

Chapter DF (Assessment Definitions)

DEFINITIONS FOR ANWR ASSESSMENT FORM

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in The Oil and Gas Resource Potential of the 1002 Area, Arctic National Wildlife Refuge, Alaska, by ANWR Assessment Team, U.S. Geological Survey Open-File Report 98-34.

1999

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Hydrocarbon Volume Parameters

Six parameters are used to calculate the volumes of oil and gas accumulations in the simulation program and in economic scenarios. Because the simulation program calculates an accumulation size using one randomly sampled number from each distribution, the spreads in the distributions express variability between accumulations. Specifically, even though some parameters (reservoir thickness, porosity, water saturation, and trap depth) could show variation within an individual accumulation, that level of variability is inappropriate for this analysis. The distribution for porosity, for example, shows how the average porosity in an accumulation varies from accumulation to accumulation. A sampled value of porosity could thus be viewed as the mean value in a given accumulation. All of the hydrocarbon volume parameters are conditional distributions -- conditional on both the play being favorable and the prospect being favorable. The uncertainty expressed in the specification of the hydrocarbon volume parameters is not intended to reflect the chance that such an attribute will be present. This is addressed by the risking.

Net Reservoir Thickness: A distribution for net reservoir thickness (in feet) in accumulations. The distribution shows how the average net reservoir thickness changes from accumulation to accumulation. It is not the same as the prospect height because it only includes net thickness of reservoir-quality rocks. It is also not the same as net pay thickness, because only some proportion of the reservoir rock contains hydrocarbons. (See trap fill.)

Area of Closure: A distribution for area of trap closure (in thousands of acres) of accumulations.

Porosity: A distribution for average porosity (in percent) in accumulations. The distribution shows how the average porosity changes from accumulation to accumulation.

Water Saturation: A distribution for water saturation (in percent) in accumulations. The distribution shows how the average water saturation changes from accumulation to accumulation. In this study, it is derived as a function of porosity.

Trap Fill: A distribution for trap fill (in percent) in accumulations. It is the volumetric percent of the gross reservoir volume (area of closure times net thickness) containing hydrocarbons.

Trap Depth: A distribution for trap depth (in thousands of feet subsea) in accumulations. The distribution shows how the average trap depth changes from accumulation to accumulation.

Risking

Minimum Reservoir Size: The smallest accumulation size being assessed, in this case 50 million barrels equivalent (MMBOE) in place. Smaller accumulations may exist in the play but are not being assessed.

Number of Prospects: A distribution showing uncertainty in the number of drillable prospects for accumulations of 50 MMBOE or larger. This distribution is conditional on the play being favorable.

Play Attributes: Three probabilities -- Charge (C), Potential Reservoir Facies (R), and Timely Trap Formation (F) -- that are used in calculating the Play Probability.

Charge (C): The probability that there has been sufficient source rock, thermal history, and migration to allow for at least one accumulation of 50 MMBOE or larger somewhere within the play.

Potential Reservoir Facies (R): The probability of occurrence of a rock containing suitable porosity and permeability capable of containing at least one accumulation of 50 MMBOE or larger somewhere within the play.

Timely Trap Formation (F): The probability that the stratigraphic and structural setting is favorable to production of at least one trap (formed in a timely manner relative to migration) of adequate size for an accumulation of 50 MMBOE or larger somewhere within the play.

Play Probability: The probability that the play is favorable, i.e. that the play attributes are adequately favorable to allow at least one accumulation of 50 MMBOE or larger. It is calculated by multiplying the three play attributes -- Charge (C), Potential Reservoir Facies (R), and Timely Trap Formation (F) -- which are assumed to be pairwise independent. Favorability of all three

play attributes is necessary, but not sufficient, for the existence of an accumulation of 50 MMBOE or larger. With a large number of prospects, the play probability is essentially equivalent to the probability that the play contains at least one accumulation of 50 MMBOE or larger. With a small number of prospects, however, there is some probability that all the play attributes are favorable, but just not together in any one prospect.

Play Risk: The probability that the play is unfavorable, i.e., that the play attributes are not sufficiently favorable to allow any accumulations of 50 MMBOE or larger. It is calculated as 1 minus the Play Probability. With a large number of prospects, it is essentially equivalent to the probability that the resource volume for the play (in accumulations 50 MMBOE or larger) is 0.

Prospect Attributes: Three probabilities -- Charge (c), Potential Reservoir Facies (r), and Timely Trap Formation (f) -- that are used in calculating the Prospect Probability. All of them are conditional probabilities -- conditional on the play being favorable. Probabilities are expressed relative to a randomly chosen prospect. This can also be thought of as giving the proportion of prospects for which a particular condition is favorable. These differ from the play attributes. For example, one may be certain that there has been sufficient source rock, thermal history, and migration to allow at least one accumulation of 50 MMBOE or larger somewhere within the play ($C = 1.0$) but estimate that only 50% of the prospects have had adequate migration paths open ($c = 0.5$).

Charge (c): The probability (given that the play is favorable) that a randomly chosen prospect has been charged by fluids sufficient for an accumulation of 50 MMBOE or larger.

Potential Reservoir Facies (r): The probability (given that the play is favorable) that a randomly chosen prospect has adequate reservoir rock for an accumulation of 50 MMBOE or larger.

Timely Trap Formation (f): The probability (given that the play is favorable) that a randomly chosen prospect has an adequate trap (formed in a timely manner relative to migration) for an accumulation of 50 MMBOE or larger.

Prospect Probability: The probability that a randomly chosen prospect is favorable (given that the play is favorable), i.e., that the prospect contains an accumulation of 50 MMBOE or larger. It is calculated by multiplying the three prospect attributes -- Charge (c), Potential Reservoir Facies (r), and Timely Trap Formation (f) -- which are assumed to be pairwise independent. Favorability of all three prospect attributes is both necessary and sufficient for the existence of an accumulation of 50 MMBOE or larger in a prospect. The prospect probability can also be thought of as giving the proportion of prospects that contain an accumulation of 50 MMBOE or greater.

Prospect Risk: The probability that a randomly chosen prospect is unfavorable, i.e. that the prospect does not contain an accumulation of 50 MMBOE or larger. It is calculated as 1 minus the Prospect Probability.

Fraction of Accumulations Being Oil: That proportion of the accumulations that will be simulated as oil accumulations as opposed to non-associated gas accumulations.

Miscellaneous

Accumulation: Trapped hydrocarbons in contiguous pools of a particular play. In this assessment only accumulations of 50 million barrels equivalent (in place) or larger are being assessed.

Field: One or more accumulations whose projections on the earth's surface are the same or overlap. All the pools in an accumulation are of the same play, but a field may include pools of different plays. The simulation methodology for plays estimates accumulation sizes. Fields are important principally in the economic part of the analysis.

Play: A geologically homogeneous collection of accumulations (discovered and undiscovered) and prospects. Homogeneous is, of course, a relative term and the amount of variability acceptable within a play can vary with data available and methodology used. The accumulations within a play generally share similar source rocks, migration pathways, timing of relevant events, trapping mechanisms, and hydrocarbon types.

Play Area: A geographic area that includes all the discovered accumulations (if any) and all the prospects (if any) in a particular play.

Prospect: A drillable feature that may contain trapped hydrocarbons.