HP workstation, 9000 series workstation model 700 or 800, with HP-UX(TM) 9.0.3 or later operating system software, X Window System(TM) X11R5 with HP-VUE or CDE 1.0.

- 12 megabytes of available hard disk space
- a 32 MB RAM

E. Silicon Graphics workstation with IRIX(TM) 5.3 or later operating system software

- 12 megabytes of available hard disk space
- a 32 MB RAM

F. IBM RS/6000 workstation with AIX(R) 4.1 or later operating system and CDE 1.0 or Motif window manager.

- 12 megabytes of available hard disk space
- a 32 MB RAM

IV. INSTRUCTIONS AND DOCUMENTATION FOR OFR 98-34

A. To get started:

Use of this CD-ROM requires the installation of Adobe Acrobat Reader. The software for the Image Gallery chapter requires Apple QuickTime 3. The Acrobat Reader software

is included on the *ANWRdata* CD-ROM in the *acroread* directory. Both of these packages are available free of charge from Adobe Inc. and Apple Inc. They can also be downloaded from the Adobe and Apple web sites. Help files and on-line manuals describe the Acrobat Reader software in detail however, the following sections will help you get started.

1. Install Acrobat Reader 3 on your hard drive if not already installed. Adobe Acrobat Reader software for Macintosh and Windows systems is included on the *ANWRdata* CD-ROM. Refer to the read me and text files supplied for each type of Acrobat reader for specific installation instructions. The read me and text files supplied for each type of Acrobat reader files are:

- a. Macintosh:
ACROREAD/README_M.MAC
ACROREAD/MAC/Reader/Reader/ReadMe-Reader
ACROREAD/MAC/Reader/Reader+Search/ReadMe-Reader
- b. Windows:
ACROREAD/WIN/READER/16BIT/README.TXT
ACROREAD/WIN/READER/ 32BIT/README.TXT
ACROREAD/WIN/RDR_SRCH/16BIT/README.TXT
ACROREAD/WIN/RDR_SRCH/32BIT/README.TXT
- c. UNIX systems:
ACROREAD/UNIX/READER/INSTGUID.TXT
ACROREAD/UNIX/READER/LICREAD.TXT
ACROREAD/UNIX/RDR_SRCH/INSTGUID.TXT
ACROREAD/UNIX/RDR_SRCH/LICREAD.TXT

2. Launch Acrobat Reader and then open the *ANWR1002.pdf* file on the *ANWRrpt* CD-ROM.

3. Hints for using Adobe Acrobat

The Acrobat toolbar is located along the top of the Acrobat screen. Most of the icons in the tool bar are self-explanatory. The arrow icons move one page at a time. The bar-arrow icons go to the first or last page in the file. The double-arrow icon allows the user to go back and retrace previous views.

Clicking on the red text links to other relevant pages or portions of pages or maps. The cursor changes to a pointing finger when it passes over links. For example, the hand icon, changes to a pointing finger, which indicates that it is over a link.

The PDF files contain several buttons to facilitate navigation within and between files. The left and right pointing red triangles advance the reader to previous and next page in the PDF file. The curved left pointing button will take you to the last menu. The “Go Back” button, the left pointing double arrow button should be used to return to the previous view. This is especially useful for returning from references in the text. Several clicks on “Go Back” button may be required since each panning or magnification change is considered a view by the Acrobat Reader software. The magnification glass icon can be accessed in the tool

bar at the top of the screen and also along the bottom of the screen to zoom in or out . The “Thumbnail” icons on the left side of the screen can be clicked on to jump directly to that page. The page that is currently displayed will be highlighted. A box on the “Thumbnail” shows which portion of the page is being displayed. Moving this box will display a different portion of the page. Changing the size of the box will also change the amount of enlargement.

The Acrobat Reader software is described in more detail in the Online Guide that can be accessed once you run the Acrobat application.

B. Contents

Files on the *ANWRrpt* CD-ROM include:

ANWR1002.pdf

AM.pdf

AO.pdf

AppME.pdf

AppOA.pdf

AppPS.pdf

AppSA.pdf

AppVR.pdf

AppWL.pdf

BC.pdf

BD.pdf

BE.pdf

BI.pdf

BR.pdf

BS.pdf

CC.pdf

CM.pdf

CM80.pdf

CM82.pdf

CM8384.pdf

CM85.pdf

CMmapsa.pdf

CMmapsb.pdf

DF.pdf

EA.pdf

FI.pdf

FP.pdf

FS.pdf

GG.pdf

GR.pdf

HG.pdf

IG.pdf

Imggal

anwring.dir

IMGGAL.EXE

imggal.mac

Xtras

MIX Services

PrintOMatic

qtvrw.qtc

qtvrw.x16

qtvrw32.qtc

qtvrw32.x32

QTVRExtra

QuickTime Asset PPC

Panos

n01.MoV

n03.MoV

n04.MoV

n05.MoV

n06a.MoV

n07.MoV

n08a.MoV

n09.MoV

n10b.MoV

n12.MoV

n13d.MoV

n14a.MoV

n14b.MoV

n17.MoV

n20.MoV

n21.MoV

n22.MoV

n22a.MoV

n24.MoV

n25a.MoV

n26.MoV

n27.MoV

ME.pdf

NA.pdf

OA.pdf

P110.pdf

PA.pdf

PlayMaps.pdf

PP.pdf

PS.pdf

ReadMe.pdf

ReadMe98-34.txt

ReadMe98-34

RS.pdf

SA.pdf

SM.pdf

SP.pdf

PDF version of ReadMe98-34

PC version of ReadMe98-34

Macintosh version of ReadMe98-34

SR.pdf
SS.pdf
TE.pdf
TK.pdf
VR.pdf
WL.pdf

The “.pdf” files are read by Acrobat Reader software. The “.MoV” files in the Imggal directory are QuickTime VR movies used by the Director movie files (“.dir”). The other files in the Imggal directory are the executable files for the Macintosh and Windows support files for the Director movies.

Files on the ANWRdata CD-ROM include:

acread Contains Adobe Acrobat installation files for Macintosh, Windows, and Unix systems.

AppME.pdf
AppOA.pdf
AppPS.pdf
AppSA.pdf
AppVR.pdf
AppWL.pdf
AppTOC.pdf

Documentation for data files on the ANWRdata CD-ROM
Start with this file to see what is on this disk.

Mecode Text files of BASIC and FORTRAN programs

MEAggre.for
MEANWR1.txt
MEANWR1a.txt
MEPU.for
MERefPr.for
MESamp.for
MEUnAgg.for

Oachrom PDF files of chromatograms

Oaoils Spreadsheet files in Excel format

OA10Table.xls
OA11Table.xls
OA12Table.xls
OA13Table.xls
OA14Table.xls
OA15Table.xls
OA16Table.xls
OA17Table.xls
OA18Table.xls
OA19Table.xls
OA1Table.xls
OA2Table.xls
OA3Table.xls
OA4Table.xls

OA5Table.xls
OA6Table.xls
OA9Table.xls
OAbiomkr.xls
OAchrom.xls
OAsample.xls
ReadMe.pdf PDF version of ReadMe98-34
ReadMe98-34.txt PC version of ReadMe98-34
ReadMe98-34 Macintosh version of ReadMe98-34
 PS1778 Spreadsheet files in Excel format
 PS1778.xls
SAwater Spreadsheet files in Excel format
 SATables.xls
VRmatur Spreadsheet files in Excel format
 VR1Table.xls
 VR2Table.xls
 VR3Table.xls
 VR4Table.xls
Wldata Data and plot files for 41 wells
 AIsIWL2
 AkA1WL3
 AkC1WL4
 AkD1WL5
 AkF1WL6
 AkJ1WL7
 AlpgWL1
 AuroWL8
 Bad1WL9
 Bad2WL10
 BelcWL11
 BeliWL12
 CIsIWL15
 CoroWL16
 CRA1wL13
 CRB1wL14
 EMikWL32
 FcrkWL17
 GalaWL18
 GyrWL19
 Ham1WL20
 Ham2WL21
 Kav1WL22
 Kav2WL23
 FormPlot Large-format plot files in hpgl.